

**TECHNICAL REPORT
IGE-251 Revision 1**



DRAGON PROGRAMMER'S MANUAL

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March, 2002

SUMMARY

The computer code DRAGON contains a collection of FORTRAN subroutines that can be called successively to simulate the neutron behavior of a unit cell or a fuel assembly in a nuclear reactor. These subroutines are generally classified by module with the main subroutine of a module being called directly inside the main DRAGON program. Each module performs a complex set of calculations associated with one of the functions that characterize a lattice cell code. Examples of such modules are the interpolation of microscopic cross sections libraries module (**LIB:**); resonance self-shielding calculations in multidimensional geometries (**SHI:**); multigroup neutron flux calculations which can take into account neutron leakage (**FLU:**); collision probability calculation (**ASM:**); editing of condensed and homogenized nuclear properties for reactor calculations (**EDI:**).

The goal of this report is to describe the flow of data inside the code DRAGON and to provide the developer of DRAGON with a full description of all the subroutines which are used inside the code. Here we will first describe the routines which are part of the main DRAGON package. The mathematical routines, those for the generation of PostScript graphical images, etc. which are part of the utility package which is distributed with DRAGON will also be described. On the other hand, the GANLIB routines which are used to control the GAN generalized driver and access to the DRAGON data structures will not be described here.

CONTENTS

SUMMARY	i
CONTENTS	iii
LIST OF CORRECTIONS	xv
1 INTRODUCTION	1
2 DRAGON DRIVER ROUTINES	3
2.1 DRAGON Main Entry and Generic Modules	3
2.1.1 DRAGON	3
2.1.2 MODULE	4
2.2 Module Control Routines	4
2.2.1 GEO	4
2.2.2 EXCELT	5
2.2.3 SYBILT	5
2.2.4 JPMT	5
2.2.5 MAC	6
2.2.6 LIB	6
2.2.7 SHI	6
2.2.8 ASM	7
2.2.9 XL3	7
2.2.10 FLU	8
2.2.11 MOC	8
2.2.12 EDI	8
2.2.13 EVO	9
2.2.14 CPO	9
2.2.15 CFC	9
2.2.16 INF	10
2.2.17 MRG	10
2.2.18 PSP	11
3 THE MODULE FOR GEOMETRY DEFINITION	13
3.1 Structure of GEO:	13
3.2 General Routines Description	13
3.2.1 GEOIN1	13
3.2.2 GEOIN2	14
3.2.3 GEOIN3	14
4 THE GENERAL CP TRACKING MODULE	17
4.1 Structure of EXCELT:	17
4.2 General Routines Description	18
4.2.1 KELMRG	18
4.2.2 KELRNG	19
4.2.3 KELSYM	20
4.2.4 LELCHK	21
4.2.5 LELCRN	22
4.2.6 XELBIN	22
4.2.7 XELCMP	24
4.2.8 XELCOP	25
4.2.9 XELCRN	25
4.2.10 XELDCL	26
4.2.11 XELDRV	28
4.2.12 XELEDK	29
4.2.13 XELEQN	30

4.2.14	XELETR	31
4.2.15	XELGPR	33
4.2.16	XELGRD	34
4.2.17	XELLIN	35
4.2.18	XELLSR	36
4.2.19	XELMRG	37
4.2.20	XELNTR	39
4.2.21	XELPRC	40
4.2.22	XELPRP	41
4.2.23	XELPSC	42
4.2.24	XELPSI	43
4.2.25	XELTI2	43
4.2.26	XELTI3	45
4.2.27	XELTRK	46
4.2.28	XELTRP	47
4.2.29	XELTS2	49
4.2.30	XELTS3	51
4.2.31	XELTSW	51
4.2.32	XELVOL	52
4.3	Routines for 2-D Cluster Geometry	53
4.3.1	XCGBCM	53
4.3.2	XCGDIM	54
4.3.3	XCGGEO	55
4.3.4	XCGROD	57
4.3.5	XCWHEX	58
4.3.6	XCWICL	58
4.3.7	XCWREC	60
4.3.8	XCWROD	61
4.3.9	XCWSCL	61
4.3.10	XCWSRT	63
4.3.11	XCWTRK	64
4.4	Routines for 2-D and 3-D Hexagonal Geometry	65
4.4.1	XHXTRK	65
4.4.2	TRKHEX	67
4.4.3	DEPLIT	69
4.4.4	DUTURN	69
4.4.5	LHXUNH	70
4.4.6	MESHST	71
5	THE INTERFACE CURRENT TRACKING MODULE	75
5.1	Structure of SYBILT:	75
5.2	General Routines Description	75
5.2.1	SYBTRK	75
5.2.2	SYBEUR	76
5.2.3	SYBHTK	78
5.2.4	SYBRTK	79
6	THE J_{\pm} TRACKING MODULE	81
6.1	Structure of JPMT:	81
6.2	General Routines Description	82
6.2.1	JPMEUR	82
6.2.2	JPMG2	84
6.2.3	JPMG3	85
6.2.4	JPMGEO	87

	6.2.5	JPMGG	89
	6.2.6	JPMPRF	90
	6.2.7	JPMTRK	91
6.3		Additional Tracking Routines	93
	6.3.1	READ3D	93
	6.3.2	READBH	94
	6.3.3	READEU	95
	6.3.4	READMT	97
	6.3.5	NUMER3	98
	6.3.6	NUMER4	99
	6.3.7	NUMERC	101
	6.3.8	NUMERH	102
	6.3.9	NEIGHB	103
	6.3.10	NEIGH1, NEIGH2, NEIGH3, NEIGH4, NEIGH5, NEIGH6, NEIGH7, NEIGH8, NEIGH9, NEIGH10, NEIGH11	104
	6.3.11	SPLIT0	105
	6.3.12	XCSANA	106
	6.3.13	XCSNUM	107
	6.3.14	XCSSEG	108
	6.3.15	XCSTRK	109
7		THE MODULE FOR MIXTURE PROCESSING	111
	7.1	Structure of MAC:	111
	7.2	General Routines Description	111
	7.2.1	MACDRV	111
	7.2.2	MACEFI	112
	7.2.3	MACIXS	113
	7.2.4	MACNFI	114
	7.2.5	MACNXS	116
	7.2.6	MACPRM	117
	7.2.7	MACPXS	118
	7.2.8	MACRDM	120
	7.2.9	MACUPD	121
	7.2.10	MACWXS	122
	7.2.11	MACXSR	123
8		THE MODULE FOR LIBRARY PROCESSING	127
	8.1	Structure of LIB:	127
	8.2	General Routines Description	128
	8.2.1	LIBAPL	128
	8.2.2	LIBBAS	130
	8.2.3	LIBCMB	131
	8.2.4	LIBCON	132
	8.2.5	LIBDEN	133
	8.2.6	LIBDEP	135
	8.2.7	LIBDRA	135
	8.2.8	LIBDRB	136
	8.2.9	LIBDRC	138
	8.2.10	LIBEAD	138
	8.2.11	LIBEDR	139
	8.2.12	LIBEIR	140
	8.2.13	LIBENI	141
	8.2.14	LIBENR	141
	8.2.15	LIBEPR	142

8.2.16	LIBEWI	143
8.2.17	LIBEWR	143
8.2.18	LIBFIS	144
8.2.19	LIBINP	145
8.2.20	LIBLAG	146
8.2.21	LIBLEX	147
8.2.22	LIBLIB	147
8.2.23	LIBMAC	149
8.2.24	LIBMFE	150
8.2.25	LIBMIX	151
8.2.26	LIBNRG	151
8.2.27	LIBSEC	152
8.2.28	LIBTE2	153
8.2.29	LIBTER	154
8.2.30	LIBTR1	155
8.2.31	LIBTR2	156
8.2.32	LIBWD4	158
8.2.33	LIBWED	160
8.2.34	LIBWET	161
8.2.35	LIBWID	161
8.2.36	LIBWIM	162
8.2.37	LIBWRE	163
8.2.38	LIBWRG	164
8.2.39	LIBWRI	165
8.2.40	LIBWRP	166
8.2.41	LIBWSC	167
8.2.42	LIBWTE	168
9	THE MODULE FOR RESONANCE SELF-SHIELDING	171
9.1	Structure of SHI:	171
9.2	General Routines Description	171
9.2.1	SHIDRV	171
9.2.2	SHIDAN	173
9.2.3	SHIJPM	175
9.2.4	SHIPIJ	176
9.2.5	SHIPST	178
9.2.6	SHIRAT	179
9.2.7	SHISN2	179
10	THE MODULE FOR CP INTEGRATION	183
10.1	Structure of ASM:	183
10.2	General Routines Description	183
10.2.1	ASMDRV	183
10.2.2	PIJCPL	185
10.2.3	PIJNOS	186
10.2.4	PIJNRM	186
10.2.5	PIJSMD	187
10.3	Complete Collision Probability Integration Routines	187
10.3.1	EXCELP	188
10.3.2	PIJAAA	189
10.3.3	PIJABC	190
10.3.4	PIJCMP	191
10.3.5	PIJI2D	191
10.3.6	PIJI3D	192

	10.3.7	PIJKST	193
	10.3.8	PIJRDG	194
	10.3.9	PIJRGL	195
	10.3.10	PIJRHL	195
	10.3.11	PIJRNL	196
	10.3.12	PIJS2D	197
	10.3.13	PIJS3D	198
	10.3.14	PIJWPR	199
10.4		Interface Current Integration Routines	199
	10.4.1	SYBILP	201
	10.4.2	SYBALC	202
	10.4.3	SYBALP	202
	10.4.4	SYBALS	203
	10.4.5	SYBCP1	204
	10.4.6	SYBCP2	205
	10.4.7	SYBHN1	205
	10.4.8	SYBHN2	206
	10.4.9	SYBHT1	207
	10.4.10	SYBHT2	208
	10.4.11	SYBPRX	209
	10.4.12	SYBRN1	210
	10.4.13	SYBRN2	210
	10.4.14	SYBRX2	211
	10.4.15	SYBRX3	213
	10.4.16	SYBRX4	214
	10.4.17	SYBRX5	216
	10.4.18	SYBRXE	217
10.5		J_{\pm} Integration Routines	218
	10.5.1	JPMA	220
	10.5.2	JPMP	221
	10.5.3	JPMASB	222
	10.5.4	JPMCP	223
	10.5.5	JPMDIS	224
	10.5.6	JPM2	225
	10.5.7	JPM3	226
	10.5.8	JPM4	227
	10.5.9	JPMDIT	228
	10.5.10	JPMGR1	229
	10.5.11	JPMGR2	230
10.6		Additional Integration Routines	232
	10.6.1	CROWH1	232
	10.6.2	CROWH2	232
	10.6.3	CROWR1	233
	10.6.4	CROWR2	234
	10.6.5	RECT1	234
	10.6.6	RECT2	235
	10.6.7	SHELL1	235
	10.6.8	SHELL2	236
	10.6.9	SLAB	237
	10.6.10	TUBE1	237
	10.6.11	TUBE2	238
	10.6.12	TUBE3D	239

10.6.13	XCSCVS	239
10.6.14	XCSINT	240
10.6.15	XCSPIJ	241
10.6.16	XCSRNU	242
10.6.17	XELPA0	242
10.6.18	XELPA1	243
10.6.19	XELPA3	244
10.6.20	XHX2D0	244
10.6.21	XHX2D1	245
11	THE GENERAL CP TRACKING AND INTEGRATION MODULE	247
11.1	Structure of EXCELL:	247
11.2	General Routines Description	248
11.2.1	XL3DRV	248
11.2.2	XL3MAC	249
11.2.3	XL3NTR	250
11.2.4	XL3SIG	250
11.2.5	XL3TI3	251
11.2.6	XL3TRK	254
11.2.7	QIJABC	255
11.2.8	QIJCMP	256
11.2.9	QIJCPL	257
11.2.10	QIJI3D	258
11.2.11	QIJNOS	259
11.2.12	QIJNRM	259
11.2.13	QIJPRL	260
11.2.14	QIJPRT	261
11.2.15	QIJRDG	261
11.2.16	QIJRGL	262
11.2.17	QIJRHL	262
11.2.18	QIJRNL	263
11.2.19	QIJSMD	264
11.2.20	QIJWPR	265
12	THE MODULE FOR FLUX CALCULATION	267
12.1	Structure of FLU:	267
12.2	General Routines Description	268
12.2.1	FLUACV	268
12.2.2	FLUADN	270
12.2.3	FLUALB	271
12.2.4	FLUASR	272
12.2.5	FLUBAL	274
12.2.6	FLUBLN	276
12.2.7	FLUDB2	278
12.2.8	FLUDRV	280
12.2.9	FLUFUI	283
12.2.10	FLUGET	284
12.2.11	FLUGFL	286
12.2.12	FLUGPI	287
12.2.13	FLUINR	289
12.2.14	FLULBD	292
12.2.15	FLUQFB	292
12.2.16	FLUQFC	293
12.2.17	FLUQFE	295

	12.2.18	FLUQFS	298
	12.2.19	FLUQFX	299
	12.2.20	FLURFL	299
	12.2.21	FLUSFL	300
	12.2.22	B1BETA	301
	12.2.23	B1DIF	301
	12.2.24	B1HOM	303
	12.2.25	B1HXS1, B1HXS2, B1HXS3	305
	12.2.26	B1SOL	307
12.3	External Routines		307
	12.3.1	TRFICF	307
	12.3.2	TRFICS	308
	12.3.3	JPMF	309
	12.3.4	JPMS	311
	12.3.5	JPMFLX	312
	12.3.6	JPMRES	313
13	THE MODULE FOR THE METHOD OF CHARACTERISTICS		315
13.1	Structure of MOCC :		315
13.2	General Routines Description		315
	13.2.1	MOC2AC	315
	13.2.2	MOC2BL	316
	13.2.3	MOC2BN	317
	13.2.4	MOC2DR	318
	13.2.5	MOC2HM	322
	13.2.6	MOC2I0	323
	13.2.7	MOC2I1	324
	13.2.8	MOC2KF	325
	13.2.9	MOC2MH	326
	13.2.10	MOC2WR	328
	13.2.11	MOC3I0	329
	13.2.12	MOC3I1	330
	13.2.13	MOCDRV	331
	13.2.14	MOCGFL	334
	13.2.15	MOCIK3	334
	13.2.16	MOCRWD	335
	13.2.17	MOC SOL	335
14	THE MODULE FOR EDITING		337
14.1	Structure of EDI :		337
14.2	General Routines Description		338
	14.2.1	EDIBAL	338
	14.2.2	EDIDEL	339
	14.2.3	EDIDRV	340
	14.2.4	EDIDST	343
	14.2.5	EDIDTX	345
	14.2.6	EDIENE	349
	14.2.7	EDIGET	350
	14.2.8	EDIHFC	352
	14.2.9	EDIISO	353
	14.2.10	EDILBD	356
	14.2.11	EDIMIC	356
	14.2.12	EDIMPR	359
	14.2.13	EDIMRR	359

	14.2.14	EDIMXS	360
	14.2.15	EDIPRR	361
	14.2.16	EDIPXS	362
	14.2.17	EDIRAT	366
	14.2.18	EDISCT	366
	14.2.19	EDISTA	368
	14.2.20	EDITIS	369
	14.2.21	EDITXS	370
	14.2.22	EDIUPS	371
14.3		The SPH Homogenization Routines	372
	14.3.1	SPHDIF	372
	14.3.2	SPHDRV	374
	14.3.3	SPHEQU	375
	14.3.4	SPHGEO	377
	14.3.5	SPHREF	378
	14.3.6	SPHTRA	380
14.4		The BIVAC 2-D Diffusion Routines	381
	14.4.1	BIVACT	381
	14.4.2	BIVCOL	382
	14.4.3	BIVDFH	383
	14.4.4	BIVDKN	384
	14.4.5	BIVF2D	385
	14.4.6	BIVF2H	387
	14.4.7	BIVFSH	388
	14.4.8	BIVFSO	389
	14.4.9	BIVG2D	390
	14.4.10	BIVG2H	392
	14.4.11	BIVGSH	393
	14.4.12	BIVGSO	394
	14.4.13	BIVPKN	395
	14.4.14	BIVPRH	396
	14.4.15	BIVSBH	397
	14.4.16	BIVTRK	398
15		THE MODULE FOR ISOTOPIC DEPLETION	401
15.1		Structure of EVO:	401
15.2		General Routines Description	401
	15.2.1	EVOBLD	401
	15.2.2	EVODPL	403
	15.2.3	EVODRV	405
	15.2.4	EVOGET	407
	15.2.5	EVOKAP	408
	15.2.6	EVOODE	409
	15.2.7	EVOPRE	410
	15.2.8	EVORCP	411
	15.2.9	EVORK	412
	15.2.10	EVORK4	414
	15.2.11	EVORRE	415
	15.2.12	EVOSAT	416
16		THE MODULE FOR REACTOR DATABASE CREATION	419
16.1		Structure of CPO:	419
16.2		General Routines Description	419
	16.2.1	CPODRV	419

	16.2.2	CPOISO	421
	16.2.3	CPOMAR	422
	16.2.4	CPOMAW	424
	16.2.5	CPOMIC	425
	16.2.6	CPOREM	426
17		THE MODULE FOR FEEDBACK DATABASE CREATION	429
17.1		Structure of CFC:	429
17.2		General Routines Description	429
	17.2.1	CFCDRV	429
	17.2.2	CFCFBM	431
18		THE LIBRARY INFORMATION MODULE	435
18.1		Structure of INFO:	435
18.2		General Routines Description	435
	18.2.1	INFAPL	435
	18.2.2	INFTRA	436
	18.2.3	INFTR1	436
	18.2.4	INFTR2	437
	18.2.5	INFWAT	437
	18.2.6	INFWD4	438
	18.2.7	INFWIM	438
19		THE MODULE FOR PRE-HOMOGENIZATION	441
19.1		Structure of MRG:	441
19.2		General Routines Description	441
	19.2.1	MRGGET	441
	19.2.2	MRGLIN	442
	19.2.3	MRGVOL	442
	19.2.4	MRGVST	443
20		THE MODULE FOR PLOTTING	445
20.1		Structure of PSP:	445
20.2		General Routines Description	445
	20.2.1	PSPCOL	445
	20.2.2	PSPFIL	446
	20.2.3	PSPGEO	446
	20.2.4	PSPGET	447
	20.2.5	PSPLEG	447
	20.2.6	PSPRAI	448
	20.2.7	PSPTRK	449
	20.2.8	PSPXCG	450
	20.2.9	PSPXEL	451
21		ADDITIONAL DRAGON ROUTINES	453
21.1		General Utility Routines	453
	21.1.1	XDREXP	453
	21.1.2	XDRKIN	453
	21.1.3	XDRVER	454
21.2		Microscopic Cross Sections Processing Routines	454
	21.2.1	XDRLGS	454
	21.2.2	XDRLPR	455
	21.2.3	XDRNED	456
21.3		Geometry Analysis Utility Routines	457
	21.3.1	LDRASS	457
	21.3.2	LDRCEL	458
	21.3.3	LDRGEO	458

21.4	GOXS Files Processing Routines	459
21.4.1	GXSINI	459
21.4.2	GXSGET	460
21.4.3	GXSPUT	461
22	UTILITY ROUTINES	463
22.1	General Utility Routines	463
22.1.1	GUCTOI	463
22.1.2	GUITOC	463
22.1.3	UPCKIC	463
22.1.4	GXSDIM	464
22.1.5	OPNIND, CLSIND, REDIND	464
22.1.6	XDRCAS	465
22.1.7	XDRDBL	465
22.1.8	XDREED, XDRITE	465
22.1.9	XDRSDB	466
22.1.10	XDRSET	466
22.2	Special Function Routines	467
22.2.1	AK0BES	467
22.2.2	AK1BES	467
22.2.3	AKIN10	467
22.2.4	TABEN	468
22.2.5	TABKI	468
22.2.6	AFERF	469
22.3	Double Precision Complex Algebra Routines	469
22.3.1	DCAABS	469
22.3.2	DCADIV	469
22.3.3	DCAPOW	470
22.4	Polynomial Interpolation Routines	471
22.4.1	ALGUER	471
22.4.2	ALPADE	471
22.4.3	ALPLSF	472
22.4.4	ALPOLY	473
22.4.5	ALROOT	473
22.4.6	AIKINT	474
22.4.7	ALDFIT	474
22.5	Quadrature Routines	475
22.5.1	ALCACT	475
22.5.2	ALGJP	476
22.5.3	ALGPT	476
22.6	Linear Algebra Routines	477
22.6.1	ALDERV	477
22.6.2	ALEIGD	477
22.6.3	ALDLFV	478
22.6.4	ALDLSV	478
22.6.5	ALINV	479
22.6.6	ALINVD	479
22.6.7	ALLDLF	480
22.6.8	ALLDLM	480
22.6.9	ALLDLS	481
22.6.10	ALLUF	481
22.6.11	ALLUM	481
22.6.12	ALLUS	482

22.6.13	ALSB	482
22.6.14	ALSBC	483
22.6.15	ALSBD	483
22.6.16	ALSVDF	484
22.6.17	ALSVDS	484
22.7	PostScript Routines	485
22.7.1	PSCPUT	485
22.7.2	PSCUTP	485
22.7.3	PSFARC	486
22.7.4	PSFCIR	486
22.7.5	PSFILL	487
22.7.6	PSFRAI	487
22.7.7	PSFREG	488
22.7.8	PSHEAD	488
22.7.9	PSLINW	489
22.7.10	PSMOVE	489
22.7.11	PSPAGE	489
22.7.12	PSSARC	490
22.7.13	PSSCIR	490
22.7.14	PSSRAI	491
22.7.15	PSSREG	491
22.7.16	PSTEXT	492
REFERENCES		493
INDEX		495

LIST OF CORRECTIONS

Implemented Corrections

- 2001/03/01:
 1. FLU structure modified;
 2. ITPIJ itemization corrected.
- 2002/03/25:
 1. SYBILP routine added;
 2. Order of modules in Section 2.2 now reflects the table of contents;
 3. DRAGON utility routines are now all located in Section 21.

1 INTRODUCTION

The goal of this report is to describe the flow of data inside the code DRAGON and to provide the developer of DRAGON with a full description of all the subroutines which are used inside the code.^[1,2] Here, we will describe the routines which are part of the main DRAGON package as well as the mathematical routines, those for the generation of PostScript graphical images, etc. and which are part of the utility package which is distributed with DRAGON. On the other hand, the GANLIB routines which are used to control the GAN generalized driver and access to the DRAGON data structures^[3] will not be described here. The programmers manual for the routines in GANLIB is already available elsewhere.^[4,5]

This manual will provide the following information for the 391 independent subroutines of DRAGON and the 65 subroutines that are found in the utility package of DRAGON:

- the general structure of each routine;
- a brief description of the purpose of each routine;
- the definition of each argument of a routine including the size, the type and the information this variable or array contains;
- the list of routine calling this routine;
- the list of routine called by this routine.

Note that the information provided in this report is not complete. For example, a description of the explicit mathematical relations used inside each subroutine would be a very valuable tool for programmers. However, because the DRAGON theory manual does not yet address the calculation technique involved inside each module, we felt that this information would be too incomplete to justify its inclusion in the present report. We expect a future release of the programmer's manual in parallel with the completion of the DRAGON theory manual should fill the missing gaps identified here.

2 DRAGON DRIVER ROUTINES

The general structure of the code DRAGON is the following:

General structure of the program: DRAGON

```

DRAGON
|----- ASM      ->
|----- CFC      ->
|----- CPO      ->
|----- EDI      ->
|----- EVO      ->
|----- EXCELT   ->
|----- FLU      ->
|----- GEO      ->
|----- INF      ->
|----- JPMT     ->
|----- LIB      ->
|----- MAC      ->
|----- MOC      ->
|----- MRG      ->
|----- PSP      ->
|----- SHI      ->
|----- SYBILT   ->
|----- XL3      ->
|----- XDREXP   ->
|----- XDRKIN   ->
|----- XDRVER   ->

```

One can find a description of the routines XDREXP, XDRKIN and XDRVER in Section 21.1.

2.1 DRAGON Main Entry and Generic Modules

To main entry point for the execution of the code is the program called DRAGON. Apart from calling a few utility routines, this main program also calls the various module control routines described in Section 2.2. However, since these control routines all have the same format, we will first describe in Section 2.1.2 the local variables used by these routines by considering a generic routine called MODULE.

2.1.1 DRAGON

Purpose To control the execution of the program DRAGON.

Author(s) A. Hébert, G. Marleau and R. Roy

Calling

DRAGON routine(s) : ASM, CFC, CPO, EDI, EVO, EXCELT, FLU, GEO, INF, JPMT, LIB, MAC, MOC, MRG, PSP, SHI, SYBILT, XL3, XDREXP, XDRKIN, XDRVER

UTILIB routine(s) :

GANLIB routine(s) : CLECST, KERNEL, SETARA, RLSARA, XABORT

2.1.2 MODULE

Syntax CALL MODULE(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Description of input parameters

- NENTRY** integer variable containing the number of data structures transferred to this module.
- HENTRY** character*12 array HENTRY(*i*) containing the name of a data structure transferred to this module. Here $1 \leq i \leq \text{NENTRY}$.
- IENTRY** integer array IENTRY(*i*) containing the data structure type identifier where:
- IENTRY(*i*)=1 for a linked list;
 - IENTRY(*i*)=2 for a direct access XSM format file;
 - IENTRY(*i*)=3 for a sequential binary file;
 - IENTRY(*i*)=4 for a sequential ASCII file;
- while all the other values of IENTRY(*i*) are illegal. Here $1 \leq i \leq \text{NENTRY}$.
- JENTRY** integer array JENTRY(*i*) containing the data structure mode identifier where:
- JENTRY(*i*)=0 if a new data structure is to be created;
 - JENTRY(*i*)=1 if an existing data structure can be modified;
 - JENTRY(*i*)=2 if an existing data structure can be accessed but not modified (read-only mode);
- and all the other values of JENTRY(*i*) are illegal. Here $1 \leq i \leq \text{NENTRY}$.
- KENTRY** integer array KENTRY(*i*) containing the data structure access key. For a file, this key is equivalent to a unit while for a linked list it represent the address in memory where this linked list is located. Here $1 \leq i \leq \text{NENTRY}$.

2.2 Module Control Routines

2.2.1 GEO

Purpose To control the execution of the GEO: module that is used to define a geometry.

Syntax CALL GEO(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : GEOIN1

UTILIB routine(s) :

GANLIB routine(s) : LCMEQU, LCMGET, XABORT

See Section 3 for more information on this module.

2.2.2 EXCELT

Purpose To control the execution of the **EXCELT**: module that is used to analyze and track 2-D and 3-D geometries for full collision probability integration or for the method of characteristics.

Syntax CALL EXCELT(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON, SPHDRV

Calling

DRAGON routine(s) : LDRASS, XELDRV

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMPUT, REDGET, SETARA, RLSARA, XABORT

See Section 4 for more information on this module.

2.2.3 SYBILT

Purpose To control the execution of the **SYBILT**: module that is used to analyze and track 1-D and 2-D geometries for the interface current approximation to the collision probability method.

Syntax CALL SYBILT(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON, SPHDRV

Calling

DRAGON routine(s) : SYBTRK

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

See Section 5 for more information on this module.

2.2.4 JPMT

Purpose To control the execution of the **JPMT**: module that is used to analyze and track 1-D and 2-D geometries for the J_{\pm} approximation to the collision probability method.

Syntax CALL JPMT(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON, SPHDRV

Calling

DRAGON routine(s) : JPMTRK

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

See Section 6 for more information on this module.

2.2.5 MAC

Purpose To control the execution of the **MAC:** module that is used for the processing of macroscopic cross-section libraries.

Syntax CALL MAC(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : MACDRV, MACUPD

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLIB, LCMPUT, LCMSIX, SETARA, REDGET, RLSARA, XABORT

See Section 7 for more information on this module.

2.2.6 LIB

Purpose To control the execution of the **LIB:** module that is used for the processing of a microscopic cross-section libraries.

Syntax CALL LIB(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : LIBDEP, LIBINP, LIBMAC

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMEQU, LCMGET, LCMLEN, LCMLIB, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

See Section 8 for more information on this module.

2.2.7 SHI

Purpose To control the execution of the **SHI:** module that is used to perform resonance self-shielding calculations.

Syntax CALL SHI(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : SHIDRV

UTILIB routine(s) :

GANLIB routine(s) : LCMEQU, LCMGET, LCMLLEN, LCMSIX, REDGET, SETARA, RLSARA, XABORT

See Section 9 for more information on this module.

2.2.8 ASM

Purpose To control the execution of the **ASM:** module that is used to compute the collision probability matrix.

Syntax CALL ASM(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : ASMDRV

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, LCMPTUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

See Section 10 for more information on this module.

2.2.9 XL3

This module is a combination of the **EXCELT:** and **ASM:** modules where the tracking lines are not stored on a sequential binary file but integrated immediately.

Purpose To control the execution of the **EXCELL:** module that is used to analyze, track and integrate the collision probability matrix in 2-D and 3-D geometries.

Syntax CALL XL3(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : LDRASS, XL3DRV, XL3MAC

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

See Section 11 for more information on this module.

2.2.10 FLU

Purpose To control the execution of the **FLU** : module that is used to solve the collision probability or response matrix equations for the flux as a fixed source or eigenvalue (k_{eff} or buckling) problem.

Syntax CALL FLU(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : FLUDRV, FLUGET

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMPUT, LCMSIX, XABORT

See Section 12 for more information on this module.

2.2.11 MOC

Purpose To control the execution of the **MOC** : module that is used to solved characteristics equations for the flux as a fixed source or eigenvalue (k_{eff} or buckling) problem.

Syntax CALL MOC(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : MOCDRV, MOCGFL

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

See Section 13 for more information on this module.

2.2.12 EDI

Purpose To control the execution of the **EDI** : module that is used to edit the result of an execution.

Syntax CALL EDI(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : EDIDRV, EDIENE, EDIGET, EDITIS

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

See Section 14 for more information on this module.

2.2.13 EVO

Purpose To control the execution of the EVO : module that is used to perform isotopic depletion calculations.

Syntax CALL EVO(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : EVODRV, EVOGET

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMEQU, LCMGET, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

See Section 15 for more information on this module.

2.2.14 CPO

Purpose To control the execution of the CPO : module that is used to generate a CPO format reactor database.

Syntax CALL CPO(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : CPODRV, CPOISO

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

See Section 16 for more information on this module.

2.2.15 CFC

Purpose To control the execution of the CFC : module that is used to generate a feedback library.

Syntax CALL CFC(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : CFCDRV

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLN, LCMNXT, LCMPUT, LCMSIX, REDGET, SETARA,
 RLSARA, XABORT

See Section 17 for more information on this module.

2.2.16 INF

Purpose To control the execution of the **INFO:** module that is used to evaluate water (light and heavy) density as a function of temperature and to evaluate the isotopic concentration of various isotopes in natural or enriched UO₂ and in water.

Syntax CALL INF(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : INFAPL, INFTRA, INFTR1, INFTR2, INFTR4, INFTR5, INFTR6, INFTR7, INFTR8, INFTR9, INFTR10, INFTR11, INFTR12, INFTR13, INFTR14, INFTR15, INFTR16, INFTR17, INFTR18, INFTR19, INFTR20, INFTR21, INFTR22, INFTR23, INFTR24, INFTR25, INFTR26, INFTR27, INFTR28, INFTR29, INFTR30, INFTR31, INFTR32, INFTR33, INFTR34, INFTR35, INFTR36, INFTR37, INFTR38, INFTR39, INFTR40, INFTR41, INFTR42, INFTR43, INFTR44, INFTR45, INFTR46, INFTR47, INFTR48, INFTR49, INFTR50, INFTR51, INFTR52, INFTR53, INFTR54, INFTR55, INFTR56, INFTR57, INFTR58, INFTR59, INFTR60, INFTR61, INFTR62, INFTR63, INFTR64, INFTR65, INFTR66, INFTR67, INFTR68, INFTR69, INFTR70, INFTR71, INFTR72, INFTR73, INFTR74, INFTR75, INFTR76, INFTR77, INFTR78, INFTR79, INFTR80, INFTR81, INFTR82, INFTR83, INFTR84, INFTR85, INFTR86, INFTR87, INFTR88, INFTR89, INFTR90, INFTR91, INFTR92, INFTR93, INFTR94, INFTR95, INFTR96, INFTR97, INFTR98, INFTR99, INFTR100

UTILIB routine(s) :

GANLIB routine(s) : REDGET, REDPUT, XABORT

See Section 18 for more information on this module.

2.2.17 MRG

Purpose To control the execution of the **MRG:** module that is used to perform regional pre-homogenization or to imposed additional symmetry in the flux distribution for geometries that have been analyzed using the **EXCELT:** module.

Syntax CALL MRG(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : MRGGET, MRGLIN, MRGVOL, MRGVST

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

See Section 19 for more information on this module.

2.2.18 PSP

Purpose To control the execution of the **PSP:** module that is used to generate a graphical PostScript file representing a valid **EXCELT:** 2-D geometry.

Syntax CALL PSP(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Called by

DRAGON routine(s) : DRAGON

Calling

DRAGON routine(s) : PSPFIL, PSPGEO, PSPGET, PSPTRK

UTILIB routine(s) : PSCUTP, PSPAGE, XDRSET

GANLIB routine(s) : LCMGET, LCMSIX, SETARA, RLSARA, XABORT

See Section 20 for more information on this module.

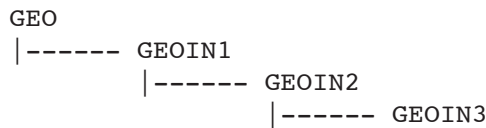
3 THE MODULE FOR GEOMETRY DEFINITION

3.1 Structure of GEO :

The main routine that controls this module is called GEO (see Section 2.2.1). It can use up to NENTRY=2 GEOMETRY data structures. These structures must be of type IENTRY(*i*)=1 (linked list) or IENTRY(*i*)=2 (XSM files). In all cases the first data structure must be in creation or modification mode (JENTRY(*i*)=0 or 1). In the case where two data structures are used, the second data structure must be in read-only mode (JENTRY(2)=2).

The GEO : module can be represented by the following tree:

Structure of the geometry module: GEO



3.2 General Routines Description

3.2.1 GEOIN1

Purpose Reading a first level geometry.

Syntax CALL GEOIN1(GEONAM, IPLIST, LEVEL , IMPX , MAXMIX)

Author(s) A. Hébert

Description of input parameters

GEONAM	character*12 scalar variable representing the name of the GEOMETRY data structure being generated or updated.
IPLIST	integer scalar variable for accessing the GEOMETRY data structure being generated or updated.
LEVEL	integer scalar variable describing the geometry level. Here LEVEL=1.
IMPX	integer scalar variable describing the amount of information printed by this routine. A value of IMPX=0 means that no information will be transferred to the output file while a value of IMPX=1 provides a description of all the records stored on the GEOMETRY data structure for the current geometry being defined. In the case where IMPX>1, the contents of the state vector is also printed. ^[3]

Description of input/output parameters

MAXMIX	integer scalar parameter describing the maximum number of mixtures used by all the geometries that have been processed at this point.
--------	---

Called by

DRAGON routine(s) : GEO

Calling

DRAGON routine(s) : GEOIN2

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMEXP, LCMGET, LCMLen, LCMNXT, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

3.2.2 GEOIN2

Purpose Reading a second level geometry (sub-geometry).

Syntax CALL GEOIN2(GEONAM, IPLIST, LEVEL , IMPX , MAXMIX)

Author(s) A. Hébert

Description of input parameters

GEONAM character*12 scalar variable representing the name of the geometry being processed.

IPLIST integer scalar variable for accessing the GEOMETRY data structure being generated or updated.

LEVEL integer scalar variable describing the geometry level. Here LEVEL=2.

IMPX integer scalar variable describing the amount of information printed by this routine. A value of IMPX=0 means that no information will be transferred to the output file while a value of IMPX=1 provides a description of all the records stored on the GEOMETRY data structure for the current geometry being defined. In the case where IMPX>1, the contents of the state vector is also printed.^[3]

Description of input/output parameters

MAXMIX integer scalar parameter describing the maximum number of mixtures used by all the geometries that have been processed at this point.

Called by

DRAGON routine(s) : GEOIN1

Calling

DRAGON routine(s) : GEOIN3

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMEXP, LCMGET, LCMLen, LCMNXT, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

3.2.3 GEOIN3

Purpose Reading a third level geometry.

Syntax CALL GEOIN3(GEONAM, IPLIST, LEVEL , IMPX , MAXMIX)

Author(s) A. Hébert

Description of input parameters

GEONAM character*12 scalar variable representing the name of the geometry being processed.

IPLIST integer scalar variable for accessing the GEOMETRY data structure being generated or updated.

LEVEL integer scalar variable describing the geometry level. Here LEVEL=3.

IMPX integer scalar variable describing the amount of information printed by this routine. A value of IMPX=0 means that no information will be transferred to the output file while a value of IMPX=1 provides a description of all the records stored on the GEOMETRY data structure for the current geometry being defined. In the case where IMPX>1, the contents of the state vector is also printed.^[3]

Description of input/output parameters

MAXMIX integer scalar parameter describing the maximum number of mixtures used by all the geometries that have been processed at this point.

Called by

DRAGON routine(s) : GEOIN2

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMEXP, LCMGET, LCMLN, LCMNXT, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

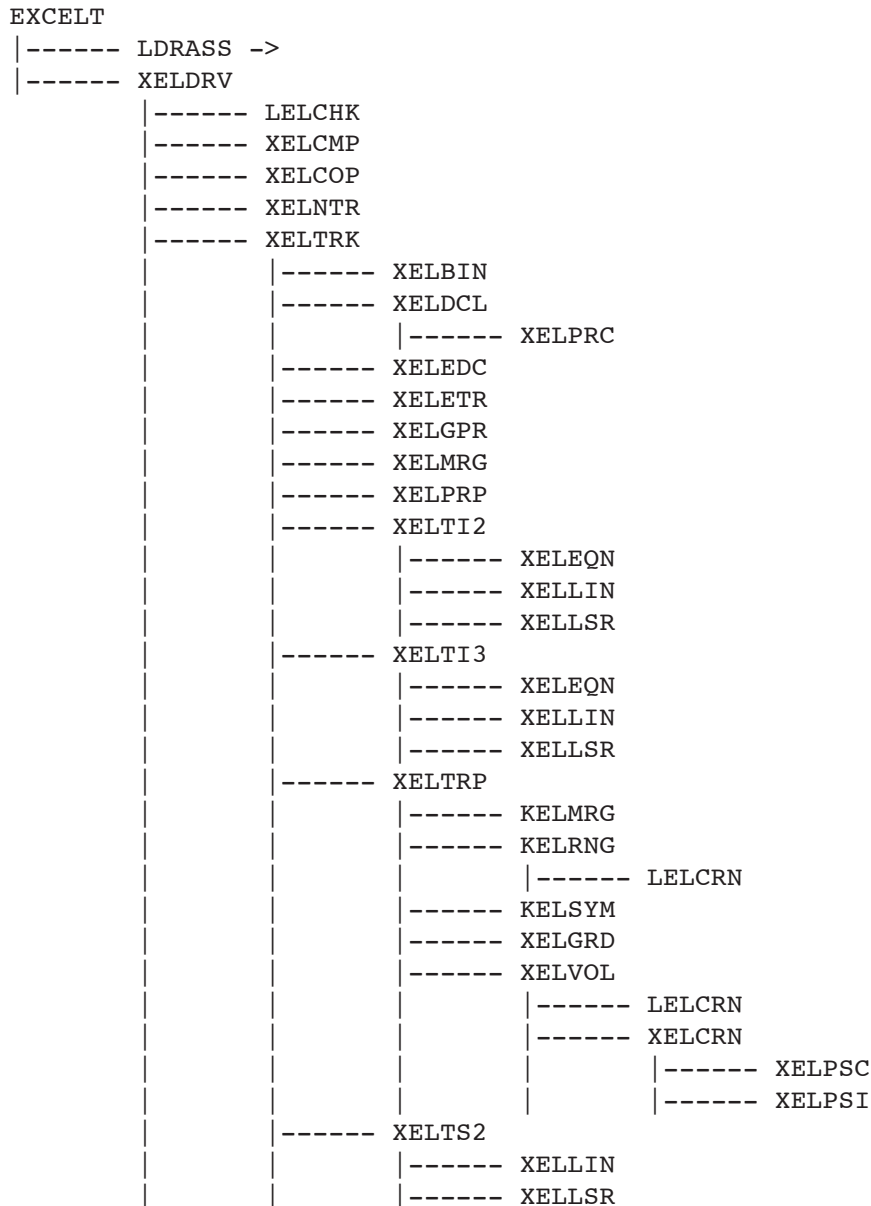
4 THE GENERAL CP TRACKING MODULE

4.1 Structure of EXCELT:

The main routine that controls this module is called EXCELT (see Section 2.2.2). It generally requires NENTRY=3 data structures. The first structure must be of type IENTRY(*i*)=1 (linked list) and will contain a TRACKING data structure. This data structure must be in creation or modification mode (JENTRY(*i*)=0 or 1). The second data structure will contain the binary tracking file (IENTRY(*i*)=3). Finally, the third data structure represents a GEOMETRY which must be located on a linked list or XSM file (IENTRY(*i*)=1 or 2) and must be in read-only mode (JENTRY(2)=2).

The EXCELT: module can be represented by the following tree:

Structure of module: EXCELT



		-----	XELTSW
		-----	XELTSW
-----	XCWTRK		
		-----	XCGBCM
		-----	XCGDIM
		-----	XCGGEO
		-----	XCGRD
		-----	XCWICL
		-----	XCWHEX
		-----	XCWREC
		-----	XCWROD
		-----	XCWSRT
		-----	XCWSCL
		-----	XCWREC
		-----	XCWROD
		-----	XCWSRT
		-----	XELTSW
		-----	XELTSW
-----	XXHTRK		
		-----	LHXUNH
		-----	DEPLIT
		-----	DUTURN
		-----	MESHST
		-----	NEIGHB ->
		-----	NEIGHB ->
		-----	TRKHEX

One can find a description of the routines LDRASS and NEIGHB in Section 21.3 and Section 6.3.9 respectively.

4.2 General Routines Description

4.2.1 KELMRG

Purpose To merge zones for a heterogeneous block.

Syntax KELMRG=KELMRG(IPGEOM, NSURO, NVOLO, IDLGEO, MATGEO)

Author(s) R. Roy

Description of input parameters

IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
NSURO	integer scalar variable describing the negative value of the number of surfaces for a specific sub-geometry.
NVOLO	integer scalar variable describing the number of zones for a specific sub-geometry.
IDLGEO	integer scalar variable for identifying the specific position of a geometry in MATGEO.
MATGEO	integer array of dimension MATGEO(NGIDL) containing material number corresponding to each zone in the geometry. Here NGIDL is computed by routine XELDCL (see Section 4.2.10).

Description of output parameters

KELMRG integer scalar variable containing the total number of surfaces and zones after merging.

Called by

DRAGON routine(s) : XELTRP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, XABORT

4.2.2 KELRNG

Purpose To renumber all zones and surfaces for a block according to rectangular/cylindrical coordinates.

Syntax KELRNG=KELRNG(IPRT, NDIM, NEXTGE, NCPC, MINDO, MAXDO, ICORDO, NSURO, NVOLO, IDLGEO, MAXC, RMESHO, MATGEO, VOLSO, INDEXO)

Author(s) R. Roy

Description of input parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT<5 means that no information will be transferred to the output file. Otherwise, the new surface and volume numbering scheme is send to the output file.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2–D problems, NDIM=2 while for 3–D problems NDIM=3.
NEXTGE	integer scalar variable describing the type of boundary. It takes the value of 0 for rectangular boundary and 1 for cylindrical boundary.
NCPC	integer scalar variable describing the number of cylindrical regions +3 in all geometry.
MINDO	integer array of dimension MINDO(NTOTCO) containing the minimum location in a RMESHO array associated with a Cartesian or cylindrical region. Here NTOTCO represents the total number of cylinders in all geometries.
MAXDO	integer array of dimension MAXDO(NTOTCO) containing the maximum location in a RMESHO array associated with a Cartesian or cylindrical region. Here NTOTCO represents the total number of cylinders in all geometries.
ICORDO	integer array of dimension ICORDO(NTOTCO) containing the coordinates in a RMESHO array associated with a Cartesian or cylindrical region. Here NTOTCO represents the total number of cylinders in all geometries.
NSURO	integer scalar variable containing the negative value of the number of surfaces for a specific sub-geometry.
NVOLO	integer scalar variable containing the number of zones for a specific sub-geometry.
IDLGEO	integer scalar variable for identifying the specific position of a geometry in MATGEO.

MAXC	integer scalar variable containing the number of elements in the RMESHO one dimensional array.
RMESHO	real array of dimension RMESHO(MAXC) containing the real mesh for the geometry.
MATGEO	integer array of dimension MATGEO(NGIDL) containing material number corresponding to each zone in the geometry. Here NGIDL is computed by routine XELDCL (see Section 4.2.10).
VOLSO	real array of dimension VOLSO(NGIDL) containing the volume and surface area associated with each each zone and surface in the geometry. Here NGIDL is computed by routine XELDCL (see Section 4.2.10).
INDEXO	integer array of dimension INDEXO(4,NGIDL) containing the indices for zones and surface identification as a function of position in RMESHO. Here NGIDL is computed by routine XELDCL (see Section 4.2.10).

Description of output parameters

KELRNG	integer scalar variable containing the number of zones and surface after the renumbering has been performed.
--------	--

Called by

DRAGON routine(s) : XELTRP

Calling

DRAGON routine(s) : LELCRN

UTILIB routine(s) :

GANLIB routine(s) :

4.2.3 KELSYM

Purpose To generate the symmetrization vector for a block.

Syntax KESYM=KESYM(IPRT, NDIM, MAXDO, NSURO, NVOLO, IDLGEO, INDEXO, MATGEO, KEYSYM)

Author(s) R. Roy

Description of input parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>0 indicates that the symmetry vector is provided on the output file.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
MAXDO	integer array of dimension MAXDO(NTOTCO) containing the maximum location in a RMESHO array associated with a Cartesian or cylindrical region. Here NTOTCO represents the total number of cylinders in all geometries.
NSURO	integer scalar variable containing the number of surfaces for a specific sub-geometry.
NVOLO	integer scalar variable containing the number of zones for a specific sub-geometry.

IDLGEO	integer scalar variable for identifying the specific position of a geometry in MATGEO.
INDEXO	integer array of dimension INDEXO(4,NGIDL) containing the indices for zones and surface identification as a function of position in RMESHO. Here NGIDL is computed by routine XELDCL (see Section 4.2.10).
MATGEO	integer array of dimension MATGEO(NGIDL) containing material number corresponding to each zone in the geometry. Here NGIDL is computed by routine XELDCL (see Section 4.2.10).

Description of output parameters

KEYSYM	integer array of dimension KEYSYM(NGIDL) containing indices for symmetry identification. Here NGIDL is computed by routine XELDCL (see Section 4.2.10).
KELSYM	integer scalar variable containing the number of zones and surface after symmetrization.

Called by

DRAGON routine(s) : XELTRP

4.2.4 LELCHK

Purpose To check the compatibility between an old TRACKING data structure and the tracking associated with the new geometry.

Syntax LELCHK=LELCHK(NSOLD, NVOLD, VOLOLD, MATOLD, ICOLD, NSNEW, NVNEW, VOLNEW, MATNEW, ICNEW, IPRT)

Author(s) R. Roy

Description of input parameters

NSURO	integer scalar variable containing the number of surfaces for an old TRACKING data structure.
NVOLD	integer scalar variable containing the maximum number of regions for an old TRACKING data structure.
VOLOLD	real array of dimension VOLOLD(-NSOLD:NVOLD) containing the volume and surface area associated with an old TRACKING data structure.
MATOLD	integer array of dimension MATOLD(-NSOLD:NVOLD) containing the mixtures and albedos associated with an old TRACKING data structure.
ICOLD	integer array of dimension ICOLD(6) for boundary conditions associated with an old TRACKING data structure.
NSNEW	integer scalar variable describing the number of surfaces for the new geometry.
NVNEW	integer scalar variable describing the maximum number of regions for the new geometry.
VOLNEW	real array of dimension VOLNEW(-NSNEW:NVNEW) containing the volume and surface area associated with the new geometry.
MATNEW	integer array of dimension MATNEW(-NSNEW:NVNEW) containing the mixtures and albedos associated with the new geometry.
ICNEW	integer array of dimension ICNEW(6) for boundary conditions associated with the new geometry.

IPRT integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>0 the changes in mixture and boundary conditions will be printed.

Description of output parameters

LELCHK logical scalar variable that is **.TRUE.** if both geometries are compatible (apart from mixture and boundary conditions) and **.FALSE.** if they are not.

Called by

DRAGON routine(s) : XELDRV

4.2.5 LELCRN

Purpose To check if a cylindrical region (crown) intersects a Cartesian mesh.

Syntax LELCRN=LELCRN(CENTEC, RAYONC, X, Y)

Author(s) R. Roy

Description of input parameters

CENTEC real array of dimension CENTEC(2) containing the center coordinates of a cylindrical region.

RAYONC real array of dimension RAYONC(2) containing the inner and outer radius of a cylindrical region.

X real array of dimension X(2) containing the *x* position of the Cartesian region.

Y real array of dimension Y(2) containing the *y* position of the Cartesian region.

Description of output parameters

LELCRN logical scalar variable that is **.TRUE.** if both geometries intersects and **.FALSE.** otherwise.

Called by

DRAGON routine(s) : KELRNG, XELVOL

4.2.6 XELBIN

Purpose To identify every zone of every type to its mixture and interfacing all internal surfaces for cells present in the supercell.

Syntax CALL XELBIN(IPGEOM, NDIM, NGEOME, L1CELL, NTYPES, NGIDL, NTIDL, NBLOCK, MAXGRI, NUNKO, IPRT, CELLG, NSURO, NVOLO, IDLGEO, MATGEO, KEYGEO, IDLTYP, IDLBLK, KEYTYP, MATTYP, KEYINT, ISPLT)

Author(s) R. Roy

Description of input parameters

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

NDIM integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.

NGEOME	integer scalar variable containing the number of sub-geometries.
L1CELL	logical scalar variable indicating the presence of a cell assembly. It is <code>.TRUE.</code> if the supercell is represented by a single geometry and <code>.FALSE.</code> otherwise.
NTYPES	integer scalar variable the number of geometry types.
NGIDL	integer scalar variable the length of the vector required for storing geometry information.
NTIDL	integer scalar variable the length of the vector required for storing geometry type information.
NBLOCK	integer scalar variable the number of geometry blocks.
MAXGRI	integer array of dimension MAXGRI(NDIM) containing the number of cells along each axis.
NUNCO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT<100 means that no information will be transferred to the output file otherwise, the region identification vector and the interface coupling will be printed.
CELLG	integer array of dimension CELLG(3*NTYPES) containing the geometry names in a integer format.
NSURO	integer array of dimension NSURO(NGEOME) containing the negative value of the number of surfaces for a specific sub-geometry.
NVOLO	integer array of dimension NVOLO(NGEOME) containing the number of zones for a specific sub-geometry.
IDLGEO	integer array of dimension IDLGEO(NGEOME) containing the position of each geometry in the numbering scheme.
MATGEO	integer array of dimension MATGEO(NGIDL) containing material number corresponding to each zone for every geometry.
KEYGEO	integer array of dimension KEYGEO(NTYPES) containing the geometry associated with each type.
IDLTP	integer array of dimension IDLTP(NTYPES) containing the position of each type in the numbering scheme.
IDLBLK	integer array of dimension IDLBLK(NBLOCK) containing the position of each block in the numbering scheme.
KEYTYP	integer array of dimension KEYTYP(NBLOCK) containing the type associated with each block.

Description of output parameters

MATTYP	integer array of dimension MATTYP(NTIDL) containing material number corresponding to each zone for every type.
KEYINT	integer array of dimension KEYINT(NUNCO) containing the interface coupling. Here MREGIO is the maximum number of region for all geometry.

Description of work parameters

ISPLT	integer array of dimension ISPLT(MREGIO) containing the splitting vector. Here MREGIO is the maximum number of region for all geometry.
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Called by

DRAGON routine(s) : PSPGEO, XELTRK, XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMLIB, LCMSIX, XABORT

4.2.7 XELCMP

Purpose To merge volumes and surfaces and recompute the number of surfaces and volumes.

Syntax CALL XELCMP(NS, NV, VOLIN, MATIN, MRGIN, NSOUT, NVOUT, VOLOUT, MATOUT,
ITGEO, ICODE)

Author(s) R. Roy

Description of input parameters

NS	integer scalar variable describing the number of surfaces before merging.
NV	integer scalar variable describing the number of volumes before merging.
VOLIN	real array of dimension VOLIN(-NS:NV) containing the volumes and surfaces before merging.
MATIN	integer array of dimension MATIN(-NS:NV) containing the mixtures and boundary conditions before merging.
MRGIN	integer array of dimension MRGIN(-NS:NV) containing the merging indices.
ITGEO	integer scalar variable describing the type of geometry.
ICODE	integer array of dimension ICODE(6) containing the boundary condition types.

Description of output parameters

NSOUT	integer scalar variable describing the number of surfaces after merging.
NVOUT	integer scalar variable describing the number of volumes after merging.
VOLOUT	real array of dimension VOLOUT(NV+NS+1) containing the volumes and surfaces after merging.
MATOUT	integer array of dimension MATOUT(NV+NS+1) containing the mixtures and boundary conditions after merging.

Called by

DRAGON routine(s) : XELDRV, XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.8 XELCOP

Purpose To duplicate a DRAGON binary tracking file.

Syntax CALL XELCOP(IFILE1, IFILE2)

Author(s) R. Roy

Description of parameters

IFILE1 integer scalar variable for accessing the binary tracking file to be copied.

IFILE2 integer scalar variable for accessing the output binary tracking file.

Called by

DRAGON routine(s) : XELDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

4.2.9 XELCRN

Purpose To find 2-D surface of intersection between annular region and Cartesian plane.

Syntax CALL XELCRN(IPRINT, RANN2, NRSPX, NRSPY, SPAT, AREAI)

Author(s) G. Marleau

Description of input parameters

IPRINT integer scalar variable describing the amount of information printed by this routine. A value of IPRNT < 10 means that no information will be transferred to the output file. Otherwise a full description of the region being analyzed is provided as well as the intersections located.

RANN2 real scalar variable describing the annular region square radius.

NRSPX integer scalar variable containing the number of x meshes.

NRSPY integer scalar variable containing the number of y meshes.

SPAT real array of dimension SPAT(NRSPX+1,NRSPY+1) containing the spatial position of the mesh.

Description of output parameters

AREAI real array of dimension AREAI(NRSPX,NRSPY) giving the area of intersection between the Cartesian mesh and the annular region.

Called by

DRAGON routine(s) : XELVOL

Calling

DRAGON routine(s) : XELPSC, XELPSI

UTILIB routine(s) : XDRSET

GANLIB routine(s) :

4.2.10 XELDCL

Purpose To associate all blocks of a problem to their block types and generate almost all useful integer values that will describe the problem.

Syntax CALL XELDCL(IPGEOM, GEONAM, NDIM, MAXGRI, LCLSYM, NBLOCK, NTYPO, LL1, LL2, IPRT, NTOTCO, MAXRO, NGEOME, NTYP, NGIDL, NTIDL, NUNKO, CELLG, NSURO, NVOLO, IDLDIM, IDLGEO, KEYTRN, KEYGEO, IDLTYP, KEYTYP, MRGCEL, IDLBLK, ITGEOM, CELLT, ISPLT)

Author(s) R. Roy

Description of input parameters

IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
GEONAM	character*12 scalar variable containing the name of the GEOMETRY data structure to be analyzed.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
MAXGRI	integer array of dimension MAXGRI(3) containing the number of grid points in the 3 Cartesian directions.
LCLSYM	integer array of dimension LCLSYM(3) containing the symmetry options in the 3 Cartesian directions.
NBLOCK	integer scalar variable describing the number of geometry blocks.
NTYPO	integer scalar variable describing the number of old geometry types.
LL1	logical scalar variable that is .TRUE. for upper diagonal symmetry and .FALSE. otherwise.
LL2	logical scalar variable that is .TRUE. for lower diagonal symmetry and .FALSE. otherwise.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while for a value of IPRT=1, the cell description will be provided. In the case where IPRT>10, the cell index vector is also printed.

Description of output parameters

NTOTCO	integer scalar variable describing the total number of cylindrical regions in all geometry.
MAXRO	integer scalar variable describing the maximum number of words provided to store the mesh.
NGEOME	integer scalar variable describing the number of geometry.

NTYP	integer scalar variable describing the number of geometry types.
NGIDL	integer scalar variable the length of the vector required for storing geometry information.
NTIDL	integer scalar variable the length of the vector required for storing geometry type information.
NUNKO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
CELLG	integer array of dimension CELLG(3*NTYPES) containing the geometry names in a integer format.
NSURO	integer array of dimension NSURO(NGEOME) containing the negative value of the number of surfaces for a specific sub-geometry.
NVOLO	integer array of dimension NVOLO(NGEOME) containing the number of zones for a specific sub-geometry.
IDLDIM	integer array of dimension IDLDIM(NBLOCK) containing the position of each geometry in cylinder numbering scheme.
IDLGEO	integer array of dimension IDLGEO(NBLOCK) containing the position of each geometry in geometry numbering scheme.
KEYTRN	integer array of dimension KEYTRN(NBLOCK) containing the turn for each block.
KEYGEO	integer array of dimension KEYGEO(NBLOCK) containing the geometry key for each type.
IDLTYT	integer array of dimension IDLTYP(NBLOCK) containing the position of each type in geometry numbering scheme.
KEYTYP	integer array of dimension KEYTYP(NBLOCK) containing the type key for each block.
MRCCEL	integer array of dimension MRCCEL(NBLOCK) containing the merging key for each block.
IDLBLK	integer array of dimension IDLBLK(NBLOCK) containing the position of each block in geometry numbering scheme.

Description of work parameters

ITGEOM	integer array of dimension ITGEOM(NBLOCK) containing the turn key by cell type.
CELLT	integer array of dimension CELLT(3*NTYPO) containing the cell type name in integer format.
ISPLT	integer array of dimension ISPLT(MREGIO) containing the splitting vector. Here MREGIO is the maximum number of region for all geometry.

Called by

DRAGON routine(s) : PSPGEO, XELTRK, XL3TRK

Calling

DRAGON routine(s) : XELPRC

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, XABORT

4.2.11 XELDRV

Purpose To read or generate a TRACKING data structure and/or re-normalization of a binary tracking file.

Syntax CALL XELDRV(IPTRK, IPGEOM, IPRT, MAXPTS, NANIS, NORE, KSPEC, KTOPT, TITREC, CUTOFX, CFTRAK, IFTRAK, IDISP, ISYMM, MATCOD, VOLUME, KEYFLX)

Author(s) R. Roy

Description of input parameters

IPTRK	integer scalar variable for accessing the TRACKING data structure to be created or read.
IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>0 implies that a general description of the geometry is provided on the output file.
MAXPTS	integer scalar variable describing the user provided maximum number of zones.
NANIS	integer scalar variable describing the anisotropy of the solution.
NORE	integer scalar variable describing the track normalization option. A value of NORE=0 implies track normalization while a value of NORE=1 implies no track normalization.
KSPEC	integer scalar variable describing the type of CP calculation. A value of KSPEC=0 is for standard CP calculation while a value of KSPEC=1 implies that in addition, directional CP will also be evaluated.
KTOPT	integer scalar variable describing the tracking type option.
TITREC	character*72 scalar variable describing the title of the problem.
CUTOFX	real scalar variable describing the mean free path cutoff for specular tracking.
CFTRAK	character*12 scalar variable containing the name of the binary tracking file to be created or read.
IFTRAK	integer scalar variable for accessing the binary tracking file to be created or read.
IDISP	integer scalar variable describing the mode for the binary tracking file. A new file has mode IDISP=1, old file has mode IDISP=0 and a file to update has mode IDISP=-1.
ISYMM	integer scalar variable describing the symmetry factor for cluster cell tracking.

Description of output parameters

MATCOD	integer array of dimension MATCOD(MAXPTS) containing the mixture number associated with each zone in the geometry.
VOLUME	real array of dimension VOLUME(MAXPTS) containing the volume of each zone in the geometry.
KEYFLX	integer array of dimension KEYFLX(MAXPTS) containing the region number associated with each zone in the geometry.

Called by

DRAGON routine(s) : EXCELT

Calling

DRAGON routine(s) : LELCHK, XCWTRK, XELCMP, XELCOP, XELNTR, XELTRK, XHXTRK

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMGET, LCMNXT, LCMPUT, SETARA, RLSARA, XABORT

4.2.12 XELED C

Purpose To associate all blocks of a problem to only one geometry and generate the 4 useful integer values that will describe the problem in its exact geometric description.

Syntax CALL XELED C(NDIM, MAXGRI, NGEOME, NTOTCO, NTYPES, NBLOCK, NUNKO, NSURO, NVOLO, MINDO, MAXDO, ICORDO, IDLDIM, KEYGEO, KEYTYP, IDLBLK, KEYINT, NTOTCL, MAXR, NSUR, NVOL, KEYCYL)

Author(s) R. Roy

Description of input parameters

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
MAXGRI	integer array of dimension MAXGRI(3) containing the number of grid points in the 3 Cartesian directions.
NGEOME	integer scalar variable describing the number of geometry.
NTOTCO	integer scalar variable describing the total number of cylindrical regions in all geometry.
NTYPES	integer scalar variable describing the number of geometry types.
NBLOCK	integer scalar variable describing the number of geometry blocks.
NUNKO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
NSURO	integer array of dimension NSURO(TYPES) containing the negative value of the number of surfaces for a specific sub-geometry.
NVOLO	integer array of dimension NVOLO(TYPES) containing the number of zones for a specific sub-geometry.
MINDO	integer array of dimension MINDO(NTOTCO) containing the minimum location in a RMESHO array associated with a Cartesian or cylindrical region.
MAXDO	integer array of dimension MAXDO(NTOTCO) containing the maximum location in a RMESHO array associated with a Cartesian or cylindrical region.
ICORDO	integer array of dimension ICORDO(NTOTCO) containing the coordinates in a RMESHO array associated with a Cartesian or cylindrical region.
IDLDIM	integer array of dimension IDLDIM(NTYPES) containing the position of each geometry in cylinder numbering scheme.
KEYGEO	integer array of dimension KEYGEO(NTYPES) containing the geometry key for each type.

KEYTYP integer array of dimension KEYTYP(NBLOCK) containing the type key for each block.

IDLBLK integer array of dimension IDLBLK(NBLOCK) containing the position of each block in geometry numbering scheme.

KEYINT integer array of dimension KEYINT(NUNKO) containing the cell interface number.

Description of output parameters

NTOTCL integer scalar variable describing the total number of cylinder in exact geometry.

MAXR integer scalar variable describing the number of elements in the REMESH one dimensional array.

NSUR integer scalar variable describing the negative value of the exact number of surfaces for a geometry.

NVOL integer scalar variable describing the exact number of regions for a geometry.

KEYCYL integer array of dimension KEYCYL(NBLOCK) containing the index of cylinder per block.

Called by

DRAGON routine(s) : PSPGEO, XELTRK, XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.13 XELEQN

Purpose To generate equal weight integration angles.

Syntax CALL XELEQN(NDIM, NANGLE, ANGEQN)

Author(s) R. Roy

Description of input parameters

NDIM integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.

NANGLE integer scalar variable describing the number of integration angles required.

Description of output parameters

ANGEQN real array of dimension ANGEQN(NDIM,NDIM) containing the director cosine for each angle in each Cartesian direction ANGEQN(NDIM,1). For $j=2$, NDIM the perpendicular director cosines are stored.

Called by

DRAGON routine(s) : XELTI2, XELTI3, XL3TI3

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.14 XELETR

Purpose To prepare for tracking by producing the required numbering and recalculating mesh for an exact geometry treatment.

Syntax CALL XELETR(IPRT, NDIM, MAXGRI, NGEOME, NTOTCO, NTYPES, NTIDL, NBLOCK, NSUR, NVOL, NTOTCL, NUNCO, NSURO, NVOLO, MINDO, MAXDO, ICORDO, IDLDIM, IDLGEO, KEYGEO, IDLTYP, KEYTYP, IDLBLK, KEYCYL, RMESHO, IDLREM, INDEXO, VOLSO, MATGEO, KEYINT, MATTYP, REMESH, MINDIM, MAXDIM, ICORD, VOLSUR, KEYMRG, INDEX, INCELL, MATALB, NSURC , NVOLC)

Author(s) R. Roy

Description of input parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>1 the global meshing in the exact geometry is provided on the output file. In the case where IPRT>5, the contents of all the output variables is also provided.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
MAXGRI	integer array of dimension MAXGRI(3) containing the number of grid points in the 3 Cartesian directions.
NGEOME	integer scalar variable describing the number of geometry.
NTOTCO	integer scalar variable describing the total number of cylindrical regions in all geometry.
NTYPES	integer scalar variable describing the number of geometry types.
NTIDL	integer scalar variable describing the length of the vector required for storing geometry type information.
NBLOCK	integer scalar variable describing the number of geometry blocks.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
NVOL	integer scalar variable describing the exact number of regions for a geometry.
NTOTCL	integer scalar variable describing the total number of cylinder in exact geometry.
NUNCO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
NSURO	integer array of dimension NSURO(NGEOME) containing the negative value of the number of surfaces for a specific sub-geometry.
NVOLO	integer array of dimension NVOLO(NGEOME) containing the number of zones for a specific sub-geometry.

MINDO	integer array of dimension MINDO(NTOTCO) containing the minimum location in a RMESHO array associated with a Cartesian or cylindrical region.
MAXDO	integer array of dimension MAXDO(NTOTCO) containing the maximum location in a RMESHO array associated with a Cartesian or cylindrical region.
ICORDO	integer array of dimension ICORDO(NTOTCO) containing the coordinates in a RMESHO array associated with a Cartesian or cylindrical region.
IDLDIM	integer array of dimension IDLDIM(NGEOME) containing the position of each geometry in cylinder numbering scheme.
IDLGEO	integer array of dimension IDLGEO(NGEOME) containing the position of each geometry in geometry numbering scheme.
KEYGEO	integer array of dimension KEYGEO(NTYPES) containing the geometry key for each type.
IDLTYT	integer array of dimension IDLTYP(NTYPES) containing the position of each type in geometry numbering scheme.
KEYTYP	integer array of dimension KEYTYP(NBLOCK) containing the type key for each block.
IDLBLK	integer array of dimension IDLBLK(NBLOCK) containing the position of each block in geometry numbering scheme.
KEYCYL	integer array of dimension KEYCYL(NBLOCK) containing the index of cylinder per block.
RMESHO	real array of dimension RMESHO(MAXRO) containing the real mesh for the geometry.
IDLREM	integer array of dimension IDLREM(NGEOME) describing position of mesh values per geometry.
INDEXO	integer array of dimension INDEXO(4,NGIDL) containing the reference index for zones and surface identification as a function of position in RMESHO. Here NGIDL is computed by routine XELDCL.
VOLSO	real array of dimension VOLSO(NGIDL) containing the volumes and surfaces as a function of position in RMESHO. Here NGIDL is computed by routine XELDCL.
MATGEO	integer array of dimension MATGEO(NGIDL) containing the material number corresponding to each zone in the geometry. Here NGIDL is computed by routine XELDCL.
KEYINT	integer array of dimension KEYINT(NUNKO) containing the interface coupling. Here MREGIO is the maximum number of region for all geometry.
MATTYP	integer array of dimension MATTYP(NTIDL) containing the material number corresponding to each zone for every type.

Description of output parameters

REMESH	real array of dimension REMESHO(MEXREM) containing the real mesh for the exact geometry.
MINDIM	integer array of dimension MINDIM(NTOTCL) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.
MAXDIM	integer array of dimension MAXDIM(NTOTCL) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.
ICORD	integer array of dimension ICORD(NTOTCL) containing the coordinates in a REMESH array associated with a Cartesian or cylindrical region.

VOLSUR	real array of dimension VOLSO(NUNK) containing the volumes and surfaces as a function of position in REMESH. Here NUNK is computed by routine XELTRK.
KEYMRG	integer array of dimension KEYMRG(NUNK) containing the merging index for exact geometry. Here NUNK is computed by routine XELTRK.
INDEX	integer array of dimension INDEX(4,NGIDL) containing the new index for zones and surface identification. Here NGIDL is computed by routine XELDCL.
INCELL	integer array of dimension INCELL(NUNK) containing the block numbering in exact geometry. Here NUNK is computed by routine XELTRK.
MATALB	integer array of dimension MATALB(NUNK) containing the albedo and mixture index in exact geometry. Here NUNK is computed by routine XELTRK.
NSURC	integer scalar variable containing the compressed number of surfaces after removal of the virtual surfaces.
NVOLC	integer scalar variable the compressed number of regions after removal of the virtual regions.

Called by

DRAGON routine(s) : PSPGEO, XELTRK, XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.15 XELGPR

Purpose To print a semi-graphical representation of the geometry.

Syntax CALL XELGPR(NDIM, NTX, NTY, NTZ, NTR, NSUR, NVOL, NTOTCL, MINDIM, MAXDIM, KEYMRG, INDEX, MATALB, NAMNUM)

Author(s) G. Marleau

Description of input parameters

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
NTX	integer scalar variable describing the number of x directed mesh.
NTY	integer scalar variable describing the number of y directed mesh.
NTZ	integer scalar variable describing the number of z directed mesh.
NTR	integer scalar variable describing the number of radial directed mesh.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
NVOL	integer scalar variable describing the exact number of regions for a geometry.

NTOTCL	integer scalar variable describing the total number of cylindrical regions +3 in exact geometry.
MINDIM	integer array of dimension MINDIM(NTOTCL) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.
MAXDIM	integer array of dimension MAXDIM(NTOTCL) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.
KEYMRG	integer array of dimension KEYMRG(NSUR:NVOL) containing the merging index for exact geometry.
INDEX	integer array of dimension INDEX(4,NSUR:NVOL) containing the index for zones and surface identification.
MATALB	integer array of dimension MATALB(NSUR:NVOL) containing the albedo and mixture index in exact geometry.

Description of work parameters

NAMNUM	integer array of dimension NAMNUM(3,NTR+1,0:NTX+1,0:NTY+1,0:NTZ+1) use for temporary storage.
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Called by

DRAGON routine(s) : XELTRK, XL3TRK

4.2.16 XELGRD

Purpose To read the geometry input for a specific type of cell.

Syntax CALL XELGRD(IPGEOM, IPRT, NDIM, NEXTGE, ITURN, MAXC, RMESHO, MINDO, MAXDO, ICORDO, ISPLT)

Author(s) R. Roy

Description of input parameters

IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>1 will provide an exact description of the geometry being processed.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
NEXTGE	integer scalar variable describing the type of boundary. It takes the value of 0 for rectangular boundary and 1 for cylindrical boundary.
ITURN	integer scalar variable describing the turn index for this geometry.

Description of output parameters

MAXC	integer scalar variable describing the real dimension of RMESHO for this geometry.
RMESHO	real array of dimension RMESHO(MAXRO) containing a description of the geometry. The value of MAXRO is available in XELTRP.

MINDO	integer array of dimension MINDO(NTOTCO) containing the minimum location in a RMESHO array associated with a Cartesian or cylindrical region where NTOTCO represents the total number of cylinders in all geometry provided in XELTRP.
MAXDO	integer array of dimension MAXDO(NTOTCO) containing the maximum location in a RMESHO array associated with a Cartesian or cylindrical region where NTOTCO represents the total number of cylinders in all geometry provided in XELTRP.
ICORDO	integer array of dimension ICORDO(NTOTCO) containing the coordinates in a RMESHO array associated with a Cartesian or cylindrical region where NTOTCO represents the total number of cylinders in all geometry provided in XELTRP.
ISPLT	integer array of dimension ISPLT(MREGIO) containing the splitting vector. Here MREGIO is the maximum number of region for all geometry.

Called by

DRAGON routine(s) : XELTRP

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, XABORT

4.2.17 XELLIN

Purpose To create one tracking line.

Syntax CALL XELLIN(NDIM, NCP, MAXREM, REMESH, NSUR, NVOL, INDEL, MINDIM, MAXDIM, ICOORD, ICUR, INCR, TRKBEG, TRKEND, TRKDIR, PROJ2, TOTLEN, CONV, LINMAX, LENGHT, NUMERO, LINE)

Author(s) R. Roy

Description of input parameters

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
NCP	integer scalar variable describing the total number of cylindrical regions +3 in exact geometry.
MAXREM	integer scalar variable describing the number of elements in the REMESH one dimensional array.
REMESH	real array of dimension REMESH(MAXREM) describing the real mesh for the exact geometry.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
NVOL	integer scalar variable describing the exact number of regions for a geometry.
INDEL	integer array of dimension INDEL(4,NVOL-NSUR+1) containing the numbering of surfaces and zones.
MINDIM	integer array of dimension MINDIM(NCP) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.

MAXDIM	integer array of dimension MAXDIM(NCP) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.
ICOORD	integer array of dimension ICOORD(NCP) containing the coordinates in a REMESH array associated with a Cartesian or cylindrical region.
TRKDIR	real array of dimension TRKDIR(NCP) describing direction of a track.
PROJC2	real array of dimension PROJ2(3) describing projections of TRKDIR along tracked angles.
TOTLEN	real scalar variable describing total length of a track.
LINMAX	integer scalar variable describing the maximum number of track segments in a single track.

Description of output parameters

LENGHT	real array of dimension LENGHT(LINMAX) containing the length of each track segments in a single track.
NUMERO	integer array of dimension NUMERO(LINMAX) containing the region number crossed by each track segments in a single track.
LINE	integer scalar variable describing the number of segment in a track.

Description of work parameters

ICUR	integer array of dimension ICUR(NCP) describing current zonal location for a track segment.
INCR	integer array of dimension INCR(NCP) describing increment direction for next track segment.
TRKBEG	real array of dimension TRKBEG(NCP) describing position where a track begins.
TRKEND	real array of dimension TRKEND(NCP) describing position where a track ends.
CONV	real array of dimension CONV(NCP) segment length of a track.

Called by

DRAGON routine(s) : XELTI2, XELTI3, XELTS2, XL3TI3

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.18 XELLSR

Purpose To locate the beginning and ending surfaces crossed by a track.

Syntax CALL XELLSR(NDIM, NCP, NSUR, MAXREM, REMESH, INDEL, MINDIM, MAXDIM,
ICOORD, ICUR, INCR, TRKORI, TRKDIR, TRKCUT, NSCUT,
NCROS, TOTLEN)

Author(s) R. Roy

Description of input parameters

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
NCP	integer scalar variable describing the total number of cylindrical regions +3 in exact geometry.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
MAXREM	integer scalar variable describing the number of elements in the REMESH one dimensional array.
REMESH	real array of dimension REMESH(MAXREM) containing the real mesh for the exact geometry.
INDEL	integer array of dimension INDEL(4,NVOL-NSUR+1) containing the numbering of surfaces and zones.
MINDIM	integer array of dimension MINDIM(NCP) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.
MAXDIM	integer array of dimension MAXDIM(NCP) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.
ICOORD	integer array of dimension ICOORD(NCP) containing the coordinates in a REMESH array associated with a Cartesian or cylindrical region.
TRKORI	real array of dimension TRKORI(3) describing origin of a track.
TRKDIR	real array of dimension TRKDIR(3) describing direction of a track.

Description of output parameters

TRKCUT	real array of dimension TRKCUT(3,2) describing points where tracks cuts the domain.
NSCUT	integer array of dimension NSCUT(2) describing surface where the track begins (NSCUT(1)) or ends (NSCUT(2)).
NCROS	integer scalar variable describing the number of surfaces crossed by the track.
TOTLEN	real scalar variable describing total length of a track.

Description of work parameters

ICUR	integer array of dimension ICUR(NCP) describing current zonal location for a track segment.
INCR	integer array of dimension INCR(NCP) describing increment direction for next track segment.

Called by

DRAGON routine(s) : XELTI2, XELTI3, XELTS2, XL3TI3

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.19 XELMRG

Purpose To build the merging vector according to implicit symmetry imposed by the boundary conditions.

Syntax CALL XELMRG(IPRT, NSUR, NVOL, NSBC, NTOTCL, INDEX, MINDIM, MAXDIM,
 LCLSYM, LCLTRA, LL1, LL2, NEXTGE, MRGCEL, MATALB, KEYMRG,
 INCELL, MATRT)

Author(s) R. Roy

Description of input parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>0 describe the number of zones and surfaces after merging. For IPRT>1, the explicit relation between the original zone and surface and their merged counterpart is also provided.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
NVOL	integer scalar variable describing the exact number of regions for a geometry.
NSBC	integer scalar variable describing the number of surfaces with independent boundary conditions.
NTOTCL	integer scalar variable describing the total number of cylindrical regions +3 in exact geometry.
INDEX	integer array of dimension INDEX(4,NGIDL) containing the index for zones and surface identification as a function of position. Here NGIDL is computed by routine XELDCL.
MINDIM	integer array of dimension MINDIM(NTOTCL) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.
MAXDIM	integer array of dimension MAXDIM(NTOTCL) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.
LCLSYM	integer array of dimension LCLSYM(3) giving the symmetry flags.
LCLTRA	integer array of dimension LCLTRA(3) giving the translation symmetry flags.
LL1	logical scalar variable that is .TRUE. for upper diagonal symmetry and .FALSE. otherwise.
LL2	logical scalar variable that is .TRUE. for lower diagonal symmetry and .FALSE. otherwise.
NEXTGE	integer scalar variable describing the type of boundary. It takes the value of 0 for rectangular boundary and 1 for cylindrical boundary.
MRGCEL	integer array of dimension MRGCEL(NBLOCK) containing the merging key for each block.
MATLAB	integer array of dimension MATLAB(NUNK) containing the albedo and mixture index in exact geometry. Here NUNK is computed by routine XELTRK.

Description of input/output parameters

KEYMRG	integer array of dimension KEYMRG(NUNK) containing the merging index for exact geometry. Here NUNK is computed by routine XELTRK.
INCELL	integer array of dimension INCELL(NUNK) containing the block numbering in exact geometry. Here NUNK is computed by routine XELTRK.

Description of output parameters

MATRT	integer array of dimension MATRT(-NSUR,2) describing reflection/transmission vector.
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Called by

DRAGON routine(s) : PSPGEO, XELTRK, XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.20 XELNTR

Purpose To re-normalize tracks to obtain true volume values.

Syntax CALL XELNTR(NDIM, IFOLD, IFTRAK, NORE, IPRT, NS, NV, VOLIN, MATIN, MRGIN, NSOUT, NVOOUT, VOLOUT, MATOUT, CUTOFX, ITGEO, ICODE, ALBEDO, NANGL, LIN, VOLTRK, ANGLES, DENSTY, PATH, NRSEG)

Author(s) R. Roy

Description of input parameters

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
IFOLD	integer scalar variable for accessing the temporary or old binary tracking file.
IFTRAK	integer scalar variable for accessing the binary tracking file to be created.
NORE	integer scalar variable describing the track normalization option. A value of NORE=0 implies track normalization while a value of NORE=1 implies no track normalization.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT \geq 999 will print the description of each tracking line.
NS	integer scalar variable describing the number of surfaces before merging.
NV	integer scalar variable describing the number of regions before merging.
VOLIN	real array of dimension VOLIN(-NS:NV) containing the volumes and surfaces before merging.
MATIN	integer array of dimension MATIN(-NS:NV) containing the mixtures and boundary conditions before merging.
MRGIN	integer array of dimension MRGIN(-NS:NV) containing the merging indices.
NSOUT	integer scalar variable describing the number of surfaces after merging.
NVOOUT	integer scalar variable describing the number of volumes after merging.
VOLOUT	real array of dimension VOLOUT(-NSOUT:NVOOUT) containing the volumes and surfaces after merging.
MATOUT	integer array of dimension MATOUT(-NSOUT:NVOOUT) containing the mixtures and boundary conditions after merging.
CUTOFX	real scalar variable describing the cutoff factor.
ITGEO	integer scalar variable describing the type of geometry.

ICODE integer array of dimension ICODE(6) containing the boundary condition types.

NANGL integer scalar variable describing the number of tracking angles.

LIN integer scalar variable describing the maximum number of segments in an integration line.

Description of output parameters

ALBEDO real array of dimension ALBEDO(6) containing the albedos.

Description of work parameters

VOLTRK double precision array of dimension VOLTRK(-NS:NV,0:NANGL) containing the volume and surfaces computed using the tracking information.

ANGLES real array of dimension ANGLES(3,NANGL) containing the tracking angles.

DENSTY real array of dimension DENSTY(NANGL) containing the effective track density.

PATH real array of dimension PATH(LIN) containing the segment length for each integration line.

NRSEG integer array of dimension NRSEG(LIN) containing the volumes and surfaces crossed by each integration line.

Called by

DRAGON routine(s) : XELDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.21 XELPRC

Purpose To read a cell and to check if it is acceptable for the EXCELT module.

Syntax CALL XELPRC(IPGEOM, GEONAM, NDIM, NNCYL, NNSUR, NNVOL, NAXREM, ISPLT)

Author(s) R. Roy

Description of input parameters

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

GEONAM character*12 scalar variable containing the name of the GEOMETRY data structure to be analyzed.

NDIM integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.

Description of output parameters

NNCYL integer scalar variable describing the number of cylinders in the geometry.

NNSUR integer scalar variable describing the number of surfaces in the geometry.

NNVOL integer scalar variable describing the number of volumes in the geometry.

NAXREM integer scalar variable describing the maximum number of coordinates to specify that geometry.

Description of work parameters

ISPLT integer array of dimension ISPLT(MREGIO) containing the splitting vector. Here MREGIO is the maximum number of region for all geometry.

Called by

DRAGON routine(s) : XELDCL

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, XABORT

4.2.22 XELPRP

Purpose To read a geometry and to check if is acceptable for the EXCELT : module.

Syntax CALL XELPRP(IPGEOM, GEONAM, NDIM, NTYPO, NBLOCK, NBMIX, MAXGRI, ALBEDO, ICODE, NCODE, LCLSYM, LCLTRA, MRGSUR, LEAKSW, LL1, LL2, L1CELL, NEXTGE, IFCSYM, IPRT)

Author(s) R. Roy

Description of input parameters

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

GEONAM character*12 scalar variable containing the name of the GEOMETRY data structure to be analyzed.

IPRT integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>2 provides the output of a full geometry description.

Description of output parameters

NDIM integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.

NTYPO integer scalar variable describing the number of old geometry types.

NBLOCK integer scalar variable describing the number of geometry blocks.

NBMIX integer scalar variable describing the number of mixtures used in this geometry.

MAXGRI integer array of dimension MAXGRI(3) containing the number of grid points in the 3 Cartesian directions.

ALBEDO real array of dimension ALBEDO(6) containing the albedos.

ICODE integer array of dimension ICODE(6) containing the boundary condition types.

NCODE	integer array of dimension NCODE(6) containing the albedo number.
LCLSYM	integer array of dimension LCLSYM(3) giving the symmetry flags.
LCLTRA	integer array of dimension LCLTRA(3) giving the translation symmetry flags.
MRGSUR	integer array of dimension MRGSUR(-6:-1) containing the similarity between faces.
LEAKSW	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
LL1	logical scalar variable that is .TRUE. for upper diagonal symmetry and .FALSE. otherwise.
LL2	logical scalar variable that is .TRUE. for lower diagonal symmetry and .FALSE. otherwise.
L1CELL	logical scalar variable indicating the presence of a cell assembly. It is .TRUE. if the supercell is represented by a single geometry and .FALSE. otherwise.
NEXTGE	integer scalar variable describing the type of boundary. It takes the value of 0 for rectangular boundary and 1 for cylindrical boundary.
IFCSYM	integer scalar variable describing the number of symmetry in full assembly.

Called by

DRAGON routine(s) : PSPGEO, XELTRK, XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, XABORT

4.2.23 XELPSC

Purpose To compute annular surface below Cartesian plane.

Syntax XELPSC=XELPSC(RANN, PLANE)

Author(s) G. Marleau

Description of input parameters

RANN real scalar variable describing annular radius.

PLANE real scalar variable describing Cartesian plane location.

Description of output parameters

XELPSC real scalar variable describing annular surface located below Cartesian plane.

Called by

DRAGON routine(s) : XELCRN

4.2.24 XELPSI

Purpose To compute the intersection surface between part of annular region to the left of x plane and either the part of the annular region above y plane or the part below the y plane.

Syntax XELPSI=XELPSI(ITYP, RANN2, XYPOS, XYPOS2, SPXY)

Author(s) G. Marleau

Description of input parameters

ITYP integer scalar variable describing the type of calculation. For ITYPE=1, the surface above the y plane is considered. For ITYPE=2, the surface below the y plane is considered.

RANN2 real scalar variable describing the squared annular radius.

XYPOS real array of dimension XYPOS(2,2) containing the Cartesian location of the x and y planes.

XYPOS2 real array of dimension XYPOS2(2,2) containing the Cartesian location of the x and y planes. These are only the square of XYPOS(2,2).

SPXY real array of dimension SPXY(2,2) containing the part of the annular surface located outside each on the planes described by XYPOS(2,2).

Description of output parameters

XELPSI real scalar variable describing the intersection surface between an annular region and a Cartesian region.

Called by

DRAGON routine(s) : XELCRN

4.2.25 XELTI2

Purpose To build the sequential tape that will contain tracks for isotropic 2-D calculations.

Syntax CALL XELTI2(IPRT, IFTEMP, NANGLE, DENUSR, LSYMXY, ANGLES, DENSTY, NTOTCL, MAXR, REMESH, LINMAX, RCUTOF, NSUR, NVOL, INDEL, MINDIM, MAXDIM, ICOORD, INCR, ICUR, TRKBEG, CONV, TRKDIR, LENGHT, NUMERO)

Author(s) R. Roy

Description of input parameters

IPRT integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1 results in a description of the tracking parameters used. For IPRT>10000, each of the tracking line generated is also printed.

IFTEMP integer scalar variable for accessing the temporary binary tracking file to be created.

NANGLE integer scalar variable describing the number of angles used in the tracking process.

DENUSR	real scalar variable describing the density of lines in a plane normal to the track direction used in the tracking process.
LSYMX	logical scalar variable describing the presence (.TRUE.) or absence (.FALSE.) of x - y symmetry.
ANGLES	real array of dimension ANGLES(3,NANGLE) containing the tracking angles used.
DENSTY	real array of dimension DENSTY(NANGLE) containing the effective line density used.
NTOTCL	integer scalar variable describing the total number of cylindrical regions +3 in exact geometry.
MAXR	integer scalar variable describing the number of elements in the REMESH one dimensional array.
REMESH	real array of dimension REMESH(MAXR) containing the real mesh for the exact geometry.
LINMAX	integer scalar variable describing the maximum number of track segments in a single track.
RCUTOF	real scalar variable describing the cutoff for corner tracking.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
NVOL	integer scalar variable describing the exact number of regions for a geometry.
INDEL	integer array of dimension INDEL(4,NVOL-NSUR+1) containing the numbering of surfaces and zones.
MINDIM	integer array of dimension MINDIM(NTOTCL) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.
MAXDIM	integer array of dimension MAXDIM(NTOTCL) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.
ICOORD	integer array of dimension ICOORD(NTOTCL) containing the coordinates in a REMESH array associated with a Cartesian or cylindrical region.

Description of work parameters

INCR	integer array of dimension INCR(NCP) containing the increment direction for next track segment.
ICUR	integer array of dimension ICUR(NCP) containing the current zonal location for a track segment.
TRKBEG	real array of dimension TRKBEG(NCP) describing position where a track begins.
CONV	real array of dimension CONV(NCP) segment length of a track.
TRKDIR	real array of dimension TRKDIR(NCP) describing direction of a track.
LENGHT	real array of dimension LENGHT(LINMAX) containing the length of each track segments in a single track.
NUMERO	integer array of dimension NUMERO(LINMAX) containing the region number crossed by each track segments in a single track.

Called by

DRAGON routine(s) : XELTRK

Calling

DRAGON routine(s) : XELEQN, XELLIN, XELLSR

UTILIB routine(s) :

GANLIB routine(s) :

4.2.26 XELTI3

Purpose To build the sequential tape that will contain tracks for isotropic 3-D calculations.

Syntax CALL XELTI3(IPRT, IFTEMP, NANGLE, DENUSR, LSYMX, ANGLES, DENSTY, NTOTCL, NEXTGE, MAXR, REMESH, LINMAX, RCUTOF, NSUR, NVOL, INDEL, MINDIM, MAXDIM, ICOORD, INCR, ICUR, TRKBEG, CONV, TRKDIR, LENGHT, NUMERO)

Author(s) R. Roy

Description of input parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1 results in a description of the tracking parameters used. For IPRT>10000, each of the tracking line generated is also printed.
IFTEMP	integer scalar variable for accessing the temporary binary tracking file to be created.
NANGLE	integer scalar variable describing the number of angles used in the tracking process.
DENUSR	real scalar variable describing density of lines in a plane normal to the track direction used in the tracking process.
LSYMX	logical scalar variable describing the presence (.TRUE.) or absence (.FALSE.) of x - y symmetry.
ANGLES	real array of dimension ANGLES(3,NANGLE) containing the tracking angles used.
DENSTY	real array of dimension DENSTY(NANGLE) containing the effective line density used.
NTOTCL	integer scalar variable describing the total number of cylindrical regions +3 in exact geometry.
NEXTGE	integer scalar variable describing the type of boundary. It takes the value of 0 for rectangular boundary and 1 for cylindrical boundary.
MAXR	integer scalar variable describing the number of elements in the REMESH array.
REMESH	real array of dimension REMESH(MAXR) containing the real mesh for the exact geometry.
LINMAX	integer scalar variable describing the maximum number of track segments in a single track.
RCUTOF	real scalar variable describing the cutoff for corner tracking.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
NVOL	integer scalar variable describing the exact number of regions for a geometry.
INDEL	integer array of dimension INDEL(4,NVOL-NSUR+1) containing the numbering of surfaces and zones.
MINDIM	integer array of dimension MINDIM(NTOTCL) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.
MAXDIM	integer array of dimension MAXDIM(NTOTCL) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.

ICOORD integer array of dimension ICOORD(NTOTCL) containing the coordinates in a REMESH array associated with a Cartesian or cylindrical region.

Description of work parameters

INCR integer array of dimension INCR(NCP) describing increment direction for next track segment.

ICUR integer array of dimension ICUR(NCP) describing current zonal location for a track segment.

TRKBEG real array of dimension TRKBEG(NCP) describing position where a track begins.

CONV real array of dimension CONV(NCP) containing the segment length of a track.

TRKDIR real array of dimension TRKDIR(NCP) containing the direction of a track.

LENGHT real array of dimension LENGHT(LINMAX) containing the length of each track segments in a single track.

NUMERO integer array of dimension NUMERO(LINMAX) containing the region number crossed by each track segments in a single track.

Called by

DRAGON routine(s) : XELTRK

Calling

DRAGON routine(s) : XELEQN, XELLIN, XELLSR

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.27 XELTRK

Purpose To track 2-D and 3-D Cartesian assemblies.

Syntax CALL XELTRK(IPTRK, IPGEOM, GEONAM, IDISP, IFTEMP, MREGIO, IPRT, NDIM, ITOPT, NV, NS, NANG, ISYMM, DENUSR, RCUTOF, MXSEG, ICODE, TITREC, RK, IK)

Author(s) R. Roy

Description of input parameters

IPTRK integer scalar variable for accessing the TRACKING data structure to be created or read.

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

GEONAM character*12 scalar variable containing the name of the GEOMETRY data structure to be analyzed.

IFTEMP integer scalar variable for accessing the temporary binary tracking file to be created.

MREGIO integer scalar variable describing the user defined maximum number of region for all geometry.

IPRT integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>1 a description of the global geometry is produced on the output file.

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
RCUTOF	real scalar variable describing the cutoff for corner tracking.
TITREC	character*72 scalar variable describing the title of the problem.

Description of input/output parameters

IDISP	integer scalar variable describing the mode for the binary tracking file. A new file has mode IDISP=1, old file has mode IDISP=0 and a file to update has mode IDISP=-1.
ITOPT	integer scalar variable describing the tracking type option.
NANGL	integer scalar variable describing the number of tracking angles.
ISYMM	integer scalar variable describing the symmetry factor for cluster cell tracking.
DENUSR	real scalar variable describing the density of lines in a plane normal to the track direction used in the tracking process.

Description of output parameters

NV	integer scalar variable describing the number of regions.
NS	integer scalar variable describing the number of surfaces.
MXSEG	integer scalar variable describing the maximum number of track segments in a single track.
ICODE	integer array of dimension ICODE(6) containing the boundary condition types.

Description of work parameters

RK	real array of dimension RK(1) for dynamical memory allocation.
IK	integer array of dimension IK(1) for dynamical memory allocation.

Called by

DRAGON routine(s) : XELDRV

Calling

DRAGON routine(s) : XELBIN, XELDCL, XELEDCL, XELETR, XELGPR, XELMRG, XELPRP, XELTI2, XELTI3, XELTRP, XELTS2

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLN, LCMPT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

4.2.28 XELTRP

Purpose To prepare for tracking by producing the required numbering and calculate volumes and surfaces.

Syntax CALL XELTRP(IPGEOM, NDIM, NGEOME, L1CELL, NTOTCO, NEXTGE, MAXRO, IPRT, CELLG, NSURO, NVOLO, IDLDIM, IDLGEO, KEYTRN, MAXDO, MINDO, ICORDO, RMESHO, IDLREM, INDEXO, VOLSO, MATGEO, KEYSYM, ISPLT)

Author(s) R. Roy

Description of input parameters

IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
NGEOME	integer scalar variable containing the number of sub-geometries.
L1CELL	logical scalar variable indicating the presence of a cell assembly. It is <code>.TRUE.</code> if the supercell is represented by a single geometry and <code>.FALSE.</code> otherwise.
NTOTCO	integer scalar variable describing the total number of cylindrical regions in all geometry.
NEXTGE	integer scalar variable describing the type of boundary. It takes the value of 0 for rectangular boundary and 1 for cylindrical boundary.
MAXRO	integer scalar variable describing the real dimension of RMESHO for this geometry.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>1 produces a description of the geometry on the output file.
CELLG	integer array of dimension CELLG(3*NGEOME) containing the geometry names in a integer format.
NSURO	integer array of dimension NSURO(NGEOME) containing the negative value of the number of surfaces for a specific sub-geometry.
NVOLO	integer array of dimension NVOLO(NGEOME) containing the number of zones for a specific sub-geometry.
IDLDIM	integer array of dimension IDLDIM(NGEOME) containing the position of each geometry in cylinder numbering scheme.
IDLGEO	integer array of dimension IDLGEO(NGEOME) containing the position of each geometry in the numbering scheme.
KEYTRN	integer array of dimension KEYTRN(NGEOME) containing the turn for each block.

Description of output parameters

MAXDO	integer array of dimension MAXDO(NTOTCO) containing the maximum location in a RMESHO array associated with a Cartesian or cylindrical region.
MINDO	integer array of dimension MINDO(NTOTCO) containing the minimum location in a RMESHO array associated with a Cartesian or cylindrical region.
ICORDO	integer array of dimension ICORDO(NTOTCO) containing the coordinates in a RMESHO array associated with a Cartesian or cylindrical region.
RMESHO	real array of dimension RMESHO(MAXRO) containing the real mesh for the geometry.
IDLREM	integer array of dimension IDLREM(NGEOME) containing the position of mesh values per geometry.

INDEXO	integer array of dimension INDEXO(4,NGIDL) containing the reference index for zones and surface identification as a function of position in RMESHO. Here NGIDL is computed by routine XELDCL.
VOLSO	real array of dimension VOLSO(NGIDL) containing the volumes and surfaces as a function of position in RMESHO. Here NGIDL is computed by routine XELDCL.
MATGEO	integer array of dimension MATGEO(NGIDL) containing material number corresponding to each zone in the geometry. Here NGIDL is computed by routine XELDCL.
KEYSYM	integer array of dimension KEYSYM(NGIDL) containing indices for symmetry identification. Here NGIDL is computed by routine XELDCL.
ISPLT	integer array of dimension ISPLT(MREGIO) containing the splitting vector. Here MREGIO is the maximum number of region for all geometry.

Called by

DRAGON routine(s) : PSPGEO, XELTRK, XL3TRK

Calling

DRAGON routine(s) : KELMRG, KELRNG, KELSYM, XELGRD, XELVOL

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMSIX, XABORT

4.2.29 XELTS2

Purpose To build the sequential tape that will contain tracks for specular 2-D.

Syntax CALL XELTS2(IPRT, IFTEMP, NANGLE, DENUSR, NCODE, ANGLES, DENSTY,
SWZERO, NTOTCL, MAXREM, REMESH, LINMAX, NSUR, NVOL, MATALB,
INDEX, MINDIM, MAXDIM, ICOORD, INCR, ICUR, TRKBEG, CONV,
TRKDIR, PTSANG, WGTANG, DNSANG, LENGHT, NUMERO)

Author(s) R. Roy

Description of input parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1 results in a description of the tracking parameters used. For IPRT>10000, each of the tracking line generated is also printed.
IFTEMP	integer scalar variable for accessing the temporary binary tracking file to be created.
NANGLE	integer scalar variable describing the number of angles used in the tracking process.
DENUSR	real scalar variable describing density of lines in a plane normal to the track direction used in the tracking process.
NCODE	integer array of dimension NCODE(6) containing the albedo number.
ANGLES	real array of dimension ANGLES(3,NANGLE) containing the tracking angles used.

DENSTY	real array of dimension DENSTY(NANGLE) containing the effective line density used.
SWZERO	logical scalar variable to specify to use (.TRUE.) or not (.FALSE.) lines parallel to the x and y axis.
NTOTCL	integer scalar variable describing the total number of cylindrical regions +3 in exact geometry.
MAXREM	integer scalar variable describing the number of elements in the REMESH one dimensional array.
REMESH	real array of dimension REMESH(MAXREM) containing the real mesh for the exact geometry.
LINMAX	integer scalar variable describing the maximum number of track segments in a single track.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
NVOL	integer scalar variable describing the exact number of regions for a geometry.
MATALB	integer array of dimension MATALB(NSUR:NVOL) containing the albedo and mixture index in exact geometry.
INDEX	integer array of dimension INDEX(4,NGIDL) containing the index for zones and surface identification as a function of position in REMESH. Here NGIDL is computed by routine XELDCL.
MINDIM	integer array of dimension MINDIM(NTOTCL) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.
MAXDIM	integer array of dimension MAXDIM(NTOTCL) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.
ICOORD	integer array of dimension ICOORD(NTOTCL) containing the coordinates in a REMESH array associated with a Cartesian or cylindrical region.

Description of work parameters

INCR	integer array of dimension INCR(NCP) describing increment direction for next track segment.
ICUR	integer array of dimension ICUR(NCP) describing current zonal location for a track segment.
TRKBEG	real array of dimension TRKBEG(NCP) describing position where a track begins.
CONV	real array of dimension CONV(NCP) segment length of a track.
TRKDIR	real array of dimension TRKDIR(NCP) containing the direction of a track.
PTSANG	double precision array of dimension PTSANG(NANGLE) containing the director cosine of the tracking angles.
WGTANG	double precision array of dimension WGTANG(NANGLE) containing the weight associated with the tracking angles.
DNSANG	double precision array of dimension DNSANG(NANGLE) containing the line density associated with the tracking angles.
LENGHT	real array of dimension LENGHT(LINMAX) containing the length of each track segments in a single track.
NUMERO	integer array of dimension NUMERO(LINMAX) containing the region number crossed by each track segments in a single track.

Called by

DRAGON routine(s) : XELTRK

Calling

DRAGON routine(s) : XELLIN, XELLSR, XELTSa, XELTSW

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.30 XELTSa

Purpose To compute the angular directions and the basic density that are required for the periodic tracking option.

Syntax CALL XELTSa(NDIM, ABSC, INDC, DENS, ANGTSa)

Author(s) R. Roy

Description of input parameters

NDIM integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.

ABSC double precision array of dimension ABSC(NDIM) containing the coordinates of the geometry.

INDC integer array of dimension INDC(NDIM) containing the index in each coordinates of the angle.

Description of output parameters

DENS double precision scalar variable describing the required basic density.

ANGTSa double precision array of dimension ANGTSa(NDIM,NDIM) containing the tracking directions.

Called by

DRAGON routine(s) : XCWSCL, XELTS2

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.31 XELTSW

Purpose To compute the weights for cyclic tracking.

Syntax CALL XELTSW(ABSC, NANGLE, PTSANG, WGTANG)

Author(s) R. Roy

Description of input parameters

ABSC	double precision array of dimension ABSC(2) containing the coordinates of the geometry.
NANGLE	integer scalar variable describing the number of angles used in the tracking process.
PTSANG	double precision array of dimension PTSANG(NANGLE) containing the director cosine of the tracking angles.

Description of output parameters

WGTANG	double precision array of dimension WGTANG(NANGLE) containing the weight associated with the tracking angles.
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Called by

DRAGON routine(s) : XCWSCL, XELTS2

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.2.32 XELVOL

Purpose To compute the volumes and surfaces.

Syntax CALL XELVOL(IPRT, NDIM, NEXTGE, NCPC, MINDO, MAXDO, ICORDO, NSURO, NVOLO, IDLGEO, INDEXO, MAXC, REMESH, MATGEO, VOLSO)

Author(s) R. Roy

Description of input parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>1 the region volume and surface area are produced on the output file.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
NEXTGE	integer scalar variable describing the type of boundary. It takes the value of 0 for rectangular boundary and 1 for cylindrical boundary.
NCPC	integer scalar variable describing the number of cylindrical regions +3 in all geometry.
MINDO	integer array of dimension MINDO(NCPC) containing the minimum location in a RMESHO array associated with a Cartesian or cylindrical region.
MAXDO	integer array of dimension MAXDO(NCPC) containing the maximum location in a RMESHO array associated with a Cartesian or cylindrical region.
ICORDO	integer array of dimension ICORDO(NCPC) containing the coordinates in a RMESHO array associated with a Cartesian or cylindrical region.
NSURO	integer scalar variable describing the negative value of the number of surfaces for a specific sub-geometry.

NVOLO	integer scalar variable describing the number of zones for a specific sub-geometry.
IDLGEO	integer scalar variable for identifying the specific position of a geometry in MATGEO.
INDEXO	integer array of dimension INDEXO(4,NGIDL) containing the index for zones and surface identification as a function of position in REMESH. Here NGIDL is computed by routine XELDCL.
MAXC	integer scalar variable describing the number of elements in the RMESHO one dimensional array.
REMESH	real array of dimension REMESH(MAXC) containing the real mesh for the geometry.
MATGEO	integer array of dimension MATGEO(NGIDL) containing material number corresponding to each zone in the geometry. Here NGIDL is computed by routine XELDCL.

Description of output parameters

VOLSO	real array of dimension VOLSO(NGIDL) containing the volume and surface area associated with each each zone and surface in the geometry. Here NGIDL is computed by routine XELDCL.
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Called by

DRAGON routine(s) : XELTRP

Calling

DRAGON routine(s) : LELCRN, XELCRN

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.3 Routines for 2-D Cluster Geometry

4.3.1 XCGBCM

Purpose To built the boundary condition matrix for cluster geometries with periodic or reflective boundary conditions.

Syntax CALL XCGBCM(IPTRK, NSOUT, NCODE, MATRT)

Author(s) G. Marleau

Description of input parameters

IPTRK	integer scalar variable for accessing the TRACKING data structure to be created.
NSOUT	integer scalar variable containing the number of outer surfaces associated with this geometry.
NCODE	integer array of dimension NCODE(NMCOD) describing the type of boundary conditions associated with each surface. Periodic boundary conditions are found at surface i in the case where $NCODE(i)=4$. Otherwise, reflective boundary conditions are assumed.

Description of output parameters

MATRT	integer array of dimension MATRT(NSOUT) containing the surface to surface coupling matrix in a compressed form.
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Called by

DRAGON routine(s) : XCWTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMPUT

4.3.2 XCGDIM

Purpose To initialize dimensions for 2-D cluster geometry.

Syntax CALL XCGDIM(IPGEOM, MREGIO, NSOUT, IROT, IAPP, MAXJ, NVOL, NBAN, MNAN, NRT, MSROD, MAROD, NSURF)

Author(s) G. Marleau

Description of input parameters

IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
MREGIO	integer scalar variable containing the maximum number of regions permitted.
NSOUT	integer scalar variable containing the maximum number of surfaces permitted.
IROT	integer scalar variable containing the CP matrix reconstruct technique to be considered. For the case where IROT=0, an explicit CP calculation will be considered. In the case where IROT=1, an interface current technique will be considered. Finally, for the case where IROT=2, a <i>ROT2</i> reconstruction is required.
IAPP	integer scalar variable containing the approximation level used for the currents at various interface. This option is only used when IROT=1 or 2. For the case where IAPP=1, a double P_0 approximation is used everywhere. For the case where IAPP=2, a double P_1 approximation is used everywhere. For the case where IAPP=3, a double P_0 approximation is used on the external surfaces and a double P_1 at all the interior interfaces.
MAXJ	integer scalar variable containing the maximum number of currents generated. This is not required if IROT=1.

Description of output parameters

NVOL	integer scalar variable containing the number of regions found in this geometry.
NBAN	integer scalar variable containing the number concentric annular rings found in this geometry.
MNAN	integer scalar variable containing the maximum number of elements in the RADIUS records that can be found in the GEOMETRY data structure found in this geometry.
NRT	integer scalar variable containing the number of rod types found in this geometry.
MSROD	integer scalar variable containing the maximum number of rod sub-regions found in this geometry.
MAROD	integer scalar variable containing the maximum number of rods that are located inside an annular ring for this geometry.

NSURF integer scalar variable containing the maximum number of surfaces to be considered in this geometry. This is not generated if IROT=0.

Called by

DRAGON routine(s) : JPMGEO, PSPGEO, SPHGEO, XCWTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMSIX, SETARA, RLSARA, XABORT

4.3.3 XCGGEO

Purpose To read and analyze a 2-D cluster geometry.

Syntax CALL XCGGEO(IPGEOM, IROT, NSOUT, NVOL, NBAN, MNAN, NRT, MSROD, IPRT, ILK, NMAT, RAN, MATANN, NRODS, RODS, MATROD, NRODR, RODR, NRINFO, MATALB, VOLSUR, ISPLIT, RAD, COTE, RADMIN, NCODE, ICODE, ZCODE, ALBEDO, KEYMRG, NXRS, NXRI, VRGIO)

Author(s) G. Marleau

Description of input parameters

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

IROT integer scalar variable containing the CP matrix reconstruct technique to be considered. For the case where IROT=0, an explicit CP calculation will be considered. In the case where IROT=1, an interface current technique will be considered. Finally, for the case where IROT=2, a *ROT2* reconstruction is required.

NSOUT integer scalar variable containing the maximum number of outer surfaces to be considered in this geometry.

NVOL integer scalar variable containing the number of regions found in this geometry.

NBAN integer scalar variable containing the number concentric annular rings found in this geometry.

MNAN integer scalar variable containing the maximum number of elements in the RADIUS records that can be found in the GEOMETRY data structure found in this geometry.

NRT integer scalar variable containing the number of rod types found in this geometry.

MSROD integer scalar variable containing the maximum number of rod sub-regions found in this geometry.

IPRT integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1. In the case where IPRT>2, the properties of the geometry are provided including the dimensions and the region mixtures.

Description of output parameters

ILK logical scalar variable indicating the presence (.TRUE.) or absence (.FALSE.) of neutron leakage through the external surfaces.

NMAT	integer scalar variable containing the total number of mixtures used in this geometry.
RAN	real array of dimension RAN(NBAN) containing the radius of the radial regions in cm.
MATANN	integer array of dimension MATANN(NBAN) containing the mixture associated with each radial ring.
NRODS	integer array of dimension NRODS(3,NRT) containing the information to describe a given rod type. The first element contains the number of rods in this type of rods, the second element contains the number of sub-rod in this type of rods and the third element contains the region number associated with the first concentric sub-region in this type of rods.
RODS	real array of dimension RODS(2,NRT) containing a description of the location of this type of rods in space. The first element describe the rod center radius and the second element the angular position of the first rod.
MATROD	integer array of dimension MATROD(MSROD,NRT) containing the mixture number associated with each sub-rod inside each type of rods.
NRODR	integer array of dimension NRODR(NRT) containing the region associated with each type of rods.
RODR	real array of dimension RODR(MSROD,NRT) containing the radius associated with each sub-rod inside each type of rods.
NRINFO	integer array of dimension NRINFO(2,NBAN) describing the annular region contents. The first element contains the region number associated with this annular ring. The second element is used to indicate the type of intersection between the annular ring and the pins in the cluster.
MATALB	integer array of dimension MATALB(-NSOUT:NVOL) containing the albedo and mixture associated respectively with the outer surfaces and the regions.
VOLSUR	real array of dimension VOLSUR(-NSOUT:NVOL) containing the quarter surface area (cm) and regional volume (cm ²) associated respectively with the outer surfaces and the regions.
ISPLIT	integer array of dimension ISPLIT(MSROD) containing the annular splitting vector for the rods (or pins).
RAD	real array of dimension RAD(MNAN) used to store temporarily the RADIUS record when it is extracted from the GEOMETRY data structure.
COTE	real scalar variable containing the width of the <i>y</i> side of a rectangular geometry in cm.
RADMIN	real scalar variable containing the minimum radius of any region in cm.
NCODE	integer array of dimension NCODE(NMCOD) containing the type of albedo to be considered for each external surface.
ICODE	integer array of dimension ICODE(NMCOD) containing the albedo cross reference vector.
ZCODE	real array of dimension ZCODE(NMCOD) containing the geometrical albedo vector.
ALBEDO	real array of dimension ALBEDO(NMCOD) containing the surface albedo.
KEYMRG	integer array of dimension KEYMRG(-NSOUT:NVOL) containing the region surface merge vector.
NXRS	integer array of dimension NXRS(NRT) describing the annular region with the largest radius that has an intersection with a specific type of rods.

NXRI integer array of dimension NXRI(NRT,NBAN) containing the multi-pin annular ring contents.

VRGIO real array of dimension VRGIO(2,NRT) containing the divided rod volume. The first element is the volume located outside a radial region and the second element is the rod radius located inside the radial region.

Called by

DRAGON routine(s) : JPMGEO, PSPGEO, SPHGEO, XCWTRK

Calling

DRAGON routine(s) : XCGROD

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMNXT, LCMSIX, SETARA, RLSARA, XABORT

4.3.4 XCGROD

Purpose To check the geometry and reorder the rod clusters if necessary. The rod cluster are numbered increasingly from the center of the cell. For two types of rods located on the same annular ring, the numbering increases angularly as a function of the angular position of the first pin in each type of rods starting at $\theta = 0$ and going counter clock-wise.

Syntax CALL XCGROD(NRT, MSROD, NRODS, RODS, MATROD, RODR, IORD)

Author(s) G. Marleau

Description of input parameters

NRT integer scalar variable containing the number of rod types.

MSROD integer scalar variable containing the maximum number of sub-rod in any rod.

Description of input/output parameters

NRODS integer array of dimension NRODS(3,NRT) containing the information to describe a given rod type. The first element contains the number of rods in this type of rods, the second element contains the number of sub-rod in this type of rods and the third element contains the region number associated with the first concentric sub-region in this type of rods.

RODS real array of dimension RODS(2,NRT) containing a description of the location of this type of rods in space. The first element describe the rod center radius and the second element the angular position of the first rod.

MATROD integer array of dimension MATROD(MSROD,NRT) containing the mixture number associated with each sub-rod inside each type of rods.

RODR real array of dimension RODR(MSROD,NRT) containing the radius associated with each sub-rod inside each type of rods.

IORD integer array of dimension IORD(NRT) containing the new numbering of the rods.

Called by

DRAGON routine(s) : XCGGEO

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.3.5 XCWHEX

Purpose To track outer hexagon for cluster geometry.

Syntax CALL XCWHEX(ANG, RADC, SIDE, LINTER, XPOS, INDS, IMS)

Author(s) G. Marleau

Description of input parameters

ANG real scalar variable containing the track angle.

RADC real scalar variable containing the y location of track (cm).

SIDE real scalar variable containing the width of one side of the hexagon (cm).

IMS integer array of dimension IMS(6). containing the surface merge vector

Description of output parameters

LINTER logical scalar variable indicating if an intersection between the line and the hexagon has been found (. TRUE .) or not (. FALSE .).

XPOS real array of dimension XPOS(2) providing the x points of intersection between the line and the hexagon (cm).

INDS integer array of dimension INDS(2) providing a pointer to the surface intersected by the line.

Called by

DRAGON routine(s) : XCWICL

4.3.6 XCWICL

Purpose To perform isotropic tracking for 2-D cluster geometry.

Syntax CALL XCWICL(NDIM, NSURX, NVOL, NBAN, NRT, MSROD, MAROD, NANGL, DENS, ISYMM, IFTEMP, IPRT, ANGLES, DENSTY, NRINFO, RAN, COTE, NRODS, RODS, NRODR, RODR, MXSEG, SEGLEN, NRSEG, RODP, ATOP, NXRS, NXRI, NNSEG, IMS)

Author(s) G. Marleau

Description of input parameters

NDIM integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.

NSURX	integer scalar variable containing the number of initial surfaces.
NVOL	integer scalar variable containing the number of regions.
NBAN	integer scalar variable containing the number concentric annular rings found in this geometry.
NRT	integer scalar variable containing the number of rod types found in this geometry.
MSROD	integer scalar variable containing the maximum number of rod sub-regions found in this geometry.
MAROD	integer scalar variable containing the maximum number of rod in the cluster.
NANGL	integer scalar variable containing the number of integration angles.
DENS	real scalar variable containing the minimum parallel lines track density in cm^{-1} .
ISYMM	integer scalar variable containing the integration angular symmetry factor.
IFTEMP	integer scalar variable for accessing the temporary binary tracking file to be created.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1. In the case where $\text{IPRT} \geq 20$ the contents of each integration line will be printed.
NRINFO	integer array of dimension NRINFO(2,NBAN) describing the annular region contents. The first element contains the region number associated with this annular ring. The second element is used to indicate the type of intersection between the annular ring and the pins in the cluster.
RAN	real array of dimension RAN(NBAN) containing the radius of the radial regions in cm.
COTE	real scalar variable containing the width of the y side of a rectangular geometry in cm.
NRODS	integer array of dimension NRODS(3,NRT) containing the information to describe a given rod type. The first element contains the number of rods in this type of rods, the second element contains the number of sub-rod in this type of rods and the third element contains the region number associated with the first concentric sub-region in this type of rods.
RODS	real array of dimension RODS(2,NRT) containing a description of the location of this type of rods in space. The first element describe the rod center radius and the second element the angular position of the first rod.
NRODR	integer array of dimension NRODR(NRT) containing the region associated with each type of rods.
RODR	real array of dimension RODR(MSROD,NRT) containing the radius associated with each sub-rod inside each type of rods.
MXSEG	integer scalar variable containing the maximum number of segments in an integration line.
NXRS	integer array of dimension NXRS(NRT) describing the annular region with the largest radius that has an intersection with a specific type of rods.
NXRI	integer array of dimension NXRI(NRT,NBAN) containing the multi-pin annular ring contents.
IMS	integer array of dimension IMS(6) containing the surface merge vector.

Description of output parameters

ANGLES	real array of dimension ANGLES(NDIM,NANGL) containing the tracking angles.
DENSTY	real array of dimension DENSTY(NANGL) containing the exact tracking density for every angle in cm^{-1} .

SEGLEN real array of dimension SEGLEN(*) containing the successive distance crossed by the line in cm.
 NRSEG integer array of dimension NRSEG(*) containing the successive region number crossed by the line.

Description of work parameters

RODP real array of dimension RODP(2,MAROD,NRT) containing the rod position in Cartesian geometry in cm.
 ATOP real array of dimension ATOP(NRT) containing the number of rods between line origin and rod type i is stored in temporarily in ATOP(i).
 NNSEG integer array of dimension NNSEG(*) containing the region number crossed by the line before the current surface intersection.

Called by

DRAGON routine(s) : XCWTRK

Calling

DRAGON routine(s) : XCWHEX, XCWREC, XCWROD, XCWSRT

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.3.7 XCWREC

Purpose To track outer rectangle for cluster geometry.

Syntax CALL XCWREC(ANGD, SIDE, TRKPOS, LINTER, ROTPOS, INDS, IMS)

Author(s) G. Marleau

Description of input parameters

ANGD double precision array of dimension ANGD(2) containing the director cosines.
 SIDE double precision array of dimension SIDE(2) containing the dimensions of the sides of the rectangle in cm.
 IMS integer array of dimension IMS(6) containing the surface merge vector.

Description of input/output parameters

TRKPOS double precision array of dimension TRKPOS(2,2) pointing to the track origin at input and to the track end at output.

Description of output parameters

LINTER logical scalar variable indicating if an intersection between the line and the hexagon has been found (.TRUE.) or not (.FALSE.).
 ROTPOS double precision array of dimension ROTPOS(2,2) containing the position of intersection with respect to the rotated axis.
 INDS integer array of dimension INDS(2) containing the index associated with the surfaces of intersection.

Called by

DRAGON routine(s) : XCWICL, XCWSCL

4.3.8 XCWROD

Purpose To track inside rods for 2-D cluster geometry.

Syntax CALL XCWROD(LRT, NRIN, NRODS, NRODR, RODR, RODP, RADC, NFSEG, NLSEG,
SEGLen, NRSEG, NNSEG)

Author(s) G. Marleau

Description of input parameters

LRT	integer scalar variable containing the rod type to be processed.
NRIN	integer scalar variable containing the current region number.
NRODS	integer array of dimension NRODS(2) containing the information to describe a given rod type. The first element contains the number of rods in this type of rods, the second element contains the number of sub-rod in this type of rods.
NRODR	integer scalar variable containing the region associated with each type of rods.
RODR	real array of dimension RODR(*) containing the radius associated with each sub-rod inside each type of rods.
RODP	real array of dimension RODP(2,*) containing the Cartesian position of the rod center.
RADC	double precision scalar variable initial y position of the track.

Description of output parameters

NFSEG	integer scalar variable containing the initial segment position for tracking inside the rod.
NLSEG	integer scalar variable containing the final segment position for tracking inside the rod.
SEGLen	real array of dimension SEGLen(*) containing the successive distance crossed by the line in cm.
NRSEG	integer array of dimension NRSEG(*) containing the successive region number crossed by the line.
NNSEG	integer array of dimension NNSEG(*) containing the region number crossed by the line before the current surface intersection.

Called by

DRAGON routine(s) : XCWICL, XCWSCL

4.3.9 XCWSCL

Purpose To perform specular tracking for 2-D cluster geometry.

Syntax `CALL XCWSCL(NDIM, NSURX, NVOL, NBAN, NRT, MSROD, MAROD, NANGL, DENS, IFTEMP, IPRT, NCODE, DANGLE, WGTANG, DNSANG, PTSANG, SWZERO, NRINFO, RAN, COTE, NRODS, RODS, NRODR, RODR, MXSEG, SEGLEN, NRSEG, RODP, ATOP, NXRS, NXRI, NNSEG, IMS)`

Author(s) G. Marleau

Description of input parameters

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
NSURX	integer scalar variable containing the number of initial surfaces.
NVOL	integer scalar variable containing the number of regions.
NBAN	integer scalar variable containing the number concentric annular rings found in this geometry.
NRT	integer scalar variable containing the number of rod types found in this geometry.
MSROD	integer scalar variable containing the maximum number of rod sub-regions found in this geometry.
MAROD	integer scalar variable containing the maximum number of rod in the cluster.
NANGL	integer scalar variable containing the number of integration angles.
DENS	real scalar variable containing the minimum parallel lines track density in cm^{-1} .
IFTEMP	integer scalar variable for accessing the temporary binary tracking file to be created.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1. In the case where $\text{IPRT} \geq 20$ the contents of each integration line will be printed.
NCODE	integer array of dimension NCODE(6) containing the boundary type associated with each surface direction.
SWZERO	logical scalar variable which takes a value <code>.TRUE.</code> when specular tracking is to be performed and <code>.FALSE.</code> otherwise.
NRINFO	integer array of dimension NRINFO(2,NBAN) describing the annular region. contents. The first element contains the region number associated with this annular ring. The second element is used to indicate the type of intersection between the annular ring and the pins in the cluster.
RAN	real array of dimension RAN(NBAN) containing the radius of the radial regions in cm.
COTE	real scalar variable containing the width of the y side of a rectangular geometry in cm.
NRODS	integer array of dimension NRODS(3,NRT) containing the information to describe a given rod type. The first element contains the number of rods in this type of rods, the second element contains the number of sub-rod in this type of rods and the third element contains the region number associated with the first concentric sub-region in this type of rods.
RODS	real array of dimension RODS(2,NRT) containing a description of the location of this type of rods in space. The first element describe the rod center radius and the second element the angular position of the first rod.
NRODR	integer array of dimension NRODR(NRT) containing the region associated with each type of rods.

RODR	real array of dimension RODR(MSROD,NRT) containing the radius associated with each sub-rod inside each type of rods.
MXSEG	integer scalar variable containing the maximum number of segments in an integration line.
NXRS	integer array of dimension NXRS(NRT) describing the annular region with the largest radius that has an intersection with a specific type of rods.
NXRI	integer array of dimension NXRI(NRT,NBAN) containing the multi-pin annular ring contents.
IMS	integer array of dimension IMS(6) containing the surface merge vector.

Description of output parameters

DANGLE	double precision array of dimension DANGLE(NDIM,2,*) containing the tracking angles director cosines.
WGTANG	double precision array of dimension WGTANG(*) containing the integration weights.
DNSANG	double precision array of dimension DNSANG(*) containing the parallel line tracking densities in cm^{-1} .
SEGLN	real array of dimension SEGLN(*) containing the successive distance crossed by the line in cm.
NRSEG	integer array of dimension NRSEG(*) containing the successive region number crossed by the line.

Description of work parameters

PTSANG	double precision array of dimension PTSANG(*) containing the principal tracking angles.
RODP	real array of dimension RODP(2,MAROD,NRT,2) containing the rod position in Cartesian geometry in cm.
ATOP	real array of dimension ATOP(NRT) containing the number of rods between line origin and rod type i is stored in temporarily in ATOP(i).
NNSEG	integer array of dimension NNSEG(*) containing the region number crossed by the line before the current surface intersection.

Called by

DRAGON routine(s) : XCWTRK

Calling

DRAGON routine(s) : XCWREC, XCWROD, XCWSRT, XELTSa, XELTSW

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.3.10 XCWSRT

Purpose To sort region intersection by increasing position.

Syntax CALL XCWSRT(IPRT, MXSEG, SEGLN, NRSEG, NNSEG, NTSEG)

Author(s) G. Marleau

Description of input parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1 . In the case where $IPRT \geq 200$ the initial and sorted integration lines are printed.
MXSEG	integer scalar variable containing the current maximum track length.

Description of input/output parameters

SEGLN	real array of dimension SEGLN(*) containing the successive distance crossed by the line in cm.
NRSEG	integer array of dimension NRSEG(*) containing the successive region number crossed by the line.
NNSEG	integer array of dimension NNSEG(*) containing the region number crossed by the line before the current surface intersection.

Description of output parameters

NTSEG	integer scalar variable containing the final number of track segments after sorting and compression.
-------	--

Called by

DRAGON routine(s) : XCWICL, XCWSCL

4.3.11 XCWTRK

Purpose To analyze a cluster geometry and perform tracking if required.

Syntax CALL XCWTRK(IPTRK, IPGEOM, GEONAM, IDISP, IFTEMP, MREGIO, IPRT, NDIM, ITOPT, NVOL, NSUR, NANGL, ISYMM, DENS, PCORN, MXSEG, ICODE, TITREC, RK, IK)

Author(s) G. Marleau

Description of input parameters

IPTRK	integer scalar variable for accessing the TRACKING data structure to be created.
IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
GEONAM	character*12 scalar variable containing the name of the GEOMETRY data structure to be analyzed.
IFTEMP	integer scalar variable for accessing the temporary binary tracking file to be created.
MREGIO	integer scalar variable containing the maximum number of regions.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1. In the case where $IPRT > 1$, a description of the geometry and integration will be provided.

Description of input/output parameters

IDISP	integer scalar variable containing the tracking file disposition. For the case where IDISP=-2, the tracking file does not exists. In the case where IDISP=-1, the tracking file may be modified while IDISP=0 implies that the tracking file is in read-only mode. Finally, for the case where IDISP=1, a new tracking file will be created.
-------	--

Description of output parameters

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
ITOPT	integer scalar variable containing the number of dimensions associated with the problem.
NVOL	integer scalar variable containing the number of regions in the problem.
NSUR	integer scalar variable containing the number of surfaces in the problem.
NANGL	integer scalar variable containing the number of tracking angles considered in the problem.
ISYMM	integer scalar variable containing the symmetry factor considered in the problem.
DENS	real scalar variable containing the effective tracking density in cm^{-1} considered in the problem.
PCORN	real scalar variable containing the corner proximity in cm considered in the problem.
MXSEG	integer scalar variable containing the maximum segment length generated for the problem.
ICODE	integer array of dimension ICODE(6) containing the albedo type associated with each direction.
TITREC	character*72 scalar variable containing the title of the execution.
RK	real array of dimension RK(*) containing the base for dynamical memory allocation of real vectors.
IK	integer array of dimension IK(*) containing the base for dynamical memory allocation of integer vectors.

Called by

DRAGON routine(s) : XELDRV

Calling

DRAGON routine(s) : XCGBCM, XCGDIM, XCGGEO, XCWICL, XCWSCL

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMput, LCMSIX, REDGET, SETARA, RLSARA, XABORT

4.4 Routines for 2-D and 3-D Hexagonal Geometry**4.4.1 XHXTRK**

Purpose To analyze and track a cell or an assembly with hexagonal boundaries.

Syntax CALL XHXTRK(IPTRK, IPGEOM, GEONAM, IDISP, IFTEMP, MREGIO, IPRT, NDIM, ITOPT, NV, NS, NANGL, ISYMM, DENS, PCORN, MXSEG, ICODE, TITREC, RK, IK)

Author(s) M. Ouisloumen

Description of input parameters

IPTRK integer scalar variable for accessing the TRACKING data structure to be created.

IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
GEONAM	character*12 scalar variable containing the name of the GEOMETRY data structure to be analyzed.
IFTEMP	integer scalar variable for accessing the temporary binary tracking file to be created.
MREGIO	integer scalar variable containing the maximum number of regions.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1. In the case where IPRT>1, a description of the geometry and integration will be provided.

Description of input/output parameters

IDISP	integer scalar variable containing the tracking file disposition. For the case where IDISP=-2, the tracking file does not exist. In the case where IDISP=-1, the tracking file may be modified while IDISP=0 implies that the tracking file is in read-only mode. Finally, for the case where IDISP=1, a new tracking file will be created.
-------	---

Description of output parameters

NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
ITOPT	integer scalar variable containing the number of dimensions associated with the problem.
NV	integer scalar variable containing the number of regions in the problem.
NS	integer scalar variable containing the number of surfaces in the problem.
NANGL	integer scalar variable containing the number of tracking angles considered in the problem.
ISYMM	integer scalar variable containing the symmetry factor considered in the problem.
DENS	real scalar variable containing the effective tracking density in cm^{-1} for 2-D geometry and in cm^{-2} for 3-D geometry considered in the problem.
PCORN	real scalar variable containing the corner proximity in cm considered in the problem.
MXSEG	integer scalar variable containing the maximum segment length generated for the problem.
ICODE	integer array of dimension ICODE(6) containing the albedo type associated with each direction.
TITREC	character*72 scalar variable containing the title of the execution.
RK	real array of dimension RK(*) containing the base for dynamical memory allocation of real vectors.
IK	integer array of dimension IK(*) containing the base for dynamical memory allocation of integer vectors.

Called by

DRAGON routine(s) : XELDRV

Calling

DRAGON routine(s) : LHXUNH, MESHST, NEIGHB, TRKHEX

UTILIB routine(s) : ALGPT, XDRSET

GANLIB routine(s) : LCMGET, LCMLN, LCMPT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

4.4.2 TRKHEX

Purpose To track a cell or an assembly with hexagonal boundaries.

Syntax CALL TRKHEX(IPRT, NCEL, FVOL, REMESH, MESH, PAS1, A, COS1, COS2, COS3, POP, STAIRS, IPLANZ, FACST, NDIM, NCYL, MAT, IFILE, IANGL, POIDS, MAT2, NSECT, T0, TSEC, V0, VSEC, PAS2, RAYON, ZMIN, ZMAX, FACB, NVOL, SECTOR, NSMIN, SURB, RAUX, NS, CORN, ICOR, VOISIN, NCEL2)

Author(s) M. Ouisloumen

Description of input parameters

IPRT	integer scalar variable containing the print flag.
NCEL	integer scalar variable containing the number of cell in the assembly.
FVOL	integer array of dimension FVOL(NCEL) containing the index for the first zone in an assembly.
REMESH	real array of dimension REMESH(MESH) containing the coordinates of the hexagons in the assembly.
MESH	integer scalar variable containing the dimensions of the vector REMESH.
PAS1	double precision scalar variable containing the spatial line spacing in the y direction in cm.
A	double precision scalar variable containing the side width of one hexagon in the assemble in cm.
COS1	double precision scalar variable containing the x director cosine for tracking.
COS2	double precision scalar variable containing the y director cosine for tracking.
COS3	double precision scalar variable containing the z director cosine for tracking.
STAIRS	integer array of dimension STAIRS(IPLANZ) containing the maximum cell region index number on each z plane.
IPLANZ	integer scalar variable containing the number of z planes in the geometry.
FACST	integer array of dimension FACST(IPLANZ) containing the maximum cell surface index number on each z plane.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
IFILE	integer scalar variable containing the logical unit number for the tracking file.
POIDS	double precision scalar variable containing the integration weight.
NSECT	integer array of dimension NSECT(NCEL) associated with the number of sector in each hexagon. The number of sector is given by $6*(NSECT-1)$.
PAS2	double precision scalar variable containing the spatial line spacing in the z direction in cm.
RAYON	double precision scalar variable containing the radius in cm of the smallest circle surrounding a 2-D projection of the hexagonal cell in the $x - y$ plane.
ZMIN	double precision scalar variable containing the lowest z position of the assembly.
ZMAX	double precision scalar variable containing the highest z position of the assembly .

FACB	integer array of dimension FACB(*) index for first surface located at the bottom or top of the assembly.
NVOL	integer array of dimension NVOL(*) containing the volume number associated with each cell.
SECTOR	logical scalar variable that takes the value of <code>.TRUE.</code> if some of the cells are subdivided into sectors and the value <code>.FALSE.</code> otherwise
NSMIN	integer scalar variable. containing -NS where NS is the number of surfaces in the assembly.
SURB	integer array of dimension SURB(NSMIN:*) containing an index associated with each surface in the assembly.
NS	integer scalar variable containing the number of surfaces in the assembly.
CORN	integer array of dimension CORN(ICOR) describing the maximum number of corner associated with each region intersection.
ICOR	integer scalar variable containing the number of corner intersection detected.
VOISIN	integer array of dimension VOISIN(6,NCEL2) containing the cell number associated with the 6 neighbor surrounding a cell.
NCEL2	integer scalar variable containing the number of cell in a 2-D projection of assembly.

Description of output parameters

IANGL integer scalar variable containing the angle number being tracked.

Description of work parameters

MAT2	integer array of dimension MAT2(*) containing the cell index.
POP	real array of dimension POP(NCLE,MAXCYL) used for temporary storage.
NCYL	integer array of dimension NCYL(NCEL) used for temporary storage.
MAT	integer array of dimension MAT(MAXCYL,NCEL) used for temporary storage.
T0	double precision array of dimension T0(2*(MAXCYL+1)) used for temporary storage.
TSEC	double precision array of dimension TSEC(2*(MAXCYL+1)*(1+MAX(NSECT(I)))) used for temporary storage.
V0	integer array of dimension V0(2*(MAXCYL+1)) used for temporary storage.
VSEC	integer array of dimension VSEC(2*(MAXCYL+1)*(1+MAX(NSECT(I)))) used for temporary storage.
RAUX	double precision array of dimension RAUX(MAXCYL) used for temporary storage.

Called by

DRAGON routine(s) : XHXTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.4.3 DEPLIT

Purpose To unfold an assembly based on intrinsic symmetry.

Syntax CALL DEPLIT(IHEX, NH, NTH, ITAB)

Author(s) M. Ouisloumen

Description of input parameters

IHEX integer scalar variable describing the symmetry. The options are 1 for S30, 2 for SA60, 3 for SB60, 4 for S90, 5 for R120, 6 for R180, 7 for SA180, 8 for SB180 and 9 for COMPLETE.

NH integer scalar variable containing the total number of hexagon in initial geometry.

Description of input parameters

NTH integer scalar variable containing the total number of hexagon in unfolded geometry.

ITAB integer array of dimension ITAB(*) containing the correspondence between the hexagon in the unfolded geometry and those in the original geometry.

Called by

DRAGON routine(s) : LHXUNH

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

4.4.4 DUTURN

Purpose To find the orientation parameter for each cell generated by the unfolding process.

Syntax CALL DUTURN(IHEX, TURN, NCEL, TURND, NCELA, CELL, NUM, NTURN, ITAB)

Author(s) M. Ouisloumen

Description of input parameters

IHEX integer scalar variable describing the symmetry. The options are 1 for S30, 2 for SA60, 3 for SB60, 4 for S90, 5 for R120, 6 for R180, 7 for SA180, 8 for SB180 and 9 for COMPLETE.

TURN integer array of dimension TURN(NCEL) containing the orientation of the cells in the original geometry.

NCEL integer scalar variable containing the number of cells in the original geometry.

NCELA integer scalar variable containing the number of cells in the unfolded geometry.

CELL integer array of dimension CELL(NCELA) containing the cell number in the assembly.

Description of output parameters

TURND integer array of dimension TURND(NCELA) containing the orientation of the cells in the unfolded geometry.

Description of work parameters

NUM integer array of dimension NUM(NCEL) used for temporary storage.

NTURN integer array of dimension NTURN(NCEL) used for temporary storage.

ITAB integer array of dimension ITAB(NCEL) used for temporary storage.

Called by

DRAGON routine(s) : LHXUNH

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

4.4.5 LHXUNH

Purpose To read and analyze an hexagonal assembly.

Syntax CALL LHXUNH(IPTRK, IPGEOM, GEONAM, LEVEL, IPRT, MESH, NCELA, IPLANZ, NCPHY, ICODE, ZCODE, MVOSU, NREGIO, ISURF, SIDE, ISTATE, NSMIN, NSMAX, MVOLUM, IHEX, LX, MCODE, IPLANI, VLAT, ID)

Author(s) M. Ouisloumen

Description of input parameters

IPTRK integer scalar variable for accessing the TRACKING data structure to be created.

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

GEONAM character*12 scalar variable containing the name of the GEOMETRY data structure to be analyzed.

LEVEL integer scalar variable containing the hierarchical level at which this geometry is located.

IPRT integer scalar variable describing the amount of information that could be printed by a routine. It is not used here.

Description of output parameters

MESH integer scalar variable containing the dimension of the vector REMESH.

NCELA integer scalar variable containing the number of cells in the unfolded geometry.

IPLANZ integer scalar variable containing the number of z planes in the geometry.

NCPHY integer scalar variable containing the number of physical cells.

ICODE integer array of dimension ICODE(6) containing the albedo indices per direction.

ZCODE real array of dimension ZCODE(6) containing the albedo per direction.

MVOSU	integer scalar variable containing the dimension of the VOLSUR vector.
NREGIO	integer scalar variable containing the number of physical regions.
ISURF	integer scalar variable containing the last surface number.
SIDE	real scalar variable containing the width of one side of the hexagon in cm.
ISTATE	integer array of dimension ISTATE(NSTATE) containing the state vector for this geometry.
NSMIN	integer scalar variable containing the minimum surface number in the assembly.
NSMAX	integer scalar variable containing the maximum surface number in the assembly.
MVOLUM	integer scalar variable containing the number of regions in the assembly.
IHEX	integer scalar variable describing the symmetry. The options are 1 for S30, 2 for SA60, 3 for SB60, 4 for S90, 5 for R120, 6 for R180, 7 for SA180, 8 for SB180 and 9 for COMPLETE.
LX	integer scalar variable containing the number of radial region inside the hexagon.
MCODE	integer scalar variable containing the z symmetry factor. it takes a value of 1 if the symmetry takes place at the bottom of the assembly, a value of 2 if it takes place at the top of the assembly and a value of 0 if no symmetry conditions are applied in the z direction.
IPLANI	integer scalar variable containing the number of z directed planes.

Description of work parameters

ID integer array of dimension ID(*) used for dynamical allocation of memory.

Called by

DRAGON routine(s) : XHXTRK

Calling

DRAGON routine(s) : DEPLIT, DUTURN

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

4.4.6 MESHST

Purpose To analyze an hexagonal assembly.

Syntax CALL MESHST(IPTRK, IPGEOM, REMESH, FVOL, STAIRS, FACST, NCEL, IPLANZ, ISTATE, NCYL, NSECT, NCPHY, VOLSUR, VOL1, VTURN, PHTURN, MATALB, SIDE, NCOUR, NSMIN, NSMAX, NS, FACB, NVOL, SURB, VSYM, SSYM, IHEX, LXI, NV, MCODE, SURL, IPLANI, VLAT, ZMIN)

Author(s) M. Ouisloumen

Description of input parameters

IPTRK integer scalar variable for accessing the TRACKING data structure to be created.

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

Description of output parameters

REMESH	real array of dimension REMESH(*) containing the coordinates of the hexagons in the assembly.
FVOL	integer array of dimension FVOL(NCEL) containing the index for the first zone in an assembly.
STAIRS	integer array of dimension STAIRS(IPLANZ) containing the maximum cell region index number on each z plane.
FACST	integer array of dimension FACST(IPLANZ) containing the maximum cell surface index number on each z plane.
NCEL	integer scalar variable containing the number of cell in the assembly.
IPLANZ	integer scalar variable containing the number of z planes in the geometry.
ISTATE	integer array of dimension ISTATE(NSTATE) containing the state vector for this geometry.
NCYL	integer array of dimension NCYL(NCEL) used for temporary storage.
NSECT	integer array of dimension NSECT(NCEL) associated with the number of sector in each hexagon. The number of sector is given by $6*(NSECT-1)$.
NCPHY	integer scalar variable containing the number of physical cells.
VOLSUR	real array of dimension VOLSUR(*) containing the external surfaces and regional volumes.
MATALB	integer array of dimension MATALB(*) containing the albedo index and mixture associated with the external surfaces and regional volumes.
SIDE	real scalar variable containing the width of one side of the hexagon in cm.
NCOUR	integer scalar variable containing the number of hexagonal rings.
NSMIN	integer scalar variable containing the minimum surface number in the assembly.
NSMAX	integer scalar variable containing the maximum surface number in the assembly.
NS	integer scalar variable containing the number of external surfaces in the assembly.
FACB	integer array of dimension FACB(*) containing the index for top or bottom surface numbering.
NVOL	integer array of dimension NVOL(*) containing the index for cell region numbering.
SURB	integer array of dimension SURB(*) containing an index associated with each surface in the assembly.
VSYM	integer array of dimension VSYM(*) containing the region number for original geometry.
SSYM	integer array of dimension SSYM(*) containing the surface number for original geometry.
IHEX	integer scalar variable describing the symmetry. The options are 1 for S30, 2 for SA60, 3 for SB60, 4 for S90, 5 for R120, 6 for R180, 7 for SA180, 8 for SB180 and 9 for COMPLETE.
LXI	integer scalar variable containing the number of radial mesh in the original geometry.
NV	integer scalar variable containing the number of regions in the assembly.
MCODE	integer scalar variable containing the z symmetry factor. it takes a value of 1 if the symmetry takes place at the bottom of the assembly, a value of 2 if it takes place at the top of the assembly and a value of 0 if no symmetry conditions are applied in the z direction.

IPLANI integer scalar variable containing the number of z directed planes.
ZMIN real scalar variable containing the lowest z position of the assembly.

Description of work parameters

VOL1 integer array of dimension VOL1(NCPHY) used for temporary storage.
VTURN integer array of dimension VTURN(NCPHY) used for temporary storage.
PHTURN integer array of dimension PHTURN(NCPHY) used for temporary storage.
SURL integer array of dimension SURL(*) used for temporary storage.
VLAT integer array of dimension VLAT(*) used for temporary storage.

Called by

DRAGON routine(s) : XHXTRK

Calling

DRAGON routine(s) : NEIGHB

UTILIB routine(s) :

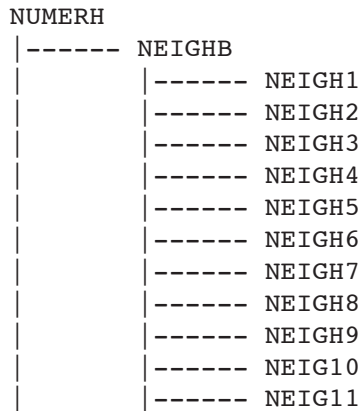
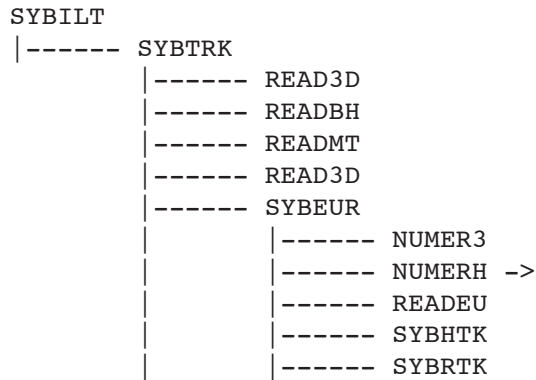
GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, SETARA, RLSARA, XABORT

5 THE INTERFACE CURRENT TRACKING MODULE

5.1 Structure of SYBILT:

The SYBILT: module can be represented by the following tree:

Structure of the module: SYBILT



Here, one can find a description of the routines SYBTRK, SYBEUR, SYBHTK and SYBRTK. Since the other routines are also used by the module JPMT: they will be described in Section 6.3.

5.2 General Routines Description

5.2.1 SYBTRK

Purpose To read the TRACKING and GEOMETRY for the SYBIL module.

Syntax CALL SYBTRK(IPTRK, IPGEOM, IMPX, MAXPTS, MAXJ, MAXZ, TITLE, MULTC,
IWIGN, IHALT, ILIGN, INORM, IRECT, IQW, JQUA1, JQUA2,
IQUA10, MAT, VOL, IDL)

Author(s) A. Hébert

Description of input/output parameters

IPTRK	integer scalar variable containing the TRACKING data structure.
IPGEOM	integer scalar variable containing the GEOMETRY data structure.
IMPX	integer scalar variable containing the print flag.
MAXPTS	integer scalar variable containing the maximum number of points.
MAXJ	integer scalar variable containing the maximum number of interface currents.
MAXZ	integer scalar variable containing the maximum space for track storage.
TITLE	character*(*) scalar variable containing the title.
MULTC	integer scalar variable containing the type of multicell approximation.
IWIGN	integer scalar variable containing the type of cylinderization.
IHALT	integer scalar variable containing the flag stop at the end of tracking.
ILIGN	integer scalar variable containing the flag to print tracks.
INORM	integer scalar variable containing the flag to normalization tracks.
IRECT	integer scalar variable containing the flag for using symmetries in square cells.
IQW	integer scalar variable containing the type on quadratures.
JQUA1	integer scalar variable containing the 1-D quadrature parameter.
JQUA2	integer array of dimension JQUA2(2) containing the 2-D quadrature parameters.
IQUA10	integer scalar variable containing the quadrature parameter for micro-structures.

Description of work parameters

MAT	integer array of dimension MAT(*) used for temporary storage.
VOL	real array of dimension VOL(*) used for temporary storage.
IDL	integer array of dimension IDL(*) used for temporary storage.

Called by

DRAGON routine(s) : SYBILT

Calling

DRAGON routine(s) : READ3D, READBH, READMT, SYBEUR

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMPOF, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

5.2.2 SYBEUR

Purpose To recover and analyze the geometry a 2-D assembly for the interface current method.

Syntax CALL SYBEUR(MAXPTS, MAXCEL, MAXJ, MAXZ, IPGEOM, NREG, IR, MAT, VOL, ILK, IMPX, IHEX, NCOUR, LMAIL, NMCEL, NMERGE, NGEN, IJAT, MULTC, IWIGN, IHALT, ILIGN, INORM, IRECT, IQW, IQUAD, XX, YY, NMC, RAYRE, MAIL, IZMAIL, RZMAIL, IFR, ALB, INUM, MIX, DVX, IGEN, POURCE, IORI)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS	integer scalar variable containing the maximum number of points.
MAXCEL	integer scalar variable containing the maximum number of cells.
MAXJ	integer scalar variable containing the maximum number of interface currents.
MAXZ	integer scalar variable containing the maximum space for track storage.
IPGEOM	integer scalar variable containing the GEOMETRY data structure.
NREG	integer scalar variable containing the total number of volumes.
IR	integer scalar variable containing the number of mixtures.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(*) containing the volumes.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary (. TRUE .).
IMPX	integer scalar variable containing the print flag.
IHEX	integer scalar variable containing the geometry flag.
NCOUR	integer scalar variable containing the number of out-currents per cell.
LMAIL	integer scalar variable containing the space required to store the tracking information.
NMCEL	integer scalar variable containing the total number of cells in the domain.
NMERGE	integer scalar variable containing the total number of merged cells for which specific values.
NGEN	integer scalar variable containing the total number of generating cells.
IJAT	integer scalar variable containing the total number of distinct out-currents.
MULTC	integer scalar variable containing the type of multicell approximation.
IWIGN	integer scalar variable containing the type of cylinderization.
IHALT	integer scalar variable containing the flag stop at the end of tracking.
ILIGN	integer scalar variable containing the flag to print tracks.
INORM	integer scalar variable containing the flag to normalization tracks.
IRECT	integer scalar variable containing the flag for using symmetries in square cells.
IQW	integer scalar variable containing the type on quadratures.
IQUAD	integer array of dimension IQUAD(*) containing the quadrature parameters.

XX	real array of dimension XX(*) containing the x -thickness of the generating cells.
YY	real array of dimension YY(*) containing the y -thickness of the generating cells.
NMC	integer array of dimension NMC(*) containing the offset of the first volume in each generating cell.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in each generating cell.
MAIL	integer array of dimension MAIL(*) containing the offset of the first tracking information in each generating cell.
IZMAIL	integer array of dimension IZMAIL(*) containing the integer tracking information.
RZMAIL	real array of dimension RZMAIL(*) containing the real tracking information.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.
INUM	integer array of dimension INUM(*) containing the index-number of the merged cell associated to each cell.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating cell.

Description of work parameters

POURCE	real array of dimension POURCE(*) used for temporary storage.
IORI	integer array of dimension IORI(*) used for temporary storage.

Called by

DRAGON routine(s) : SYBTRK

Calling

DRAGON routine(s) : NUMER3, NUMERH, READEU, SYBHTK, SYBRTK

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

5.2.3 SYBHTK

Purpose To compute the tracking information related to a hexagonal heterogeneous cell with a DP_1 approximation.

Syntax CALL SYBHTK(NA, NX, NR, R, Z, ZI, INORM, PREC, ILIGN, IQW, COTE, L, R2, VOL, RCO, RSQ)

Author(s) M. Ouisloumen

Description of input/output parameters

NA integer scalar variable containing the number of angles.

NX	integer scalar variable containing the number of tracks in each sub domain for a given angle.
NR	integer scalar variable containing the number of regions in the cell.
R	real array of dimension R(NR) radius of cylinders.
Z	real array of dimension Z(*) integration length.
ZI	integer array of dimension ZI(*) integration region.
INORM	integer scalar variable containing the type of normalization.
PREC	real scalar variable containing the accuracy for the normalized tracks.
ILIGN	integer scalar variable containing the flag to print the tracking information.
IQW	integer scalar variable to select equal weight quadrature.
COTE	real scalar variable containing the length of one of the hexagone.
L	integer scalar variable containing the number of mesh.

Description of work parameters

R2	real array of dimension R2(NR) used for temporary storage.
VOL	real array of dimension VOL(3,NR*(NR+1)/2) used for temporary storage.
RCO	real array of dimension RCO(NR-1,NR-1) used for temporary storage.
RSQ	real array of dimension RSQ(NR-1,NR-1) used for temporary storage.

Called by

DRAGON routine(s) : JPMEUR, SYBEUR, XCSANA

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGPT

GANLIB routine(s) : XABORT

5.2.4 SYBRTK

Purpose To compute the tracking information related to a Cartesian heterogeneous cell.

Syntax CALL SYBRTK(NA, NX, NZ, A, B, RAYRE, ILIGN, INORM, IRECT, IQW, L, Z, IZ, PREC, VAP)

Author(s) A. Hébert

Description of input parameters

NA	integer scalar variable containing the number of angles.
NX	integer scalar variable containing the number of tracks in each sub domain for a given angle.
NZ	integer scalar variable containing the number of regions in the cell.

A	real scalar variable containing the x dimension of the cell.
B	real scalar variable containing the y dimension of the cell.
RAYRE	real array of dimension RAYRE(*) radius of cylinders.
ILIGN	integer scalar variable containing the flag to print the tracking information.
INORM	integer scalar variable containing the type of normalization.
IRECT	integer scalar variable containing the flag to indicate that the cell is square.
IQW	integer scalar variable to select equal weight quadrature.

Description of output parameters

L	integer scalar variable containing the number of mesh.
Z	real array of dimension Z(*) integration length.
IZ	integer array of dimension IZ(*) integration region.
PREC	real scalar variable containing the accuracy for the normalized tracks.

Description of work parameters

VAP	real array of dimension VAP(*) used for temporary storage.
-----	--

Called by

DRAGON routine(s) : JPMEUR, SYBEUR, XCSANA

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGPT

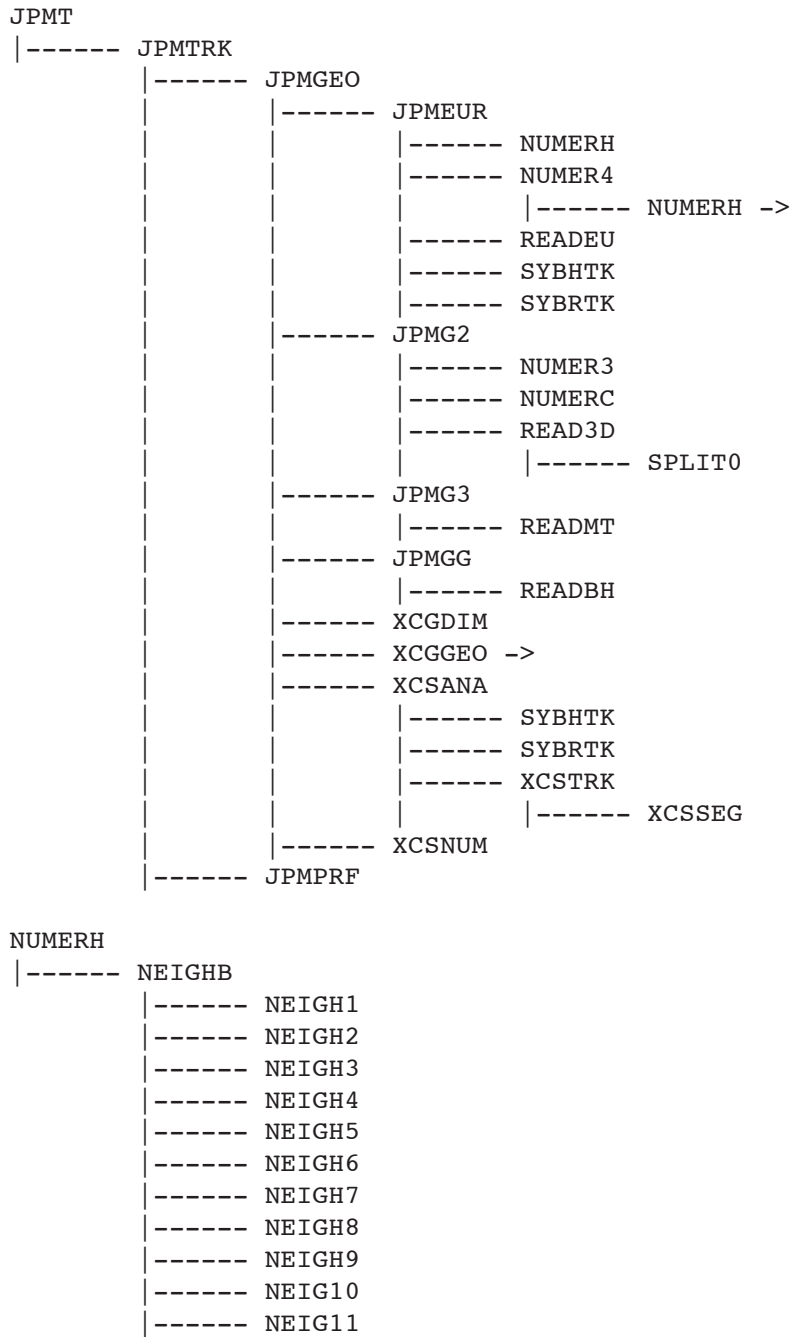
GANLIB routine(s) : XABORT

6 THE J_{\pm} TRACKING MODULE

6.1 Structure of JPMT :

The JPMT : module can be represented by the following tree:

Structure of the flux module: JPMT



6.2 General Routines Description

6.2.1 JPMEUR

Purpose To read and analyze a 2-D assembly.

Syntax CALL JPMEUR(MAXPTS, MAXJ , MAXZ, IPGEOM, IR, MAT, VOL, ILK, LMAIL, ITGEN, COORD, MAIL, IZMAIL, RZMAIL, IMPX, IAPP, MULTC, IWIGN, IHALT, ILIGN, INORM, IRECT, IQW, IQUAD, NMBLK, IFR, ALB, NMERGE, IJAT, INUM, MIX, DVX, NGEN, IGEN, ISURF, CHORD, XX, YY, RAYRE, NMC, IORI)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS	integer scalar variable containing the allocated storage for geometrical arrays.
MAXJ	integer scalar variable containing the allocated storage for currents arrays.
MAXZ	integer scalar variable containing the allocated storage for storing the tracking information.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IR	integer scalar variable containing the number of mixtures.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(*) containing the volumes.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary.
LMAIL	integer scalar variable containing the space required to store the tracking information.
ITGEN	integer array of dimension ITGEN(*) containing the type of each generating block.
COORD	real array of dimension COORD(3,*) containing the dimensions of each generating block.
MAIL	integer array of dimension MAIL(*) containing the offset of the first tracking information in each generating block.
IZMAIL	integer array of dimension IZMAIL(*) containing the tracking region identification.
RZMAIL	real array of dimension RZMAIL(*) containing the tracking length identification.
IMPX	integer scalar variable containing the print flag.
IAPP	integer scalar variable containing the type of interface current approximation between the blocks.
MULTC	integer scalar variable containing the type of eurydice multicell approximation.
IWIGN	integer scalar variable containing the type of cylinderization.
IHALT	integer scalar variable containing the flag to finish execution at the end of tracking.
ILIGN	integer scalar variable containing the flag for track printout.
INORM	integer scalar variable containing the flag for track normalization.

IRECT	integer scalar variable containing the flag for using symmetries in square cells.
IQW	integer scalar variable containing the type on quadratures.
IQUAD	integer array of dimension IQUAD(*) containing the quadrature parameters.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of incoming currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each incoming current.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
IJAT	integer scalar variable containing the total number of distinct out going currents.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(*) containing the index-number of out going currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out going currents.
NGEN	integer scalar variable containing the total number of generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.

Description of work parameters

XX	real array of dimension XX(*) containing the spatial mesh in the x direction.
YY	real array of dimension YY(*) containing the spatial mesh in the y direction.
RAYRE	real array of dimension RAYRE(*) containing the radial mesh.
NMC	integer array of dimension NMC(*) containing the offsets of the first zone in each generating cell.
IORI	integer array of dimension IORI(*) containing the orientation of the cells.

Called by

DRAGON routine(s) : JPMGEO

Calling

DRAGON routine(s) : NUMER4, READEU, SYBHTK, SYBRTK

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

6.2.2 JPMG2

Purpose To analyze a Cartesian, cylindrical or spherical geometry.

Syntax CALL JPMG2 (MAXPTS, MAXJ, IPGEOM, IR, MAT, VOL, ILK, ITYPE, IHEX, IAPP, IQUAD, IHALT, XX, YY, ZZ, IMPX, NMBLK, IFR, ALB, NMERGE, IJAT, INUM, MIX, DVX, NGEN, IGEN, ISURF, CHORD, XXX, YYY, ZZZ, IORI)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS	integer scalar variable containing the allocated storage for geometrical arrays.
MAXJ	integer scalar variable containing the allocated storage for currents arrays.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IR	integer scalar variable containing the number of mixtures.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(*) containing the volumes.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary.
ITYPE	integer scalar variable containing the type of geometry.
IHEX	integer scalar variable containing the type of hexagonal geometry.
IAPP	integer scalar variable containing the type of interface current approximation between the blocks.
IQUAD	integer scalar variable containing the quadrature parameter.
IHALT	integer scalar variable containing the flag to finish execution at the end of tracking.
XX	real array of dimension XX(*) containing the spatial mesh in the x direction.
YY	real array of dimension YY(*) containing the spatial mesh in the y direction.
ZZ	real array of dimension ZZ(*) containing the spatial mesh in the z direction.
IMPX	integer scalar variable containing the print flag.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of incoming currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each incoming current.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
IJAT	integer scalar variable containing the total number of distinct out going currents.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.

MIX	integer array of dimension MIX(*) containing the index-number of out going currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out going currents.
NGEN	integer scalar variable containing the total number of generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.

Description of work parameters

XXX	real array of dimension XXX(*) used for temporary storage.
YYY	real array of dimension YYY(*) used for temporary storage.
ZZZ	real array of dimension ZZZ(*) used for temporary storage.
IORI	integer array of dimension IORI(*) containing the orientation of the cells.

Called by

DRAGON routine(s) : JPMGEO

Calling

DRAGON routine(s) : NUMER3, NUMERC, READ3D

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

6.2.3 JPMG3

Purpose To recover and analyze an arbitrary multicell using the 'do-it-yourself' approach.

Syntax CALL JPMG3 (MAXPTS, MAXJ, IPGEOM, IR, MAT, VOL, ILK, NSUPCE, IAPP, IQUAD, IHALT, ISTAT, NMC, RAYRE, PROCEL, IMPX, NGEN, IFR, ALB, IJAT, INUM, MIX, DVX, IGEN, ISURF, CHORD, POURCE, SURFA, IWRK)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS	integer scalar variable containing the allocated storage for geometrical arrays.
MAXJ	integer scalar variable containing the allocated storage for currents arrays.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IR	integer scalar variable containing the number of mixtures.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.

VOL	real array of dimension VOL(*) containing the volumes.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary.
NSUPCE	integer scalar variable containing the number of cells.
IAPP	integer scalar variable containing the type of interface current approximation between the blocks.
IQUAD	integer scalar variable containing the quadrature parameter for the CP calculation of the micro blocks.
IHALT	integer scalar variable containing the flag to finish execution at the end of tracking.
ISTAT	integer scalar variable containing the flag for statistical information.
NMC	real array of dimension RAYRE(*) containing the radial mesh.
RAYRE	integer array of dimension NMC(*) containing the offsets of the first zone in each generating cell.
PROCEL	real array of dimension PROCEL(*) containing the user supplied geometrical matrix.
IMPX	integer scalar variable containing the print flag.
NGEN	integer scalar variable containing the total number of generating blocks.
IFR	integer array of dimension IFR(*) containing the index-number of incoming currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each incoming currents.
IJAT	integer scalar variable containing the total number of distinct out going currents.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(*) containing the index-number of out going currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out going currents.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.

Description of work parameters

POURCE	real array of dimension POURCE(*) used for temporary storage.
SURFA	real array of dimension SURFA(*) used for temporary storage.
IWRK	integer array of dimension IWRK(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMGEO

Calling

DRAGON routine(s) : READMT

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

6.2.4 JPMGEO

Purpose To analyze the geometry for the JPM module.

Syntax CALL JPMGEO(IPTRK, IPGEOM, MAXPTS, MAXJ, MAXZ, IR, ITG, VOL, MAT, ILK, IMPX, IAPP, MULTC, IWIGN, IHALT, ILIGN, INORM, IRECT, IQW, JQUA1, JQUA2, IFTRAK, ITRAK, IROT, IBPP, JQUAB, NMBLK, IJAS, IFR, ALB, NMERGE, IJAT, IJAR, INUM, MIX, DVX, NGEN, NPIS, IGEN, ISURF, CHORD)

Author(s) A. Hébert

Description of parameters

IPTRK	integer scalar variable containing the pointer to the TRACKING data structure.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
MAXPTS	integer scalar variable containing the allocated storage for geometrical arrays.
MAXJ	integer scalar variable containing the allocated storage for currents arrays.
MAXZ	integer scalar variable containing the allocated storage for storing the tracking information.
IR	integer scalar variable containing the number of mixtures.
ITG	integer scalar variable containing the type of geometry.
VOL	real array of dimension VOL(*) containing the volumes.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary.
IMPX	integer scalar variable containing the print flag.
IAPP	integer scalar variable containing the type of interface current approximation between the blocks.
MULTC	integer scalar variable containing the type of eurydice multicell approximation.
IWIGN	integer scalar variable containing the type of cylinderization.
IHALT	integer scalar variable containing the flag to finish execution at the end of tracking.
ILIGN	integer scalar variable containing the flag for track printout.
INORM	integer scalar variable containing the flag for track normalization.
IRECT	integer scalar variable containing the flag for using symmetries in square cells.
IQW	integer scalar variable containing the type on quadratures.
JQUA1	integer scalar variable containing the 1-D quadrature parameter.
JQUA2	integer array of dimension JQUA2(2) containing the 2-D quadrature parameters.

IFTRAK	integer scalar variable containing the unit associated with the tracking file for clusters.
ITRAK	integer scalar variable containing the flag for processing the tracking file.
IROT	integer scalar variable containing the flag for surface splitting in cluster reconstruction.
IBPP	integer scalar variable containing the type of interface current approximation between the micro-structures.
JQUAB	integer scalar variable containing the quadrature parameter for micro-structures in BIHET.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IJAS	integer scalar variable containing the total number of distinct incoming currents surrounding all the blocks.
IFR	integer array of dimension IFR(*) containing the index-number of incoming currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each incoming current.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
IJAT	integer scalar variable containing the total number of distinct out going currents.
IJAR	integer scalar variable containing the total number of out going currents leaving all the merged blocks.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(*) containing the index-number of out going currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out going current.
NGEN	integer scalar variable containing the total number of generating blocks.
NPIS	integer scalar variable containing the total number of surfaces surrounding all the generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.

Called by

DRAGON routine(s) : JPMTRK

Calling

DRAGON routine(s) : JPMEUR, JPMG2, JPMG3, JPMGG, XCGDIM, XCGGEO, XCSANA, XCSNUM

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLN, LCMPOF, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

One can find a description of the routines XCGDIM and XCGGEO in Section 4.3.2 and Section 4.3.3 respectively.

6.2.5 JPMGG

Purpose To analyze a geometry using the double-heterogeneity option.

Syntax CALL JPMGG (MAXPTS, MAXJ, IPGEOM, IR, MAT, VOL, NGEN2, NG, NSMAX, MICRO, IQUAD, IAPP, IHALT, NS, IGI, RS, FRACT, ISURF2, CHORD2, IMPX, NMBLK, IFR, ALB, NMERGE, IJAT, INUM, MIX, DVX, NGEN, IGEN, ISURF, CHORD, ITEMP, IBI)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS	integer scalar variable containing the allocated storage for geometrical arrays.
MAXJ	integer scalar variable containing the allocated storage for currents arrays.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IR	integer scalar variable containing the number of mixtures.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(*) containing the volumes.
NGEN2	integer scalar variable containing the number of generating blocks in the macro geometry.
NG	integer scalar variable containing the number of different kind of micro structures.
NSMAX	integer scalar variable containing the maximum number of blocks (tubes or shells) in each kind of micro structure.
MICRO	integer scalar variable containing the type of micro blocks.
IQUAD	integer scalar variable containing the quadrature parameter for the CP calculation of the micro blocks.
IAPP	integer scalar variable containing the type of interface current approximation between the blocks.
IHALT	integer scalar variable containing the flag to finish execution at the end of tracking.
NS	integer array of dimension NS(*) containing the number of blocks in each kind of micro structure.
IGI	integer array of dimension IGI(*) containing the type of mixture in each generating block of the macro geometry.
RS	real array of dimension RS(1+NSMAX,*) containing the radius of the micro blocks.
FRACT	real array of dimension FRACT(NG,*) containing the volumic fractions of the micro blocks.
ISURF2	integer array of dimension ISURF2(*) containing the number of surfaces surrounding each generating block of the macro geometry.
CHORD2	real array of dimension CHORD2(*) containing the mean chord length associated with each surface of the macro geometry.

IMPX	integer scalar variable containing the print flag.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of incoming currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each incoming current.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
IJAT	integer scalar variable containing the total number of distinct out going currents.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(*) containing the index-number of out going currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out going current.
NGEN	integer scalar variable containing the total number of generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.

Description of work parameters

ITEMP	integer array of dimension ITEMP(NSMAX,*) used for temporary storage.
IBI	integer array of dimension IBI(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMGEO

Calling

DRAGON routine(s) : READBH

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

6.2.6 JPMPRF

Purpose To compute the compressed storage parameters for the collision probability matrix.

Syntax CALL JPMPRF(IMPX, NMBLK, IFR, NMERGE, IJAT, INUM, MIX, NGEN, IGEN, ISURF, MU1, IMA, IGAT)

Author(s) A. Hébert

Description of input parameters

IMPX	integer scalar variable containing the print flag.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
IJAT	integer scalar variable containing the total number of distinct out-currents.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
NGEN	integer scalar variable containing the total number of generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.

Description of output parameters

MU1	integer array of dimension MU1(*) containing the position of each diagonal element in matrix compressed collision probability matrix.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in matrix compressed collision probability matrix.

Description of work parameters

IGAT	integer array of dimension IGAT(*) used for temporary storage.
------	--

Called by

DRAGON routine(s) : JPMTRK

6.2.7 JPMTRK

Purpose To recover the geometry and to perform tracking for JPM module.

Syntax CALL JPMTRK(IPTRK, IPGEOM, IMPX, MAXPTS, MAXJ, MAXZ, TITLE, IUOLD, IAPP, MULTC, IWIGN, IHALT, ILIGN, INORM, IRECT, IQW, JQUA1, JQUA2, CFTRAK, IFTRAK, ITRAK, IROT, IBPP, JQUAB, MAT, VOL, IDL)

Author(s) A. Hébert

Description of input/output parameters

IPTRK	integer scalar variable containing the pointer to the TRACKING data structure.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IMPX	integer scalar variable containing the print flag.

MAXPTS	integer scalar variable containing the allocated storage for geometrical arrays.
MAXJ	integer scalar variable containing the allocated storage for currents arrays.
MAXZ	integer scalar variable containing the allocated storage for storing the tracking information.
TITLE	character*72 scalar variable containing the title.
IUOLD	integer scalar variable containing the flag to use (IUOLD=1) old block collision probabilities if possible.
IAPP	integer scalar variable containing the type of interface current approximation between the blocks.
MULTC	integer scalar variable containing the type of eurydice multicell approximation.
IWIGN	integer scalar variable containing the type of cylinderization.
IHALT	integer scalar variable containing the flag to finish execution at the end of tracking.
ILIGN	integer scalar variable containing the flag for track printout.
INORM	integer scalar variable containing the flag for track normalization.
IRECT	integer scalar variable containing the flag for using symmetries in square cells.
IQW	integer scalar variable containing the type on quadratures.
JQUA1	integer scalar variable containing the 1-D quadrature parameter.
JQUA2	integer array of dimension JQUA2(2) containing the 2-D quadrature parameters.
CFTRAK	character*12 scalar variable containing the name of the tracking file for clusters.
IFTRAK	integer scalar variable containing the unit associated with the tracking file for clusters.
ITRAK	integer scalar variable containing the flag for processing the tracking file.
IROT	integer scalar variable containing the flag for surface splitting in cluster reconstruction.
IBPP	integer scalar variable containing the type of interface current approximation between the micro-structures.
JQUAB	integer scalar variable containing the quadrature parameter for micro-structures in BIHET.

Description of work parameters

MAT	integer array of dimension MAT(*) used for temporary storage.
VOL	real array of dimension VOL(*) used for temporary storage.
IDL	integer array of dimension IDL(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMT

Calling

DRAGON routine(s) : JPMGEO, JPMPRF

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMPUT, SETARA, RLSARA

6.3 Additional Tracking Routines

6.3.1 READ3D

Purpose To recover the description of a 1-D, 2-D or 3-D Cartesian, cylindrical, spherical or hexagonal domain.

Syntax CALL READ3D(MAXX, MAXY, MAXZ, MAXPTS, IPGEOM, IHEX, IR, MAT, ILK, SIDE, XXX, YYY, ZZZ, IMPX, LX, LY, LZ, NMBLK, NCODE, ZCODE, ISPLTX, ISPLTY, ISPLTZ)

Author(s) A. Hébert

Description of input/output parameters

MAXX	integer scalar variable containing the maximum x directed mesh size.
MAXY	integer scalar variable containing the maximum y directed mesh size.
MAXZ	integer scalar variable containing the maximum z directed mesh size.
MAXPTS	integer scalar variable containing the allocated storage for arrays large arrays.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IHEX	integer scalar variable containing the type of hexagonal geometry.
IR	integer scalar variable containing the number of mixtures.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary.
SIDE	real scalar variable containing the side of the hexagons.
XXX	real array of dimension XXX(*) containing the Cartesian coordinates of the domain along the x -axis.
YYY	real array of dimension YYY(*) containing the Cartesian coordinates of the domain along the y -axis.
ZZZ	real array of dimension ZZZ(*) containing the Cartesian coordinates of the domain along the z -axis.
IMPX	integer scalar variable containing the print flag.
LX	integer scalar variable containing the explicit x directed mesh size.
LY	integer scalar variable containing the explicit y directed mesh size.
LZ	integer scalar variable containing the explicit z directed mesh size.
NMBLK	integer scalar variable containing the number of elements in the domain.
NCODE	integer array of dimension NCODE(6) boundary condition relative to each side of the domain.
ZCODE	real array of dimension ZCODE(6) albedo relative to each side of the domain.

Description of work parameters

ISPLTX integer array of dimension ISPLTX(*) containing the explicit x directed mesh-splitting.
 ISPLTY integer array of dimension ISPLTY(*) containing the explicit y directed mesh-splitting.
 ISPLTZ integer array of dimension ISPLTZ(*) containing the explicit z directed mesh-splitting.

Called by

DRAGON routine(s) : BIVTRK, JPMG2, SYBTRK

Calling

DRAGON routine(s) : SPLIT0

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMNXT, XABORT

6.3.2 READBH

Purpose To recover the double heterogeneity option.

Syntax CALL READBH(MAXPTS, IPGEOM, IR, IR2, IPAS, IPAS2, MAT, VOL, NG, NSMAX, MICRO,
 NS, IBI,RS, FRACT, VOLK, IMPX, MILIEU, IDIL, ITEMP, FTEMP)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS integer scalar variable containing the allocated storage for large arrays.
 IPGEOM integer scalar variable containing the pointer to the GEOMETRY data structure.
 IR integer scalar variable containing the number of ordinary mixtures.
 IR2 integer scalar variable containing the number of ordinary and composite mixtures.
 IPAS integer scalar variable containing the number of volumes in the composite geometry.
 IPAS2 integer scalar variable containing the number of volumes in the macro geometry.
 MAT integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume of the composite geometry,
 VOL real array of dimension VOL(*) containing the volumes of the macro geometry,
 NG integer scalar variable containing the number of different kind of micro structures,
 NSMAX integer scalar variable containing the maximum number of volumes (tubes or shells) in each kind of micro structure,
 MICRO integer scalar variable containing the type of micro volumes,
 NS integer array of dimension NS(*) containing the number of tubes or shells in each kind of micro structure,
 IBI integer array of dimension IBI(*) containing the type of composite mixture in each volume of the macro geometry,

RS	real array of dimension RS(NSMAX+1,*) containing the radius of the micro volumes,
FRACT	real array of dimension FRACT(NG,*) containing the volumic fractions of each type of micro volumes in each ordinary or composite mixture.
VOLK	real array of dimension VOLK(NG,*) containing the volumic fractions of the tubes or shells in the micro volumes.
IMPX	integer scalar variable containing the print flag.

Description of work parameters

MILIEU	integer array of dimension MILIEU(*) used for temporary storage.
IDIL	integer array of dimension IDIL(*) used for temporary storage.
ITEMP	integer array of dimension ITEMP(NSMAX,*) used for temporary storage.
FTEMP	real array of dimension FTEMP(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMGG, SYBTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, LCMNXT, XABORT

6.3.3 READEU

Purpose To recover the description of a 2-D assembly.

Syntax CALL READEU(MAXPTS, IPGEOM, IR, MAT, ILK, NMCEL, NMERGE, NGEN, INUM, IGEN, NMBLK, LX, LY, XX, YY, RAYRE, NMC, IORI, NCODE, ZCODE, IHEX, IMPX, MILIE, NBREG, MILIEU, RAYON, CELL, XXX, YYY)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS	integer scalar variable containing the allocated storage for arrays large arrays.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IR	integer scalar variable containing the number of mixtures.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary.
NMCEL	integer scalar variable containing the total number of cells in the domain.
NMERGE	integer scalar variable containing the total number of merged cells for which specific values of the neutron flux and reactions rates are required.

NGEN	integer scalar variable containing the total number of generating cells.
INUM	integer array of dimension INUM(*) containing the index-number of the merged cell associated with each cell.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating cell associated with each merged cell.
NMBLK	integer scalar variable containing the total number of volumes in all the merged cells.
LX	integer scalar variable containing the number of cells along the x -axis.
LY	integer scalar variable containing the number of cells along the y -axis.
XX	real array of dimension XX(*) containing the x thickness of each cell or side of the hexagons.
YY	real array of dimension YY(*) containing the y thickness of each cell.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in the generating cells.
NMC	integer array of dimension NMC(*) containing the offsets of the first zone in each generating cell.
IORI	integer array of dimension IORI(*) containing the orientation of the cells.
NCODE	integer array of dimension NCODE(6) containing the boundary condition relative to each side of the domain.
ZCODE	real array of dimension ZCODE(6) containing the albedo relative to each side of the domain.
IHEX	integer scalar variable containing the type of symmetry for hexagonal geometry.
IMPX	integer scalar variable containing the print flag.

Description of work parameters

MILIE	integer array of dimension MILIE(*) used for temporary storage.
NBREG	integer array of dimension NBREG(*) used for temporary storage.
MILIEU	integer array of dimension MILIEU(*) used for temporary storage.
RAYON	real array of dimension RAYON(*) used for temporary storage.
CELL	real array of dimension CELL(*) used for temporary storage.
XXX	real array of dimension XXX(*) used for temporary storage.
YYY	real array of dimension YYY(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMEUR, SPHGEO, SYBEUR

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMNXT, LCMSIX, XABORT

6.3.4 READMT

Purpose To recover the description of an arbitrary multicell using the 'do-it-yourself' approach.

Syntax CALL READMT(MAXPTS, IPGEOM, IR, MAT, VOL, ILK, ISTAT, NSUPCE, IPAS, NMC,
RAYRE, PROCEL, POURCE, SURFA, IMPX, NBREG, MILIEU, RAYZON,
CELL)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS	integer scalar variable containing the allocated storage for arrays large arrays.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IR	integer scalar variable containing the number of mixtures.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(*) containing the volumes.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary.
ISTAT	integer scalar variable containing the flag for the statistical approximation.
NSUPCE	integer scalar variable containing the number of cells.
IPAS	integer scalar variable containing the number of volumes.
NMC	integer array of dimension NMC(*) containing the offset of the first volume in each cell.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in each cell.
PROCEL	real array of dimension PROCEL(*) containing the user supplied geometrical matrix.
POURCE	real array of dimension POURCE(*) containing the proportion of each cell in a lattice.
SURFA	real array of dimension SURFA(*) containing the surfaces.
IMPX	integer scalar variable containing the print flag.

Description of work parameters

NBREG	integer array of dimension NBREG(*) used for temporary storage.
MILIEU	integer array of dimension MILIEU(*) used for temporary storage.
RAYZON	real array of dimension RAYZON(*) used for temporary storage.
CELL	real array of dimension CELL(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMG3, SYBTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMNXT, LCMSIX, XABORT

6.3.5 NUMER3

Purpose To apply the surface renumbering for Cartesian geometry.

Syntax CALL NUMER3(NCOUR, MULTC, NCODE, ZCODE, LX, LY, LZ, IORI, ISM, POURCE, IMPX, NMBLK, IFR, ALB, NMERGE, INUM, MIX, DVX, IGEN, XX, YY, ZZ, JF2, GG3)

Author(s) A. Hébert

Description of input/output parameters

NCOUR	integer scalar variable containing the number of surfaces per block.
MULTC	integer scalar variable containing the type of multicell approximation.
NCODE	integer array of dimension NCODE(*) containing the type of boundary condition on each side of the domain.
ZCODE	real array of dimension ZCODE(*) containing the value of the albedo on each side of the domain.
LX	integer scalar variable containing the total number of cells along x direction.
LY	integer scalar variable containing the total number of cells along y direction.
LZ	integer scalar variable containing the total number of cells along z direction.
IORI	integer array of dimension IORI(*) containing the orientation of each cell.
ISM	integer array of dimension ISM(6,*) containing the permutation index corresponding to each orientation.
POURCE	real array of dimension POURCE(*) containing the weight associated with each merged block.
IMPX	integer scalar variable containing the print flag.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current
NMERGE	integer scalar variable containing the total number of merged blocks.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.

XX real array of dimension XX(*) containing the x thickness of the generating cells.

YY real array of dimension YY(*) containing the y thickness of the generating cells.

ZZ real array of dimension ZZ(*) containing the z thickness of the generating cells.

Description of work parameters

JF2 integer array of dimension JF2(*) used for temporary storage.

GG3 real array of dimension GG3(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMG2, NUMER4, SYBEUR

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

6.3.6 *NUMER4*

Purpose To apply the surface renumbering algorithm for an assembly of rectangular or hexagonal cells with tubes in some cells.

Syntax CALL NUMER4(MAXPTS, MAXJ, NCOUR, MULTC, IAPP, IWIGN, NCODE, ZCODE, IHEX,
 LX, LY, VOL, ISS,IORI, ISM, IMPX, NMBLK, IFR, ALB, NMERGE, INUM,
 MIX, DVX, NGEN, IGEN, ISURF,CHORD, ITGEN, COORD, NSUPCE, XX,
 YY, RAYRE, NMC, POURCE, JF2, IGEN2, INUM2)

Author(s) A. Hébert

Description of input/output parameters

MAXPTS integer scalar variable containing the allocated storage for large arrays.

MAXJ integer scalar variable containing the allocated storage for current arrays.

NCOUR integer scalar variable containing the number of surfaces per block.

MULTC integer scalar variable containing the type of multicell approximation.

IAPP integer scalar variable containing the type of angular flux expansion between the tubes.

IWIGN integer scalar variable containing the type of cylinderization.

NCODE integer array of dimension **NCODE**(*) containing the type of boundary condition on each side of the domain.

ZCODE real array of dimension ZCODE(*) containing the value of the albedo on each side of the domain.

IHEX	integer scalar variable containing the hexagonal flag.
------	--

LX integer scalar variable containing the total number of cells along x direction.

LY	integer scalar variable containing the total number of cells along y direction.
VOL	real array of dimension VOL(*) containing the volumes of the merged blocks.
ISS	integer array of dimension ISS(*) containing the mixture number associated with each merged block.
IORI	integer array of dimension IORI(*) containing the orientation of each cell.
ISM	integer array of dimension ISM(NCOUR+2,*) containing the permutation index corresponding to each orientation.
IMPX	integer scalar variable containing the print flag.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.
NMERGE	integer scalar variable containing the total number of merged blocks.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
NGEN	integer scalar variable containing the total number of generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces surrounding each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with surface of the generating blocks.
ITGEN	integer array of dimension ITGEN(*) containing the type of each generating block.
COORD	real array of dimension COORD(3,*) containing the dimensions of each generating block.
NSUPCE	integer scalar variable containing the number of generating Cartesian cells.
XX	real array of dimension XX(*) containing the x thickness of the generating cells.
YY	real array of dimension YY(*) containing the y thickness of the generating cells.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in each generating cell.
NMC	integer array of dimension NMC(*) containing the offset of the first volume in each generating Cartesian cell.

Description of work parameters

POURCE	real array of dimension POURCE(*) used for temporary storage.
JF2	integer array of dimension JF2(*) used for temporary storage.
IGEN2	integer array of dimension IGEN2(*) used for temporary storage.

INUM2 integer array of dimension INUM2(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMEUR

Calling

DRAGON routine(s) : NUMER3, NUMERH

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

6.3.7 NUMERC

Purpose To apply the surface renumbering for cylindrical geometry.

Syntax CALL NUMERC(ITYPE, IAPP, NCODE, ZCODE, LX, LZ, POURCE, IMPX, NMBLK, IFR, ALB, NMERGE, INUM, NGEN, IGEN, XX, YY, ZZ, ISURF, JF1, JF2)

Author(s) A. Hébert

Description of input/output parameters

ITYPE	integer scalar variable containing the type of geometry.
IAPP	integer scalar variable containing the type of angular flux expansion between the tubes.
NCODE	integer array of dimension NCODE(*) containing the type of boundary condition on each side of the domain.
ZCODE	real array of dimension ZCODE(*) containing the value of the albedo on each side of the domain.
LX	integer scalar variable containing the total number annular regions in the cell.
LZ	integer scalar variable containing the total number of cells along z direction.
POURCE	real array of dimension POURCE(*) containing the weight associated with each merged block.
IMPX	integer scalar variable containing the print flag.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission coefficients and albedos associated with each in-currents.
NMERGE	integer scalar variable containing the total number of merged blocks.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
NGEN	integer scalar variable containing the total number of generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.

XX	real array of dimension XX(*) containing the internal radius of the generating cells.
YY	real array of dimension YY(*) containing the external radius of the generating cells.
ZZ	real array of dimension ZZ(*) containing the z thickness of the generating cells.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.

Description of work parameters

JF2	integer array of dimension JF2(*) used for temporary storage.
GG3	real array of dimension GG3(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMG2

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

6.3.8 NUMERH

Purpose To apply the surface renumbering algorithm for hexagonal geometry.

Syntax CALL NUMERH(NCOUR, MULTC, NCODE, ZCODE, IHEX, LX, LZ, IORI, ISM, POURCE, IMPX, NMBLK, IFR,ALB, NMERGE, INUM, MIX, DVX, IGEN, XX, ZZ, JF2, GG3)

Author(s) A. Hébert

Description of input/output parameters

NCOUR	integer scalar variable containing the number of surfaces per block.
MULTC	integer scalar variable containing the type of multicell approximation.
NCODE	integer array of dimension NCODE(*) containing the type of boundary condition on each side of the domain.
ZCODE	integer array of dimension ZCODE(*) containing the value of the albedo on each side of the domain.
IHEX	integer scalar variable containing the type of hexagonal symmetry.
LX	integer scalar variable containing the total number of hexagons in one plane.
LZ	integer scalar variable containing the total number of hexagonal planes.
IORI	integer array of dimension IORI(*) containing the orientation of each block.
ISM	integer array of dimension ISM(8,*) containing the permutation index corresponding to each orientation.

POURCE	real array of dimension POURCE(*) containing the weight associated with each merged block.
IMPX	integer scalar variable containing the print flag.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
XX	real array of dimension XX(*) containing the side of the generating hexagons.
ZZ	real array of dimension ZZ(*) containing the z-thickness of the generating blocks.

Description of work parameters

JF2	integer array of dimension JF2(*) used for temporary storage.
GG3	real array of dimension GG3(*) used for temporary storage.

Called by

DRAGON routine(s) : NUMER4, SYBEUR

Calling

DRAGON routine(s) : NEIGHB

UTILIB routine(s) :

GANLIB routine(s) : XABORT

6.3.9 NEIGHB

Purpose To compute the index of a neighbor hexagon taking into account the symmetries.

Syntax NEIGHB=NEIGHB(J, K, IHEX, NH, POIDS)

Author(s) A. Benaboud

Description of input parameters

J	integer scalar variable containing the index of the hexagon.
K	integer scalar variable containing the index of the side.

IHEX integer scalar variable containing the type of symmetry.
 NH integer scalar variable containing the total number of hexagons.
 POIDS real scalar variable containing the weight of the hexagon.

Description of output parameters

NEIGHB integer scalar variable containing the symmetry index.

Called by

DRAGON routine(s) : BIVSBH, MESHST, NUMERH, XHXTRK

Calling

DRAGON routine(s) : NEIGH1, NEIGH2, NEIGH2, NEIGH4, NEIGH5, NEIGH6, NEIGH7, NEIGH8,
 NEIGH9, NEIG10, NEIG11

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

6.3.10 NEIGH1, NEIGH2, NEIGH3, NEIGH4, NEIGH5, NEIGH6, NEIGH7, NEIGH8, NEIGH9, NEIG10, NEIG11

Purpose To compute the index of a neighbor hexagon for a given symmetry.

Syntax CALL NEIGH1(NC, N, K, M, POIDS, NBA, FSTA, LSTA, INTA)
 CALL NEIGH2(NC, N, K, M, POIDS, NBA, FSTA, LSTA)
 CALL NEIGH3(NC, N, K, M, POIDS, NBA, FSTA, LSTA)
 CALL NEIGH4(NC, N, K, M, POIDS, NBA, FSTA, LSTA, INTA)
 CALL NEIGH5(NC, N, K, M, POIDS, NBA, FSTA, LSTA)
 CALL NEIGH6(NC, N, K, M, POIDS, NBA, FSTA, LSTA)
 CALL NEIGH7(NC, N, K, M, POIDS, NBA, FSTA, LSTA)
 CALL NEIGH8(NC, N, K, M, POIDS, NBA, FSTA, LSTA)
 CALL NEIGH9(NC, N, K, M, POIDS, NBA, FSTA, LSTA)
 CALL NEIG10(NC, N, K, M, POIDS, NBA, FSTA, LSTA)
 CALL NEIG11(NC, N, K, M, POIDS, NBA, FSTA, LSTA)

Author(s) A. Benaboud

Description of input/output parameters

NC integer scalar variable containing the total number of hexagonal crowns.
 N integer scalar variable index of the considered hexagon.
 K integer scalar variable containing the index of the side.

M integer scalar variable containing the index of the neighbor hexagon.

POIDS real scalar variable containing the weight of the hexagon.

Description of work parameters

NBA integer array of dimension NBA(*) used for temporary storage.

FSTA integer array of dimension FSTA(*) used for temporary storage.

LSTA integer array of dimension LSTA(*) used for temporary storage.

INTA integer array of dimension INTA(*) used for temporary storage.

Called by

DRAGON routine(s) : NEIGHB

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

6.3.11 SPLIT0

Purpose To perform the mesh splitting.

Syntax CALL SPLIT0(MAXPTS, ITYPE, NCODE, LXOLD, LYOLD, LZOLD, ISPLTX, ISPLTY, ISPLTZ,
NMBLK, LX, LY, LZ,XXX, YYY, ZZZ, MAT, ITYP, IMPX)

Author(s) A. Hébert

Description of parameters

MAXPTS integer scalar variable containing the dimension of vector MAT.

ITYPE integer scalar variable containing the type of geometry.

NCODE integer array of dimension NCODE(6) containing the boundary condition relative to each side of the domain.

LXOLD integer scalar variable containing the number of regions along the x -axis.

LYOLD integer scalar variable containing the number of regions along the y -axis.

LZOLD integer scalar variable containing the number of regions along the z -axis.

ISPLTX integer array of dimension ISPLTX(*) containing the mesh-splitting data for regions along the x -axis.

ISPLTY integer array of dimension ISPLTY(*) containing the mesh-splitting data for regions along the y -axis.

ISPLTZ integer array of dimension ISPLTZ(*) containing the mesh-splitting data for regions along the z -axis.

NMBLK	integer scalar variable containing the number of regions in the domain.
LX	integer scalar variable containing the number of regions along the x -axis after mesh-splitting.
LY	integer scalar variable containing the number of regions along the y -axis after mesh-splitting.
LZ	integer scalar variable containing the number of regions along the z -axis after mesh-splitting.
XXX	real array of dimension XXX(*) containing the Cartesian coordinates along the x -axis.
YYY	real array of dimension YYY(*) containing the Cartesian coordinates along the y -axis.
ZZZ	real array of dimension ZZZ(*) containing the Cartesian coordinates along the z -axis.
MAT	integer array of dimension MAT(*) containing the index-number of the mixture type assigned to each volume.
ITYP	logical scalar variable containing the type of update considered. If ITYP=.TRUE., then the update takes place in all directions and in the mixtures. Otherwise, only the mixtures are updated.
IMPX	integer scalar variable containing the print flag.

Called by

DRAGON routine(s) : READ3D

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

6.3.12 XCSANA

Purpose To perform a DP_1 tracking for cluster geometry.

Syntax CALL XCSANA(NBAN, NRT, MSROD, NRINFO, RAN, NRODS, RODS, RODR, NINT, IFTRAK, IMPX, MRTRK, NMTRAK, MTRK, NSOUT, COTE)

Author(s) G. Marleau

Description of parameters

NBAN	integer scalar variable containing the number of concentric regions.
NRT	integer scalar variable containing the number of rod types.
MSROD	integer scalar variable containing the maximum number of sub-rods per rods.
NRINFO	integer array of dimension NRINFO(2,NBAN) containing the type of concentric region.
RAN	real array of dimension RAN(NBAN) containing the radius /lattice side of concentric region.
NRODS	integer array of dimension NRODS(3,NRT) containing the integer description of rod of a given type.
RODS	real array of dimension RODS(2,NRT) containing the real description of rod of a given type.

RODR	real array of dimension RODR(MSROD,NRT) containing the sub-rods radius.
NINT	integer array of dimension NINT(3) containing the integration parameters.
IFTRAK	integer scalar variable containing the unit allocated to tracking file.
IMPX	integer scalar variable containing the print level.
MRTRK	integer scalar variable containing the simplified track length.
NMTRAK	integer scalar variable containing the maximum possible track length.
MTRK	integer scalar variable containing the current maximum track length.
NSOUT	integer scalar variable containing the number of outer surface.
COTE	real scalar variable containing the y dimension for rectangle.

Called by

DRAGON routine(s) : JPMGEO

Calling

DRAGON routine(s) : SYBHTK, SYBRTK, XCSTRK

UTILIB routine(s) : ALGPT

GANLIB routine(s) : SETARA, RLSARA

See Section 5.2.3 and Section 5.2.4 for a description of SYBHTK and SYBRTK respectively.

6.3.13 XCSNUM

Purpose To set current information for 2-D cluster.

Syntax CALL XCSNUM(NSOUT, NVOL, NBAN, NRT, MSROD, IPRT, IROT, IAPP, NSURF, RAN, COTE, NRODS, RODR, NRINFO, MATALB, VOLSUR, ZCODE, ISS, VOL, ISURF, VOLW, CHORD, IFR, MIX, ALB, DVX)

Author(s) G. Marleau

Description of input parameters

NSOUT	integer scalar variable containing the number of outer surface.
NVOL	integer scalar variable containing the maximum number of regions.
NBAN	integer scalar variable containing the number of concentric regions.
NRT	integer scalar variable containing the number of rod types.
MSROD	integer scalar variable containing the maximum number of sub-rods per rods.
IPRT	integer scalar variable containing the impression level.
IROT	integer scalar variable containing the type of JPM reconstruction.
IAPP	integer scalar variable containing the level of DP approximation.

NSURF	integer scalar variable containing the total number of currents.
RAN	real array of dimension RAN(NBAN) containing the radius of annular regions.
COTE	real scalar variable containing the y -side of rectangle.
NRODS	integer array of dimension NRODS(3,NRT) containing the integer description of rod of a given type.
RODR	real array of dimension RODR(MSROD,NRT) containing the sub-rods radius.
NRINFO	integer array of dimension NRINFO(2,NBAN) containing the annular region content.
MATALB	integer array of dimension MATALB(-NSOUT:NVOL) containing the albedo-material of regions.
VOLSUR	real array of dimension VOLSUR(-NSOUT:NVOL) containing the surface/4-volume of regions.
ZCODE	real array of dimension ZCODE(NMCO) containing the albedo.

Description of output parameters

ISS	integer array of dimension ISS(NVOL) containing the material of region.
VOL	real array of dimension VOL(NVOL) containing the volume of region.
ISURF	integer array of dimension ISURF(NVOL) containing the number of surfaces per regions.
VOLW	real array of dimension VOLW(NVOL) containing the weight associated with each block.
CHORD	real array of dimension CHORD(NSURF) containing the mean chord for each current.
IFR	integer array of dimension IFR(NSURF) containing the index-number of in-currents.
MIX	integer array of dimension MIX(NSURF) containing the index number of out current.
ALB	real array of dimension ALB(NSURF) containing the transmission/albedo for each current.
DVX	real array of dimension DVX(NSURF) containing the weight associated for each current.

Called by

DRAGON routine(s) : JPMGEO

6.3.14 XCSSEG

Purpose To segment total integration angles for rod cluster according to region encountered.

Syntax CALL XCSSEG(MRTRK, NOREG, DISREG, ZTRAK, XTRAK, KTRAK, NREG)

Author(s) G. Marleau

Description of parameters

MRTRK	integer scalar variable containing the maximum number of segment for region.
NOREG	integer scalar variable containing the region number currently analyzing.
DISREG	real scalar variable containing the region distance from startup surface.

ZTRAK	real array of dimension ZTRAK(2,MRTRK) containing the initial bottom and top angles permitted for new region.
XTRAK	real array of dimension XTRAK(3,MRTRK) containing the bottom, top angles and distance of segment already tracked.
KTRAK	integer array of dimension KTRAK(MRTRK) containing the region type of segment of angle.
NREG	integer scalar variable containing the initial/final number of segment.

Called by

DRAGON routine(s) : XCSTRK

6.3.15 XCSTRK

Purpose To track rod cluster for transmission probability calculations.

Syntax CALL XCSTRK(NGPT1, NGPT2, ZGPT, WGPT, RINER, ROUTR, NRODS, RODRAD, RODCEN, NTRAK, TRAK, NMTRAK, VD, XTRAK, KTRAK, ZTRAK, MRTRK, IMPX, IVAR)

Author(s) G. Marleau

Description of input parameters

NGPT1	integer scalar variable containing the number of gauss integration points for 1-D integration of last integral in 2-D.
NGPT2	integer scalar variable containing the number of gauss integration points for first integral in 2-D.
ZGPT	real array of dimension ZGPT(*) containing the gauss integration points.
WGPT	real array of dimension WGPT(*) containing the gauss integration weights.
RINER	real scalar variable containing the radius of inner shell.
ROUTR	real scalar variable containing the radius of outer shell.
NRODS	integer scalar variable containing the number of equally spaced rods between inner and outer shell.
RODRAD	real scalar variable containing the radius of rods.
RODCEN	real scalar variable containing the distance of rod center from shell center.
MRTRK	integer scalar variable number of rod region permitted.
IMPX	integer scalar variable print flag.
IVAR	integer scalar variable type of clusters.

Description of output parameters

NTRAK	integer array of dimension NTRAK(NTYP) containing the number of track for each of the 5 types of probabilities.
TRAK	real array of dimension TRAK(4,NMTRAK) containing the tracks and weight for integration.
NMTRAK	integer scalar variable containing the maximum number of track region permitted.

VD real array of dimension VD(NTYP,NDIR,NDIR,NOR) containing the series expansion of Bickley functions contribution.

Description of work parameters

XTRAK real array of dimension XTRAK(3,MRTRK) containing the top angle, bottom angle and distance for integration region.

KTRAK integer array of dimension KTRAK(MRTRK) containing the rod number for integration region.

ZTRAK real array of dimension ZTRAK(2,MRTRK) containing the angle limits for rod considered.

Called by

DRAGON routine(s) : XCSANA

Calling

DRAGON routine(s) : XCSSEG

UTILIB routine(s) :

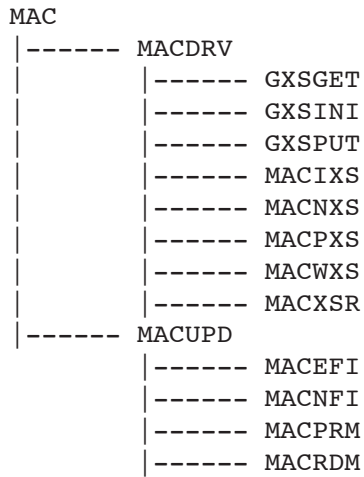
GANLIB routine(s) :

7 THE MODULE FOR MIXTURE PROCESSING

7.1 Structure of MAC :

The MAC : module can be represented by the following tree:

Structure of the mixture processing module: MAC



7.2 General Routines Description

7.2.1 MACDRV

Purpose To control the input of macroscopic cross sections.

Syntax CALL MACDRV(IPMACR, INDREC, IPRINT, NBMIX, NGROUP, NANISO, NIFISS, NEDMAC, ITRANC, NALBD)

Author(s) G. Marleau

Description of input parameters

IPMACR integer scalar variable for accessing the MACROLIB data structure being generated or updated.

INDREC integer scalar variable containing the status of the MACROLIB data structure. If INDREC=0, then one assumes that the data structure is to be created while in the case where INDREC=1, the data structure is assumed to be in update mode

IPRINT integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file while a value of IPRINT=1 provides a description of all the records stored on the MACROLIB data structure being defined. In the case where IPRINT>1, the contents of various records on the MACROLIB data structure are sent to the output file.

Description of output parameters

NBMIX integer scalar variable containing the maximum number of mixture to be stored in the MACROLIB.

NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NIFISS	integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.
NEDMAC	integer scalar variable containing the maximum number of editing cross sections considered in the MACROLIB.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, then no transport correction is available. For the case where ITRANC=1, an APOLLO type transport correction is to be considered while for ITRANC=2 a WIMS-AECL type transport correction is selected.
NALBD	integer scalar variable containing the number of physical albedo.

Called by

DRAGON routine(s) : MAC

Calling

DRAGON routine(s) : GXSGET, GXSINI, GXSPUT, MACIXS, MACNXS, MACPXS, MACWXS, MACXSR

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMPUT, REDGET, SETARA, RLSARA, XABORT

7.2.2 MACEFI

Purpose To read the energy produced per fission and to store on the MACROLIB.

Syntax CALL MACEFI(IPMACR, IPRINT, IEN, NTOTMX, NBMIXF, NIFISF, IMLOC, IEFPRO, NUMFN, XSGEN, XSTMP)

Author(s) G. Marleau

Description of parameters

IPMACR	integer scalar variable for accessing the MACROLIB data structure being generated or updated.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file while a value of IPRINT=1 provides a description of all the records stored on the MACROLIB data structure.
IEN	integer scalar variable identifying the MACROLIB to be processed.
NTOTMX	integer scalar variable containing the maximum number of mixtures.
NBMIXF	integer scalar variable containing the final number of mixtures.
NIFISF	integer scalar variable containing the final number of fissile isotopes.
IMLOC	integer array of dimension IMLOC(2,NTOTMX) containing the mixture location.
IEFPRO	integer scalar variable containing a flag for fissile isotope processing.

NUMFN	integer array of dimension NUMFN(NBMIXF,NIFISF) containing the final set of fissile isotope number associated with a mixture.
XSGEN	real array of dimension XSGEN(NBMIXF,NIFISF) containing the general cross section vector.
XSTMP	real array of dimension XSTMP(NTOTMX*(NIFISF+1)) used for temporary cross section storage.

Called by

DRAGON routine(s) : MACUPD

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN

7.2.3 MACIXS

Purpose To initialize the cross section before reading new values on the input stream.

Syntax CALL MACIXS(IPMACR, NBMIX, NGROUP, NANISO, NIFISS, MAXFIS, LOIDX, XSTOTL, XSTRAN, XSFIS, XSFIXE, XSSCAT, XSWORK, INGSCT, IFGSCT, ISCATA, XEFISS)

Author(s) G. Marleau

Description of input parameters

IPMACR	integer scalar variable for accessing the MACROLIB data structure being generated or updated.
NBMIX	integer scalar variable containing the maximum number of mixture to be stored in the MACROLIB.
NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NIFISS	integer scalar variable containing the number of fissile isotopes considered for the fission cross section.
MAXFIS	integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.

Description of output parameters

LOLDXS	logical array of dimension LOLDXS(NBXS) indicating the presence (.TRUE.) of a specific cross section type on the MACROLIB. The cross sections are ordered as follows: <ul style="list-style-type: none"> • LOLDXS=1 for total cross section Σ; • LOLDXS=2 for neutron fission yield cross section $\nu\Sigma_f$; • LOLDXS=3 for fixed neutron source S; • LOLDXS=4 for neutron fission energy production spectrum χ; • LOLDXS=5 for scattering cross section Σ_s;
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- LOLDXS=6 for transport correction cross section Σ_{tc} ;
- LOLDXS=7 for fixed adjoint neutron source S^* ;
- LOLDXS=8 for fixed generalized adjoint neutron source S_{Γ}^* ;
- LOLDXS=9 for fission cross section Σ_f ;
- LOLDXS=10 for energy emitted per fission κ .

XSTOTL	real array of dimension XSTOTL(NBMIX,NGROUP) containing the total cross section.
XSTRAN	real array of dimension XSTRAN(NBMIX,NGROUP) containing the transport correction cross section.
XSFISS	real array of dimension XSFISS(NBMIX,MAXFIS,NGROUP,3) containing $\nu\Sigma_f$, Σ_f and χ .
XSFIXE	real array of dimension XSFIXE(NBMIX,NGROUP,3) containing the fixed sources S , S^* and S_{Γ}^* .
XSSCAT	real array of dimension XSSCAT(NGROUP,NBMIX,NANISO,NGROUP) containing the scattering cross section.
XSWORK	real array of dimension XSWORK(NBMIX*NGROUP) used for temporary storage of cross section.
INGSCT	integer array of dimension INGSCT(NBMIX) used for temporary storage.
IFGSCT	integer array of dimension IFGSCT(NBMIX) used for temporary storage.
ISCATA	integer array of dimension ISCATA(NANISO) indicating the presence (ISCATA(l)=1) or absence (ISCATA(l)=2) of a scattering anisotropy of level l .
XEFISS	real array of dimension XEFISS(NBMIX,MAXFIS) containing the average energy emitted per fission κ .

Called by

DRAGON routine(s) : MACDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMSIX

7.2.4 MACNFI

Purpose To update the list of fissile isotopes and first group with up-scattering.

Syntax CALL MACNFI(IPMACR, IPRINT, IEN, NTOTMX, NGROUP, NANISO, NIFISS, NEDMAC, NBMIXF, NGROF, NIFISF, NEDF, NBMIXO, NGROO, NLO, NIFISO, NEDO, IMLOC, ENERGN, NAMEDN, NAMFN, NUMFN, IFGUPS, ENERGO, NAMEDO, NAMFO, NUMFO, IFGUPO)

Author(s) G. Marleau

Description of parameters

IPMACR	integer scalar variable for accessing the MACROLIB data structure being generated or updated.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file while a value of IPRINT=1 provides a description of all the records stored on the MACROLIB data structure.
IEN	integer scalar variable identifying the MACROLIB to be processed.
NTOTMX	integer scalar variable containing the maximum number of mixtures.
NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NIFISS	integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.
NEDMAC	integer scalar variable containing the maximum number of editing cross sections considered in the MACROLIB.
NBMIXF	integer scalar variable containing the final number of mixtures.
NGROF	integer scalar variable containing the number of groups tested.
NIFISF	integer scalar variable containing the final number of fissile isotope.
NEDF	integer scalar variable containing the final number of edition cross sections.
NBMIXO	integer scalar variable containing the number of mixture in the IPMACR MACROLIB.
NGROO	integer scalar variable containing the number of groups in the IPMACR MACROLIB.
NLO	integer scalar variable containing the anisotropy order in the IPMACR MACROLIB.
NIFISO	integer scalar variable containing the number of fissile isotopes in the IPMACR MACROLIB.
NEDO	integer scalar variable containing the number of editing cross sections in the IPMACR MACROLIB.
IMLOC	integer array of dimension IMLOC(2,NTOTMX) containing the mixture location.
ENERGN	real array of dimension ENERGN(2*NGROUP+1) containing the final energy and lethargy associated with each group.
NAMEDN	integer array of dimension NAMEDN(2,NEDMAC) containing the new cross section names used for editing.
NAMFN	integer array of dimension NAMFN(2,NIFISS) containing the new fissile isotope names.
NUMFN	integer array of dimension NUMFN(NBMIXF,NIFISS) containing the new fissile isotope number.
IFGUPS	integer array of dimension IFGUPS(NBMIXF,NANISO) containing the new minimum group number with up-scattering.
ENERGO	real array of dimension ENERGO(2*NGROO+1) containing the old energy and lethargy associated with each group.
NAMEDO	integer array of dimension NAMEDO(2,NEDO) containing the old editing cross section names.
NAMFO	integer array of dimension NAMFO(2,NIFISO) containing the old fissile isotope names.

NUMFO integer array of dimension NUMFO(NBMIXO,NIFISO) containing the old fissile isotope number.

IFGUPO integer array of dimension IFGUPO(NBMIXO,NLO) containing the old minimum group number with up-scattering.

Called by

DRAGON routine(s) : MACUPD

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET

7.2.5 MACNXS

Purpose To normalize macroscopic cross section.

Syntax CALL MACNXS(IPMACR, NBMIX, NGROUP, NANISO, NIFISS, MAXFIS, NBWRK, INGSCT, IFGSCT, XSWORK, SCWORK, CHWORK)

Author(s) G. Marleau

Description of input parameters

IPMACR integer scalar variable for accessing the MACROLIB data structure being generated or updated.

NBMIX integer scalar variable containing the maximum number of mixture to be stored in the MACROLIB.

NGROUP integer scalar variable containing the number of energy groups considered in the MACROLIB.

NANISO integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.

NIFISS integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.

MAXFIS integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.

NBWRK integer scalar variable containing the dimensions of the work vectors.

Description of work parameters

INGSCT integer array of dimension INGSCT(NBMIX) used for temporary storage.

IFGSCT integer array of dimension IFGSCT(NBMIX) used for temporary storage.

XSWORK real array of dimension XSWORK(NBWRK) use for temporary storage.

SCWORK double precision array of dimension SCWORK(NBMIX,NANISO,NGROUP) use for temporary storage.

CHWORK real array of dimension CHWORK(NBMIX,MAXFIS) use for temporary storage.

Called by

DRAGON routine(s) : MACDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX

7.2.6 MACPRM

Purpose To create a new MACROLIB from a set of old MACROLIB.

Syntax CALL MACPRM(IPMACR, IPRINT, NGROUP, NANISO, NBMIXF, NIFISF, NEDF, NREACD, NTREA, IGR, NAMREA, NAMEDN, IXSPRO, XSGEN, XSSCAT, SCTMP, ISCAT)

Author(s) G. Marleau

Description of parameters

IPMACR	integer scalar variable for accessing the MACROLIB data structure being generated or updated.
IPRINT	integer scalar variable containing the print flag.
NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NBMIXF	integer scalar variable containing the maximum number of mixture to be stored in the MACROLIB.
NIFISF	integer scalar variable containing the number of fissile isotopes considered for the fission cross section.
MAXFIS	integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.
NEDF	integer scalar variable containing the maximum number of editing cross sections considered in the MACROLIB.
NREACD	integer scalar variable containing the number of default cross section.
NTREA	integer scalar variable containing the total number of cross section.
IGR	integer scalar variable containing the current group number being processed.
NAMREA	character array of dimension NAMREA(NREACD)*12 containing the names of the default cross section.
NAMEDN	integer array of dimension NAMEDN(2,NEDF) containing the names of the additional editing cross section.
IXSPRO	integer array of dimension IXSPRO(NTREA+NANISO). If IXSPRO(<i>i</i>)=1, then this cross section type is saved on the MACROLIB, otherwise this cross section type is not saved on the MACROLIB.

XSGEN	real array of dimension XSGEN(NBMIXF,NTREA) containing the general cross sections. The cross section are classified as specified in the vectors NAMREA and NAMEDN.
XSSCAT	real array of dimension XSSCAT(NGROUP,NBMIXF,NANISO,2) containing the general scattering cross section matrix.
SCTMP	real array of dimension SCTMP(NGROUP*NBMIXF) used for temporary storage.
ISCAT	integer array of dimension ISCAT(NBMIXF,3) used for temporary storage.

Called by

DRAGON routine(s) : MACUPD

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMPUT

7.2.7 MACPXS

Purpose To transfer a set of cross section to the MACROLIB.

Syntax CALL MACPXS(IPMACR, NBMIX, NGROUP, NANISO, NIFISS, MAXFIS, ITRANC, LNEWXS, NEDMAC, XSTOTL, XSTRAN, XSFISS, XSFIEX, XSSCAT, XSWORK, INGSCT, IFGSCT, IPOSCT, ISCATA, XEFISS, IFGUPS)

Author(s) G. Marleau

Description of parameters

IPMACR	integer scalar variable for accessing the MACROLIB data structure being generated or updated.
NBMIX	integer scalar variable containing the maximum number of mixture to be stored in the MACROLIB.
NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NIFISS	integer scalar variable containing the number of fissile isotopes considered for the fission cross section.
MAXFIS	integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, then no transport correction is available. For the case where ITRANC=1, an APOLLO type transport correction is to be considered while for ITRANC=2 a WIMS-AECL type transport correction is selected.
LNEWXS	logical array of dimension LNEWXS(NBXS) indicating the presence (.TRUE.) of a specific cross section. type on the MACROLIB. The cross sections are ordered as follows:

- LNEWXS=1 for total cross section Σ ;

- LNEWXS=2 for neutron fission yield cross section $\nu\Sigma_f$;
- LNEWXS=3 for fixed neutron source S ;
- LNEWXS=4 for neutron fission energy production spectrum χ ;
- LNEWXS=5 for scattering cross section Σ_s ;
- LNEWXS=6 for transport correction cross section Σ_{tc} ;
- LNEWXS=7 for fixed adjoint neutron source S^* ;
- LNEWXS=8 for fixed generalized adjoint neutron source S_Γ^* ;
- LNEWXS=9 for fission cross section Σ_f ;
- LNEWXS=10 for energy emitted per fission κ .

NEDMAC	integer scalar variable containing the maximum number of editing cross sections considered in the MACROLIB.
XSTOTL	real array of dimension XSTOTL(NBMIX,NGROUP) containing the total cross section.
XSTRAN	real array of dimension XSTRAN(NBMIX,NGROUP) containing the transport correction cross section.
XSFISS	real array of dimension XSFISS(NBMIX,MAXFIS,NGROUP,3) containing $\nu\Sigma_f$, Σ_f and χ .
XSFIXE	real array of dimension XSFIXE(NBMIX,NGROUP,3) containing the fixed sources S , S^* and S_Γ^* .
XSSCAT	real array of dimension XSSCAT(NGROUP,NBMIX,NANISO,NGROUP) containing the scattering cross section.
XSWORK	real array of dimension XSWORK(NBMIX*(NGROUP+1)) used for temporary storage of cross section.
INGSCT	integer array of dimension INGSCT(NBMIX) used for temporary storage.
IFGSCT	integer array of dimension IFGSCT(NBMIX) used for temporary storage.
IPOSCT	integer array of dimension IFGSCT(NBMIX) used for temporary storage.
ISCATA	integer array of dimension ISCATA(NANISO) indicating the presence (ISCATA(l)=1) or absence (ISCATA(l)=2) of a scattering anisotropy of level l .
XEFISS	real array of dimension XEFISS(NBMIX,MAXFIS) containing the average energy emitted per fission κ .
IFGUPS	integer array of dimension IFGUPS(NBMIX,NANISO) containing the first group number that has non-vanishing up-scattering cross sections.

Called by

DRAGON routine(s) : MACDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX, SETARA, RLSARA

7.2.8 MACRDM

Purpose To read an old MACROLIB and transfer to memory.

Syntax CALL MACRDM(IPMACR, IPRINT, IEN, NTOTMX, NGROUP, NANISO, NBMIXF, NIFISF, NEDF, NREACD, NTREA, IMLOC, NAMREA, NAMEDN, NUMFN, IXSPRO, XSGEN, XSSCAT, XSTMP, SCTMP, ISCAT)

Author(s) G. Marleau

Description of parameters

IPMACR	integer scalar variable for accessing the MACROLIB data structure being generated or updated.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file while a value of IPRINT=1 provides a description of all the records stored on the MACROLIB data structure.
IEN	integer scalar variable identifying the MACROLIB to be processed.
NTOTMX	integer scalar variable containing the maximum number of mixtures.
NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NBMIXF	integer scalar variable containing the final number of mixtures.
NIFISF	integer scalar variable containing the final number of fissile isotope.
NEDF	integer scalar variable containing the final number of edition cross sections.
NREACD	integer scalar variable containing the number of default cross section.
NTREA	integer scalar variable containing the total number of cross section.
IMLOC	integer array of dimension IMLOC(2,NTOTMX) containing the mixture location.
NAMREA	character array of dimension NAMREA(NREACD)*12 containing the names of the default cross section.
NAMEDN	integer array of dimension NAMEDN(2,NEDMAC) containing the new cross section names used for editing.
NUMFN	integer array of dimension NUMFN(NBMIXF,NIFISS) containing the new fissile isotope number.
IXSPRO	integer array of dimension IXSPRO(NTREA+NANISO). If ISXPRO(i)=1, then this cross section type is saved on the MACROLIB, otherwise this cross section type is not saved on the MACROLIB.
XSGEN	real array of dimension XSGEN(NBMIXF,NTREA) containing the general cross sections. The cross section are classified as specified in the vectors NAMREA and NAMEDN.
XSSCAT	real array of dimension XSSCAT(NGROUP,NBMIXF,NANISO,2) containing the general scattering cross section matrix.
XSTMP	real array of dimension XSTMP(NTOTMX*(NIFISF+1)) used for temporary storage.
SCTMP	real array of dimension SCTMP(NGROUP*NTOTMX) used for temporary storage.

ISCAT integer array of dimension ISCAT(NTOTMX,3) used for temporary storage.

Called by

DRAGON routine(s) : MACUPD

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLEN

7.2.9 MACUPD

Purpose To update a MACROLIB using information stored on other read-only MACROLIB.

Syntax CALL MACUPD(NENTRY, KENTRY, IPRINT, NTOTMX, NBMIX, NGROUP, NANISO, NIFISS, NEDMAC, ITRANC, IMLOC)

Author(s) G. Marleau

Description of parameters

NENTRY	integer scalar variable containing the number of read-only MACROLIB data structure that can be processed.
KENTRY	integer array of dimension KENTRY(NENTRY) containing the pointer to the MACROLIB data structure in read-only mode that can be processed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file while a value of IPRINT=1 provides a description of all the records stored on the MACROLIB data structure.
NTOTMX	integer scalar variable containing the maximum number of mixtures.
NBMIX	integer scalar variable containing the maximum number of mixture to be stored in the MACROLIB.
NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NIFISS	integer scalar variable containing the number of fissile isotopes considered for the fission cross section.
NEDMAC	integer scalar variable containing the maximum number of editing cross sections considered in the MACROLIB.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, then no transport correction is available. For the case where ITRANC=1, an APOLLO type transport correction is to be considered while for ITRANC=2 a WIMS-AECL type transport correction is selected.
IMLOC	integer array of dimension IMLOC(2,NTOTMX) containing the mixture location.

Called by

DRAGON routine(s) : MAC

Calling

DRAGON routine(s) : MACEFI, MACNFI, MACPRM, MACRDM

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMput, LCMSIX, REDGET, SETARA, RLSARA, XABORT

7.2.10 MACWXS

Purpose To transfer a set of cross section to the output file.

Syntax CALL MACWXS(IPMACR, IPRINT, NBMIX, NGROUP, NANISO, NIFISS, ITRANC, NEDMAC, NBWRK, INGSCT, IFGSCT, IPOSCT, XSWORK, CADNAM)

Author(s) G. Marleau

Description of parameters

IPMACR	integer scalar variable for accessing the MACROLIB data structure being generated or updated.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file while a value of IPRINT=1 provides a description of all the records stored on the MACROLIB data structure being defined. In the case where IPRINT>1, the contents of various records on the MACROLIB data structure are sent to the output file.
NBMIX	integer scalar variable containing the maximum number of mixture to be stored in the MACROLIB.
NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NIFISS	integer scalar variable containing the number of fissile isotopes considered for the fission cross section.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, then no transport correction is available. For the case where ITRANC=1, an APOLLO type transport correction is to be considered while for ITRANC=2 a WIMS-AECL type transport correction is selected.
NEDMAC	integer scalar variable containing the maximum number of editing cross sections considered in the MACROLIB.
NBWRK	integer scalar variable containing the dimensions of the temporary storage vector XSWORK.
INGSCT	integer array of dimension INGSCT(NBMIX) used for temporary storage.
IFGSCT	integer array of dimension IFGSCT(NBMIX) used for temporary storage.
IPOSCT	integer array of dimension IFGSCT(NBMIX) used for temporary storage.
XSWORK	real array of dimension XSWORK(NBMIX*(NGROUP+1)) used for temporary storage of cross section.

CADNAM integer array of dimension CADNAM(2,NEDMAC+1) containing the additional editing cross section. names

Called by

DRAGON routine(s) : MACDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, XABORT

7.2.11 MACXSR

Purpose To read cross section from input stream.

Syntax CALL MACXSR(IPRINT, NBMIX, NGROUP, NANISO, NIFISS, MAXFIS, LOLDXS, LNEWXS, CARLIR, LADD, LUPD, XSTOTL, XSTRAN, XSFISS, XSFIKE, XSSCAT, ISCATA, XEFISS, LINIXS)

Author(s) G. Marleau

Description of parameters

IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file while a value of IPRINT=1 provides a description of all the records stored on the MACROLIB data structure being defined. In the case where IPRINT>1, the contents of various records on the MACROLIB data structure are sent to the output file.
NBMIX	integer scalar variable containing the maximum number of mixture to be stored in the MACROLIB.
NGROUP	integer scalar variable containing the number of energy groups considered in the MACROLIB.
NANISO	integer scalar variable containing the maximum anisotropic level considered for the scattering cross section.
NIFISS	integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.
MAXFIS	integer scalar variable containing the maximum number of fissile isotopes considered for the fission cross section.
LOLDXS	logical array of dimension LOLDXS(NBXS) indicating the presence (.TRUE.) of a specific cross section type on the MACROLIB. The cross sections are ordered as follows: <ul style="list-style-type: none"> • LOLDXS=1 for total cross section Σ; • LOLDXS=2 for neutron fission yield cross section $\nu\Sigma_f$; • LOLDXS=3 for fixed neutron source S; • LOLDXS=4 for neutron fission energy production spectrum χ; • LOLDXS=5 for scattering cross section Σ_s; • LOLDXS=6 for transport correction cross section Σ_{tc};

	<ul style="list-style-type: none"> • LOLDXS=7 for fixed adjoint neutron source S^*; • LOLDXS=8 for fixed generalized adjoint neutron source S_{Γ}^*; • LOLDXS=9 for fission cross section Σ_f; • LOLDXS=10 for energy emitted per fission κ.
LNEWXS	<p>logical array of dimension LNEWXS(NBXS) indicating the presence (.TRUE.) of a specific cross section type on the MACROLIB. The cross sections are ordered as follows:</p> <ul style="list-style-type: none"> • LNEWXS=1 for total cross section Σ; • LNEWXS=2 neutron fission yield cross section $\nu\Sigma_f$; • LNEWXS=3 fixed neutron source S; • LNEWXS=4 neutron fission energy production spectrum χ; • LNEWXS=5 scattering cross section Σ_s; • LNEWXS=6 transport correction cross section Σ_{tc}; • LNEWXS=7 fixed adjoint neutron source S^*; • LNEWXS=8 fixed generalized adjoint neutron source S_{Γ}^*; • LNEWXS=9 fission cross section Σ_f; • LNEWXS=10 energy emitted per fission κ.
CARLIR	character*12 scalar variable containing the last keyword obtained from from the input stream.
LADD	logical scalar variable. In the case where LADD is .TRUE. the new cross section are added to the current cross section otherwise the new cross section are stored explicitly in the current cross section.
LUPD	logical scalar variable In the case where LADD is .TRUE. the new cross section are substituted to the current cross section otherwise the new cross section are stored explicitly in the current cross section.
XSTOTL	real array of dimension XSTOTL(NBMIX,NGROUP) containing the total cross section.
XSTRAN	real array of dimension XSTRAN(NBMIX,NGROUP) containing the transport correction cross section.
XSFISS	real array of dimension XSFISS(NBMIX,MAXFIS,NGROUP,3) containing $\nu\Sigma_f$, Σ_f and χ .
XSFIXE	real array of dimension XSFIXE(NBMIX,NGROUP,3) containing the fixed sources S , S^* and S_{Γ}^* .
XSSCAT	real array of dimension XSSCAT(NGROUP,NBMIX,NANISO,NGROUP) containing the scattering cross section.
ISCATA	integer array of dimension ISCATA(NANISO) indicating the presence (ISCATA(l)=1) or absence (ISCATA(l)=2) of a scattering anisotropy of level l .
XEFISS	real array of dimension XEFISS(NBMIX,MAXFIS) containing the average energy emitted per fission κ .
LINIXS	logical array of dimension LINIXS(NBXS,NBMIX). In the case where LINIXS(i,j)=.TRUE., then the cross section of type i was been provided on the input for mixture j .

Called by

DRAGON routine(s) : MACDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

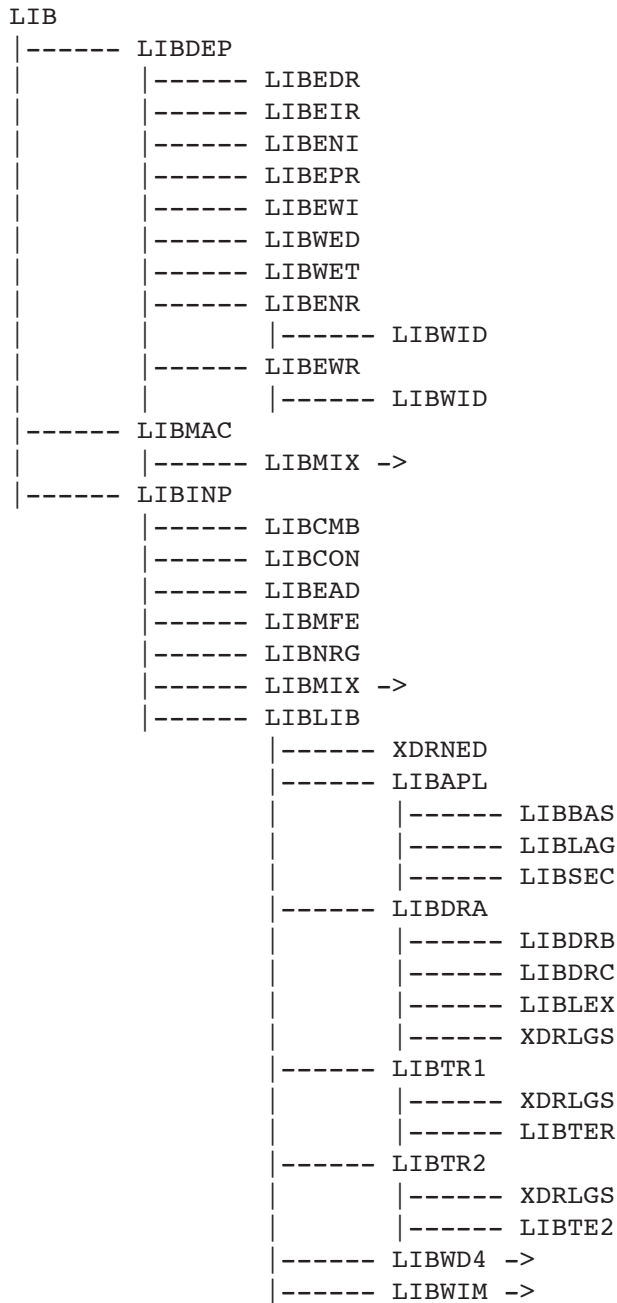
GANLIB routine(s) : REDGET, XABORT

8 THE MODULE FOR LIBRARY PROCESSING

8.1 Structure of LIB:

The LIB: module can be represented by the following tree:

Structure of the library module: LIB



LIBWD4

```

|----- LIBLEX
|----- LIBWRE
|----- LIBWRG
|----- LIBWRI
|----- LIBWRP
|----- LIBWSC
|----- LIBWTE
|----- XDRLGS
|----- XDRLPR

```

LIBWIM

```

|----- LIBLEX
|----- LIBWRE
|----- LIBWRI
|----- LIBWSC
|----- LIBWTE
|----- XDRLGS
|----- XDRLPR

```

LIBMIX

```

|----- XDRNED
|----- LIBFIS
|----- LIBDEN
|----- XDRLGS

```

One can find a description of the routines XDRNED, XDRLGS and XDRLPR in Section 21.2.

8.2 General Routines Description

8.2.1 LIBAPL

Purpose To process and interpolate microscopic cross section data from an APOLIB library.

Syntax CALL LIBAPL(IPLIB, IMPX, CFILNA, NGRO, NBISO, NL, ISONAM, ISONRF, ISHINA, TN, AW, SN, SB, ILIB, ITISOM, DELTA, NGFR, ITRANC, IPR, VECT, SIGS, SIG1, SIGA, SIGN, PRI, VTHER, PHI, PP, PP1, SSS, SSS1, SS1, SS11, UUU, SCAT, GAR, NJJ, IJJ, SEFF, NISB, NISBEF, NPROC, ITYPRO)

Author(s) A. Hébert

Description of parameters

IPLIB	integer scalar variable containing the pointer to the MICROLIB data structure.
IMPX	integer scalar variable containing the print flag.
CFILNA	character*8 scalar variable containing the name of the APOLIB.
NGRO	integer scalar variable containing the number of energy groups.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.
NL	integer scalar variable containing the maximum number of Legendre orders for scattering required.

ISONAM	integer array of dimension ISONAM(3,NBISO) containing the alias name of isotopes.
ISONRF	integer array of dimension ISONRF(3,NBISO) containing the reference name of isotopes.
ISHINA	integer array of dimension ISHINA(2,NBISO) containing the self shielding name.
TN	real array of dimension TN(*) containing the temperature of each isotope.
AW	real array of dimension AW(*) containing the atomic weight.
SN	real array of dimension SN(NGRO,*) containing the dilution cross section in each energy group of each isotope.
SB	integer array of dimension SB(NGRO,*) containing the dilution cross section as used by Livolant and Jeanpierre normalization.
ILIB	integer scalar variable containing the library to process.
ITISOM	integer array of dimension ITISOM(NBISO) containing the isotope index.
DELTA	real array of dimension DELTA(*) containing the lethargy.
NGFR	integer scalar variable containing the number of fast+resonance groups.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
IPR	integer array of dimension IPR(2,*) used for temporary storage.
VECT	real array of dimension VECT(*) used for temporary storage.
SIGS	real array of dimension SIGS(*) used for temporary storage.
SIG1	real array of dimension SIG1(*) used for temporary storage.
SIGA	real array of dimension SIGA(*) used for temporary storage.
SIGN	real array of dimension SIGN(*) used for temporary storage.
PRI	real array of dimension PRI(*) used for temporary storage.
VOTHER	real array of dimension VOTHER(*) used for temporary storage.
PHI	real array of dimension PHI(NGRO,*) used for temporary storage.
PP	real array of dimension PP(NGRO,*) used for temporary storage.
PP1	real array of dimension PP1(NGRO,*) used for temporary storage.
SSS	real array of dimension SSS(*) used for temporary storage.
SSS1	real array of dimension SSS1(*) used for temporary storage.
SS1	real array of dimension SS1(*) used for temporary storage.
SS11	real array of dimension SS11(*) used for temporary storage.
UUU	real array of dimension UUU(*) used for temporary storage.
SCAT	real array of dimension SCAT(NGRO,*) used for temporary storage.

GAR	integer array of dimension GAR(*) used for temporary storage.
NJJ	integer array of dimension NJJ(*) used for temporary storage.
IJJ	integer array of dimension IJJ(*) used for temporary storage.
SEFF	real array of dimension SEFF(MAXDIL,NGRO,*) used for temporary storage.
NISB	integer array of dimension NISB(*) used for temporary storage.
NISBEF	integer array of dimension NISBEF(*) used for temporary storage.
NPROC	integer scalar variable containing the number of cross section type processed.
ITYPRO	integer array of dimension ITYPRO(NPROC) flag for cross section type processed.

Called by

DRAGON routine(s) : LIBLIB

Calling

DRAGON routine(s) : LIBBAS, LIBLAG, LIBSEC

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMGET, LCMPUT, LCMSIX, XABORT

8.2.2 LIBBAS

Purpose To process the scattering kernel based on the free gas model or Brown and St. John models.

Syntax CALL LIBBAS(NISO, AT, AKT, AMT, T, IX, V, DV, NDTE, P, XS, X, E)

Author(s) A. Hébert

Description of parameters

NISO	integer scalar variable containing the number of terms in the model where: <ul style="list-style-type: none"> • NISO=1 for pure free gas model; • NISO=2 for Brown and St. John model.
AT	real array of dimension AT(*) containing the potential microscopic cross section.
AKT	real array of dimension AKT(*) containing the exponential constant in the model and is equal to 0.0 for the pure free gas model.
AMT	real array of dimension AMT(*) containing the isotope mass divided by neutron mass.
T	real scalar variable containing the absolute temperature divided by 293.6 K.
IX	integer scalar variable containing the number of thermal groups.
V	real array of dimension V(*) containing the neutron velocities.
DV	real array of dimension DV(*) used to transform velocity to energy.
NDTE	integer scalar variable containing the first dimension of matrix P

P	real array of dimension P(NDTE,*) containing the scattering kernel. the first index is for secondary neutrons.
XS	real array of dimension XS(*) containing the scattering microscopic cross section.
X	real array of dimension X(*) used for temporary storage.
E	real array of dimension E(*) used for temporary storage.

Called by

DRAGON routine(s) : LIBAPL

Calling

DRAGON routine(s) :

UTILIB routine(s) : AFERF

GANLIB routine(s) :

8.2.3 LIBCMB

Purpose To combine mixtures by volume fraction.

Syntax CALL LIBCMB(MAXMIX, MAXISO, NBISO, NEWISO, NNMIX, MIXCMB, VOLTOT, VOLFRA, DENMIX, ISONAM, ISONRF, ISOMIX, IHLIB, DENISO, TMPISO, AWRISO, LSHI, SNISO, NTFG, MASKI, NELSN, NGRCD, DILSN, DILSB)

Author(s) G. Marleau

Description of parameters

MAXMIX	integer scalar variable containing the maximum value of NBMIX.
MAXISO	integer scalar variable containing the maximum nb isotopes permitted.
NBISO	integer scalar variable containing the nb isotopes before combination.
NEWISO	integer scalar variable containing the nb isotopes after combination.
NNMIX	integer scalar variable containing the new mixture to create or modify.
MIXCMB	integer scalar variable containing the mixture to add.
VOLTOT	real scalar variable containing the total volume fraction to date.
VOLFRA	real scalar variable containing the volume fraction of current mixture.
DENMIX	real array of dimension DENMIX(MAXMIX) containing the density of each mixture.
ISONAM	integer array of dimension ISONAM(3,MAXISO) containing the name of isotopes.
ISONRF	integer array of dimension ISONRF(3,MAXISO) containing the reference name of isotopes.
ISOMIX	integer array of dimension ISOMIX(MAXISO) containing the mix number of each isotope.
IHLIB	integer array of dimension IHLIB(2,MAXISO,5) containing the isotope options.

DENISO	real array of dimension DENISO(MAXISO) containing the density of isotopes.
TMPISO	real array of dimension TMPISO(MAXISO) containing the temperature of isotopes.
AWRISO	real array of dimension AWRISO(MAXISO) containing the atomic weight of isotopes.
LSHI	integer array of dimension LSHI(MAXISO) containing the self-shielding flag.
SNISO	real array of dimension SNISO(MAXISO) containing the dilution cross section.
NTFG	integer array of dimension NTFG(MAXISO) containing the number thermal inelastic groups.
MASKI	logical array of dimension MASKI(MAXISO) containing the treat isotope logical.
NELSN	integer scalar variable containing the total length of arrays DILSN and DILSB.
NGRCD	integer scalar variable containing the first dimension of arrays DILSN and DILSB.
DILSN	real array of dimension DILSN(NGRCD,MAXISO) containing the standard dilution.
DILSB	real array of dimension DILSB(NGRCD,MAXISO) containing the Livolant and Jeanpierre dilution.

Called by

DRAGON routine(s) : LIBINP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.4 LIBCON

Purpose To convert weight percent to atomic density.

Syntax CALL LIBCON(IMX, NBISO, ISOMIX, DENISO, AWRISO, DENMIX, IN)

Author(s) A. Hébert

Description of parameters

IMX	integer scalar variable containing the mixture index to process.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.
ISOMIX	integer array of dimension ISOMIX(NBISO) containing the mix number of each isotope.
DENISO	real array of dimension DENISO(NBISO) containing the density of each isotope.
AWRISO	real array of dimension AWRISO(NBISO) containing the atomic weight of each isotope.
DENMIX	real scalar variable containing the mixture density in g cm^{-3} .
IN	integer scalar variable containing the conversion direction where:

- IN=1 is for the conversion of weight % to number of atom with DENMIX;

- IN=2 is for the conversion of the number of atom to weight % with DENMIX.

Called by

DRAGON routine(s) : LIBINP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.5 LIBDEN

Purpose To transform the isotope ordered microscopic cross sections to group ordered macroscopic cross sections.

Syntax CALL LIBDEN(IPLIB, NGROUP, NBISO, NBMIX, NL, NED, NNFI, MXXS, ISONAM, ISONFI, MIX, DEN, MASKK, MASK, MASKG, HVECT, IVECT, ITRANC, IFGUPS, IPXS, IPSC, NIFIS, NOFIS, GAS, GXS, SCT, NJJ, IJJ, IPOS, SCAT, ISTATE, ITSTMP, TMPDAY, SCTISO, NPROC, INDPRO, ITYPRO, XSREC)

Author(s) A. Hébert

Description of parameters

IPLIB	integer scalar variable containing the pointer to the MICROLIB data structure.
NGROUP	integer scalar variable containing the number of energy groups.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.
NBMIX	integer scalar variable containing the number of mixtures present in the calculation domain.
NL	integer scalar variable containing the maximum number of Legendre orders for scattering required.
NED	integer scalar variable containing the maximum number of edit xs.
NNFI	integer scalar variable containing the maximum number of fissile isotopes.
MXXS	integer scalar variable containing the number of vector xs.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the name of each isotope.
ISONFI	integer array of dimension ISONFI(2,NBISO) containing the names of fissile isotopes.
MIX	integer array of dimension MIX(NBISO) containing the mixture number of each isotope.
DEN	real array of dimension DEN(NBISO) containing the density of each isotope.
MASKK	logical scalar variable that is set to <code>.TRUE.</code> if a MACROLIB exists.
MASK	logical array of dimension MASK(*) that is set to <code>.TRUE.</code> if a mixture is to be created.
MASKG	logical array of dimension MASKG(*) that is set to <code>.TRUE.</code> if an energy group is to be treated.

HVECT	character array of dimension HVECT(*)*(*) containing the names of the additional editing cross sections.
IVECT	integer array of dimension IVECT(NED) containing the pointer for additional editing cross sections.
ITRANC	integer scalar variable containing the type of transport corrections. If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
IFGUPS	integer array of dimension IFGUPS(NBMIX,NL) used for temporary storage.
IPXS	integer array of dimension IPXS(*) used for temporary storage.
IPSC	integer array of dimension IPSC(*) used for temporary storage.
NIFIS	integer array of dimension NIFIS(NBMIX,*) used for temporary storage.
NOFIS	integer array of dimension NOFIS(*) used for temporary storage.
GAS	real array of dimension GAS(*) used for temporary storage.
GXS	real array of dimension GXS(NBMIX,MXXS,NGROUP) used for temporary storage.
SCT	real array of dimension SCT(NBMIX,NGROUP,NL,NGROUP) used for temporary storage.
NJJ	integer array of dimension NJJ(*) used for temporary storage.
IJJ	integer array of dimension IJJ(*) used for temporary storage.
IPOS	integer array of dimension IPOS(*) used for temporary storage.
SCAT	real array of dimension SCAT(NGROUP*NBMIX) used for temporary storage.
ISTATE	integer array of dimension ISTATE(NSTATE) containing the initial information on MACROLIB.
ITSTMP	integer scalar variable containing the perturbation information.
TMPDAY	real array of dimension TMPDAY(3) containing the current time in days, the burnup and the irradiation .
SCTISO	real array of dimension SCTISO(NGROUP,NGROUP,NL) used for temporary storage of the scattering cross section.
NPROC	integer scalar variable containing the maximum number of cross sections to process.
INDPRO	integer array of dimension INDPRO(NPROC) containing the flags for cross sections to process.
ITYPRO	integer array of dimension ITYPRO(NPROC) used for temporary storage.
XSREC	real array of dimension XSREC(NGROUP,NPROC) used for temporary storage.

Called by

DRAGON routine(s) : LIBMIX

Calling

DRAGON routine(s) : XDRLGS

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMput, LCMSIX, SETARA, RLSARA, XABORT

8.2.6 LIBDEP

Purpose To read the information related to the depletion calculation.

Syntax CALL LIBDEP(IPLIB, IMPX, NDEPL)

Author(s) A. Hébert and G. Marleau

Description of parameters

IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.

IMPX integer scalar variable containing the print flag.

NDEPL integer scalar variable containing the number of depleting isotopes.

Called by

DRAGON routine(s) : LIB

Calling

DRAGON routine(s) : LIBEDR, LIBEIR, LIBENI, LIBENR, LIBEPR, LIBEWI, LIBEWR, LIBWED, LIBWET

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMCL, LCMGET, LCMLen, LCMOP, LCMput, LCMSIX, REDGET, SETARA, RLSARA, XABORT

8.2.7 LIBDRA

Purpose To generate the interpolated microscopic cross section data from a DRAGON library.

Syntax CALL LIBDRA(IPLIB, IMPX, CFILNA, NGRO, NBISO, NL, ISONAM, ISONRF, TN, AW, SN, SB, ILIB, ITISOM, DELTA, NGFR, ITRANC, NPROC, INDPRO, ITYPRO, XSREC, SCAT, XSCMP, NIJ, IJJ)

Author(s) A. Hébert

Description of parameters

IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.

IMPX integer scalar variable containing the print flag.

CFILNA character*8 scalar variable containing the name of the dragon library file.

NGRO integer scalar variable containing the number of energy groups.

NBISO integer scalar variable containing the number of isotopes present in the calculation domain.

NL integer scalar variable containing the maximum number of Legendre orders for scattering required.

ISONAM integer array of dimension ISONAM(3,NBISO) containing the local names of isotopes.

ISONRF	integer array of dimension ISONRF(3,NBISO) containing the library names of isotopes.
TN	real array of dimension TN(NBISO) containing the temperature of isotopes.
AW	real array of dimension AW(NBISO) containing the atomic weight of isotopes.
SN	real array of dimension SN(NGRO,NBISO) containing the dilution cross section in each energy group of each isotope.
SB	real array of dimension SB(NGRO,NBISO) containing the dilution cross section as used by the Livolant and Jeanpierre normalization.
ILIB	integer scalar variable containing the library index to process.
ITISOM	integer array of dimension ITISOM(NBISO) containing the library index for each isotope.
DELTA	real array of dimension DELTA(NGRO) containing the lethargy width of groups.
NGFR	integer scalar variable containing the number of fast and resonance groups.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
NPROC	integer scalar variable containing the number of cross section type processed.
INDPRO	integer array of dimension INDPRO(NPROC) containing the lag for cross section type to process.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing the flag for cross section type processed.
XSREC	real array of dimension XSREC(NGRO,NPROC) used for temporary storage.
SCAT	real array of dimension SCAT(NGRO,NGRO,NL) used for temporary storage.
XSCMP	real array of dimension XSCMP(NGRO*NGRO) used for temporary storage.
NJJ	integer array of dimension NJJ(NGRO) used for temporary storage.
IJJ	integer array of dimension IJJ(NGRO) used for temporary storage.

Called by

DRAGON routine(s) : LIBLIB

Calling

DRAGON routine(s) : LIBDRB, LIBDRC, LIBLEX, XDRLGS

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMCL, LCMGET, LCMLN, LCMLIB, LCMOP, LCMPUT, LCMSIX, SETARA, RL-SARA, XABORT

8.2.8 LIBDRB

Purpose To read and interpolate in dilution one isotope in a DRAGON format library at a selected temperature.

Syntax CALL LIBDRB(IPDRL, IMPX, NGRO, LBIN, NL, SN, SB, DELTA, NPROC, INDPRO, ITYPRO, BIN, XSREC, SCAT, XSCMP, NJJ, IJJ, TERP, LSDIL)

Author(s) A. Hébert

Description of parameters

IPDRL	integer scalar variable containing the pointer to the MICROLIB data structure.
IMPX	integer scalar variable containing the print flag.
NGRO	integer scalar variable containing the number of energy groups.
LBIN	integer scalar variable containing the number of fine groups.
NL	integer scalar variable containing the maximum number of Legendre orders for scattering required.
SN	real array of dimension SN(NGRO) containing the dilution cross section in each energy group.
SB	real array of dimension SB(NGRO) containing the dilution cross section as used in Livolant and Jeanpierre normalization.
DELTA	real array of dimension DELTA(NGRO) containing the lethargy widths.
NPROC	integer scalar variable containing the number of cross section type processed.
INDPRO	integer array of dimension INDPRO(NPROC) containing the flag for cross section type to process.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing the flag for cross section type processed.
BIN	real array of dimension BIN(LBIN,3) containing the fine group cross sections where: <ul style="list-style-type: none"> • BIN(IGR,1) is for the total total cross section; • BIN(IGR,2) is for the isotropic scattering cross section; • BIN(IGR,3) is for $\nu\Sigma_f$.
XSREC	real array of dimension XSREC(NGRO,NPROC) used for temporary storage.
SCAT	real array of dimension SCAT(NGRO,NGRO,NL) used for temporary storage.
XSCMP	real array of dimension XSCMP(NGRO*(NGRO+2)) used for temporary storage.
NJJ	integer array of dimension NJJ(NGRO) used for temporary storage.
IJJ	integer array of dimension IJJ(NGRO) used for temporary storage.
TERP	real array of dimension TERP(MAXDIL,NGRO) used for temporary storage.
LSDIL	integer array of dimension LSDIL(2,NL) used for temporary storage.

Called by

DRAGON routine(s) : LIBDRA

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XDRSET

LCMGET, LCMLen, LCMSIX, XABORT

8.2.9 LIBDRC

Purpose To interpolate in temperature one isotope in the DRAGON format.

Syntax CALL LIBDRC(NGRO, LBIN, NL, NPROC, INDPRO, ITYPRO, TERPM, XSREC, SCAT, BIN, XSREC2, SCAT2, BIN2)

Author(s) A. Hébert

Description of parameters

NGRO	integer scalar variable containing the number of energy groups.
LBIN	integer scalar variable containing the number of fine groups.
NL	integer scalar variable containing the maximum number of Legendre orders for scattering required.
NPROC	integer scalar variable containing the number of cross section type processed.
INDPRO	integer array of dimension INDPRO(NPROC) containing the flag for cross section type to process.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing the flag for cross section type processed.
TERPM	double precision scalar variable containing the interpolation factor.
XSREC	real array of dimension XSREC(NGRO,NPROC) containing the vector cross section record.
SCAT	real array of dimension SCAT(NGRO,NGRO,NL) containing the scattering matrix.
BIN	real array of dimension BIN(LBIN,3) containing the fine group cross sections.
XSREC2	real array of dimension XSREC2(NGRO,NPROC) used for temporary storage.
SCAT2	real array of dimension SCAT2(NGRO,NGRO,NL) used for temporary storage.
BIN2	real array of dimension BIN2(LBIN,3) used for temporary storage.

Called by

DRAGON routine(s) : LIBDRA

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) :

8.2.10 LIBEAD

Purpose To add the missing isotopes in HNAMEIS from the depletion chain.

Syntax CALL LIBEAD(MAXISO, MAXMIX, NDEPL, MAXR, NBXR, NCOMB, NBISO, ISONAM, ISONRF, IHLIB, ISOMIX, DENISO, TMPISO, MASKI, ISOEVO, INAM, IDR, KPAR, MILVO)

Author(s) A. Hébert and G. Marleau

Description of parameters

MAXISO	integer scalar variable containing the maximum number of isotopes.
MAXMIX	integer scalar variable containing the maximum number of mixtures.
NDEPL	integer scalar variable containing the number of depleting isotopes.
MAXR	integer scalar variable containing the number of depleting reactions.
NBXR	integer scalar variable containing the number of production reactions.
NCOMB	integer scalar variable containing the number of depleting mixtures.
NBISO	integer scalar variable containing the old/new number of isotopes present in the calculation domain.
ISONAM	integer array of dimension ISONAM(3,MAXISO) containing the name of each isotope.
ISONRF	integer array of dimension ISONRF(3,MAXISO) containing the reference name of each isotope.
IHLIB	integer array of dimension IHLIB(2,MAXISO,5) containing the isotope options.
ISOMIX	integer array of dimension ISOMIX(MAXISO) containing the mix number of each isotope.
DENISO	real array of dimension DENISO(MAXISO) containing the density of each isotope.
TMPISO	real array of dimension TMPISO(MAXISO) containing the temperature of each isotope.
MASKI	logical array of dimension MASKI(MAXISO) containing the isotope mask.
ISOEVO	integer array of dimension ISOEVO(MAXISO) used for temporary storage.
INAM	integer array of dimension INAM(2,NDEPL) used for temporary storage.
IDR	integer array of dimension IDR(MAXR,NDEPL) used for temporary storage.
KPAR	integer array of dimension KPAR(NBXR,NDEPL) used for temporary storage.
MILVO	integer array of dimension MILVO(MAXMIX) containing the index for burnable material identification.

Called by

DRAGON routine(s) : LIBINP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.11 LIBEDR

Purpose To create cross section records from DRAGON format library.

Syntax CALL LIBEDR(MAXR, NAXPAR, NDEPL, NFISS, NSUPF, DCR, KPAR, BPAR, KFISS, YIELD, QF, KPAX, BPAX)

Author(s) G. Marleau

Description of parameters

MAXR	integer scalar variable containing the number of reaction types.
NAXPAR	integer scalar variable containing the max number of reaction saved.
NDEPL	integer scalar variable containing the number of depleting isotopes.
NFISS	integer scalar variable containing the number of fissile isotopes.
NSUPF	integer scalar variable containing the number of fissile products.
DCR	real array of dimension DCR(NDEPL) containing the isotope decay rate.
KPAR	integer array of dimension KPAR(NDEPL,NAXPAR) containing the reaction type.
BPAR	real array of dimension BPAR(NDEPL,NAXPAR) containing the reaction yield.
KFISS	integer array of dimension KFISS(NFISS) containing the fissile isotopes.
YIELD	real array of dimension YIELD(NFISS,NSUPF) containing the fissile yield.
QF	real array of dimension QF(NFISS) containing the fission energy.
KPAX	integer array of dimension KPAX(NDEPL+MAXR,NDEPL) containing the complete reaction type matrix.
BPAX	real array of dimension BPAX(NDEPL+MAXR,NDEPL) containing the complete branching ratio matrix.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.12 LIBEIR

Purpose To read depletion data on input file.

Syntax CALL LIBEIR(MAXR, NEL, ITNAM, ITZEA, KPAX, BPAX)

Author(s) A. Hébert and G. Marleau

Description of parameters

MAXR	integer scalar variable containing the number of reaction types.
------	--

NEL integer scalar variable containing the number of isotopes on library.

ITNAM integer array of dimension ITNAM(2,NEL) containing the reactive isotope names in chain.

ITZEA integer array of dimension ITZEA(NEL) containing the 6-digit nuclide identifier.

KPAX integer array of dimension KPAX(NEL+MAXR,NEL) containing the complete reaction type matrix.

BPAX real array of dimension BPAX(NEL+MAXR,NEL) containing the complete branching ratio matrix.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : REDGET, XABORT

8.2.13 LIBENI

Purpose To initialize dimensions for depletion data on WIMS-D4 format library.

Syntax CALL LIBENI(CFILNA, NEL)

Author(s) G. Marleau

Description of parameters

CFILNA character*8 scalar variable containing the file name associated with this library.

NEL integer scalar variable containing the number of isotope in the library.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : KDROPN, KDRCLS, XABORT

8.2.14 LIBENR

Purpose To read depletion data on WIMS-D4 format library.

Syntax CALL LIBENR(CFILNA, MAXR, NEL, ITNAM, KPAX, BPAX)

Author(s) G. Marleau

Description of parameters

CFILNA	character*8 scalar variable containing the WIMS-D4 file name.
MAXR	integer scalar variable containing the number of reaction types.
NEL	integer scalar variable containing the number of isotopes on library.
ITNAM	integer array of dimension ITNAM(2,NEL) containing the reactive isotope names in chain.
KPAX	integer array of dimension KPAX(NEL+MAXR,NEL) containing the complete reaction type matrix.
BPAX	real array of dimension BPAX(NEL+MAXR,NEL) containing the complete branching ratio matrix.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) : LIBWID

UTILIB routine(s) :

GANLIB routine(s) : KDROPN, KDRCLS, XABORT

8.2.15 LIBEPR

Purpose To print the isotopic depletion chain on the output file.

Syntax CALL LIBEPR(MAXR, NDEPL, NDFI, NDFP, NBXR, HNADPL, IDR, RER, KPAR, BPAR, YIELD)

Author(s) G. Marleau

Description of parameters

MAXR	integer scalar variable containing the number of reaction types.
NDEPL	integer scalar variable containing the number of depleting isotopes.
NDFI	integer scalar variable containing the number of direct fissile isotopes.
NDFP	integer scalar variable containing the number of direct fission product.
NBXR	integer scalar variable containing the maximum number of parent isotopes from decay and capture.
HNADPL	integer array of dimension HNADPL(2,NDEPL) containing the reactive isotope names in chain.
IDR	integer array of dimension IDR(MAXR,NDEPL) containing the reaction identifier.
RER	real array of dimension RER(MAXR,NDEPL) containing the reaction constant.
KPAR	integer array of dimension KPAR(NBXR,NDEPL) containing the reduced reaction type matrix.
BPAR	real array of dimension BPAR(NBXR,NDEPL) containing the reduced branching ratio matrix.
YIELD	real array of dimension YIELD(NDFI,NDFP) containing the fission product yield.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.16 LIBEWI

Purpose To initialize dimensions for depletion data on WIMS-AECL format library.

Syntax CALL LIBEWI(CFILNA, NEL)

Author(s) G. Marleau

Description of parameters

CFILNA character*8 scalar variable containing the WIMS-AECL type library file name.

NEL integer scalar variable containing the number of isotopes on library.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) :

UTILIB routine(s) : OPNIND, REDIND, CLSIND

GANLIB routine(s) : KDROPN, XABORT

8.2.17 LIBEWR

Purpose To read depletion data on WIMS-AECL format library.

Syntax CALL LIBEWR(CFILNA, MAXR, NEL, ITNAM, KPAX, BPAX)

Author(s) G. Marleau

Description of parameters

CFILNA character*8 scalar variable containing the WIMS-AECL format library file name.

MAXR integer scalar variable containing the number of reaction types.

NEL integer scalar variable containing the number of isotopes on library.

ITNAM integer array of dimension ITNAM(2,NEL) containing the reactive isotope names in chain.

KPAX integer array of dimension KPAX(NEL+MAXR,NEL) containing the complete reaction type matrix.

BPAX real array of dimension BPAX(NEL+MAXR,NEL) containing the complete branching ratio matrix.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) : LIBWID

UTILIB routine(s) : OPNIND, REDIND, CLSIND, UPCKIC

GANLIB routine(s) : KDROPN, XABORT

8.2.18 LIBFIS

Purpose To set up fission information vector.

Syntax CALL LIBFIS(IPLIB, NBISO, NBMIX, NOFI, NNFI, ISONAM, ISONFI, MIX, IPXS, NIFIS, NOFIS)

Author(s) A. Hébert

Description of parameters

IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.

NBISO integer scalar variable containing the number of isotopes present in the calculation domain.

NBMIX integer scalar variable containing the number of mixtures present in the calculation domain.

NOFI integer scalar variable containing the maximum number of old fissile isotopes.

NNFI integer scalar variable containing the maximum number of new fissile isotopes.

ISONAM integer array of dimension ISONAM(3,NBISO) containing the name of each isotope.

ISONFI integer array of dimension ISONFI(2,*) containing the local names of fissile isotopes.

MIX integer array of dimension MIX(*) containing the mixture number of each isotope.

IPXS integer array of dimension IPXS(*) used for temporary storage.

NIFIS integer array of dimension NIFIS(NBMIX,*) used for temporary storage.

NOFIS integer array of dimension NOFIS(*) used for temporary storage.

Called by

DRAGON routine(s) : LIBMIX

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, XABORT

8.2.19 LIBINP

Purpose To read the information related to microscopic cross section library.

Syntax CALL LIBINP(IPLIB, INDREC, IPRINT, MAXMIX, MAXED, MAXISO, NBISO, NGROUP, NGT, NL, ITRANC, ITIME, NLIB, NDEPL, NCOMB, NEDMAC, NBMIX, NRES, NGF, NGFR, ISOADD, HVECT, ISONAM, ISONRF, ISOMIX, DENISO, TMPISO, AWRISO, NTFG, LSHI, SNISO, MASKI, MASK, DENMIX, TMPMIX, IHLIB)

Author(s) A. Hébert

Description of parameters

IPLIB	integer scalar variable containing the pointer to the MICROLIB data structure.
INDREC	integer scalar variable containing the status of the MICROLIB data structure where: <ul style="list-style-type: none"> • INDREC=1 for the MICROLIB is created; • INDREC=2 for the MICROLIB is updated; • INDREC=3 for the MICROLIB is read-only.
IPRINT	integer scalar variable containing the print flag.
MAXMIX	integer scalar variable containing the maximum value of NBMIX permitted.
MAXED	integer scalar variable containing the maximum value of NEDMAC permitted.
MAXISO	integer scalar variable containing the maximum number of isotopes permitted.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.
NGROUP	integer scalar variable containing the number of energy groups.
NGT	integer scalar variable containing the number of energy groups to test.
NL	integer scalar variable containing the maximum number of Legendre orders for scattering required.
ITRANC	integer scalar variable containing the type of transport corrections option. If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
ITIME	integer scalar variable that takes the value of 1 for steady-state calculations and 2 from prompt calculations.
NLIB	integer scalar variable containing the number of independent library.
NDEPL	integer scalar variable containing the number of depleting isotopes.
NCOMB	integer scalar variable containing the number of depleting mixtures.
NEDMAC	integer scalar variable containing the number of additional editing cross section.
NBMIX	integer scalar variable containing the number of mixtures defined in the library.

NRES	integer scalar variable containing the number of resonant mixtures.
NGF	integer scalar variable containing the number of fast groups.
NGFR	integer scalar variable containing the number of fast and resonance groups.
ISOADD	integer scalar variable containing the flag to complete mixture definition if the depletion chain present. For a value ISOADD=0 the isotopic contents of the mixtures will be completed and for ISOADD=1 no completion will take place.
HVECT	character array of dimension HVECT(MAXED)*6 containing the names of the extra vector edits.
ISONAM	integer array of dimension ISONAM(NTC,MAXISO) containing the name of each isotope.
ISONRF	integer array of dimension ISONRF(NTC,MAXISO) containing the reference name of each isotope.
ISOMIX	integer array of dimension ISOMIX(MAXISO) containing the mix number of each isotope.
DENISO	real array of dimension DENISO(MAXISO) containing the density of each isotope.
TMPISO	real array of dimension TMPISO(MAXISO) containing the temperature of each isotope.
AWRISO	real array of dimension AWRISO(MAXISO) containing the atomic weight of each isotope.
NTFG	integer array of dimension NTFG(MAXISO) containing the number of thermal groups where thermal inelastic correction is applied.
LSHI	integer array of dimension LSHI(MAXISO) containing the resonant region number associated with each self-shielded isotope in SHIBA.
SNISO	real array of dimension SNISO(MAXISO) containing the dilution cross section of each group and each isotope.
MASKI	logical array of dimension MASKI(MAXISO) containing the isotope update logical.
MASK	logical array of dimension MASK(MAXMIX) containing the mixture update logical.
DENMIX	real array of dimension DENMIX(MAXMIX) containing the density of each mixture.
TMPMIX	real array of dimension TMPMIX(MAXMIX) containing the temperature of each mixture.
IHLIB	integer array of dimension IHLIB(NTC-1,MAXISO,5) containing the isotope options.

Called by

DRAGON routine(s) : LIB

Calling

DRAGON routine(s) : LIBCMB, LIBCON, LIBEAD, LIBLIB, LIBMFE, LIBMIX, LIBNRG

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

8.2.20 LIBLAG

Purpose To perform a Lagrange interpolation in a table of points.

Syntax CALL LIBLAG(NEF, XE, GE, XI, GS)

Author(s) A. Hébert and G. Marleau

Description of input parameters

NEF integer scalar variable containing the number of points.
 XE real array of dimension XE(*) containing the tabulation points.
 GE real array of dimension GE(*) containing the tabulation values.
 XI real scalar variable containing the value at which interpolating is required.

Description of output parameters

GS real scalar variable containing the interpolated value.

Called by

DRAGON routine(s) : LIBAPL

8.2.21 LIBLEX

Purpose To compute factors for Lagrangian interpolation.

Syntax CALL LIBLEX(NELE, PNTE, ELMT, NOTX, TERP)

Author(s) A. Hébert

Description of input parameters

NELE integer scalar variable containing the number of elements in table.
 PNTE real scalar variable containing the extrapolation point.
 ELMT real array of dimension ELMT(NELE) containing the values of elements in table.
 NOTX integer scalar variable containing the order of extrapolation.

Description of output parameters

TERP double precision array of dimension TERP(NELE) containing the extrapolation factor.

Called by

DRAGON routine(s) : LIBDRA, LIBWD4, LIBWIM

8.2.22 LIBLIB

Purpose To control the treatment of microscopic cross section from various format of libraries.

Syntax CALL LIBLIB(IPLIB, IMPX, MAXISO, NBISO, NGROUP, ISONAM, ISONRF, IHLIB, NTFG, TMPISO, AWRISO, SNISO, SBISO, MASKI, NL, ITIME, NEDMAC, HVECT, ITRANC, ITISOM, DELTA, NGFR)

Author(s) A. Hébert and G. Marleau

Description of parameters

IPLIB	integer scalar variable containing the pointer to the MICROLIB data structure.
IPRINT	integer scalar variable containing the print flag.
MAXISO	integer scalar variable containing the maximum number of isotopes permitted.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.
NGROUP	integer scalar variable containing the number of energy groups.
ISONAM	integer array of dimension ISONAM(3,MAXISO) containing the name of each isotope.
ISONRF	integer array of dimension ISONRF(3,MAXISO) containing the reference name of each isotope.
IHLIB	integer array of dimension IHLIB(2,MAXISO,5) containing the isotope options.
NTFG	integer array of dimension NTFG(MAXISO) containing the number of thermal groups where thermal inelastic correction is applied.
TMPISO	real array of dimension TMPISO(MAXISO) containing the temperature of each isotope.
AWRISO	real array of dimension AWRISO(MAXISO) containing the atomic weight of each isotope.
SNISO	real array of dimension SNISO(NGROUP,MAXISO) containing the dilution cross section of each group and each isotope.
SBISO	real array of dimension SBISO(NGROUP,MAXISO) containing the dilution cross section of each group and each isotope used with Livolant-Jeanpierre normalization.
MASKI	logical array of dimension MASKI(MAXISO) containing the isotope update logical.
NL	integer scalar variable containing the number of Legendre orders for scattering required in the calculation.
ITIME	integer scalar variable that takes the value of 1 for steady-state calculations and 2 from prompt calculations.
NEDMAC	integer scalar variable containing the number of additional editing cross section.
HVECT	character array of dimension HVECT(MAXED)*6 containing the names of the extra vector edits.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
ITISOM	integer array of dimension ITISOM(NBISO) containing the temporary mask for isotope.
DELTA	real array of dimension DELTA(NGROUP+1) containing the lethargy limits of groups.
NGFR	integer scalar variable containing the number of fast and resonance groups.

Called by

DRAGON routine(s) : LIBINP, SHISN2

Calling

DRAGON routine(s) : LIBAPL, LIBDRA, LIBTR1, LIBTR2, LIBWD4, LIBWIM, XDRNED

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, SETARA, RLSARA, XABORT

8.2.23 LIBMAC

Purpose To read the information related to microscopic cross section library.

Syntax CALL LIBMAC(IPLIB, IPLIBX, IPRINT, MAXISO, NBISO, NBISOX, NBMIX, NBMIXX, NGRO, TMPDAY, ISONAM, ISONMX, MIX, DEN, DENMIX, MIXIX, DENIX, LOCUPD, LISM, DENMOD, MASKM, MASKG)

Author(s) A. Hébert

Description of parameters

IPLIB	integer scalar variable containing the pointer to the MICROLIB data structure.
IPLIBX	integer scalar variable containing the pointer to the BURNUP data structure.
IPRINT	integer scalar variable containing the print flag.
MAXISO	integer scalar variable containing the maximum number of isotopes permitted.
NBISO	integer scalar variable containing the number of isotopes present on original MICROLIB data structure.
NBISOX	integer scalar variable containing the number of isotopes present on the BURNUP data structure.
NBMIX	integer scalar variable containing the number of mixtures defined on original MICROLIB data structure.
NBMIXX	integer scalar variable containing the number of mixtures defined on the BURNUP data structure.
NGRO	integer scalar variable containing the number of energy groups.
TMPDAY	real array of dimension TMPDAY(3) containing the time/burnup/irradiation stamp in days.
ISONAM	integer array of dimension ISONAM(NTC,MAXISO) containing the old name of isotopes.
ISONMX	integer array of dimension ISONMX(NTC,MAXISO) containing the new name of isotopes.
MIX	integer array of dimension MIX(MAXISO) containing the mix number of each isotope on the original MICROLIB data structure.
DEN	real array of dimension DEN(MAXISO) containing the density of each isotope on the original MICROLIB data structure.
DENMIX	real array of dimension DENMIX(NBMIX) containing the density of mixture on the original MICROLIB data structure.
MIXIX	integer array of dimension MIXIX(MAXISO) containing the mix number of each isotope on the BURNUP data structure.
DENIX	real array of dimension DENIX(MAXISO) containing the density of each isotope on the BURNUP data structure.

LOCUPD	integer array of dimension LOCUPD(NBMIX) containing the location of mixture on the BURNUP data structure.
LISM	integer array of dimension LISM(MAXISO) containing the location of isotope associated with a mixture.
DENMOD	real array of dimension DENMOD(MAXISO) containing the modified density of each isotope on original MICROLIB data structure.
MASKM	logical array of dimension MASKM(NBMIX) containing the mixture update mask.
MASKG	logical array of dimension MASKG(NGRO) containing the group update mask.

Called by

DRAGON routine(s) : LIB

Calling

DRAGON routine(s) : LIBMIX

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX, REDGET, XABORT

8.2.24 LIBMFE

Purpose To extract from the depletion chain the energy per fission for an isotope.

Syntax CALL LIBMFE(NDEPL, MAXR, NBISO, NBMIX, NNFI, ISONAM, ISONRF, ISOMIX, INAM, IDR, RER, ISONFI, NIFIS, EMEV)

Author(s) G. Marleau

Description of parameters

NDEPL	integer scalar variable containing the number of depleting isotopes.
MAXR	integer scalar variable containing the number of depleting reactions.
NBISO	integer scalar variable containing the number of isotopes present.
NBMIX	integer scalar variable containing the number of mixtures.
NNFI	integer scalar variable containing the number of fissile isotopes.
ISONAM	integer array of dimension ISONAM(NTC,NBISO) containing the name of isotopes.
ISONRF	integer array of dimension ISONRF(NTC,NBISO) containing the reference name of isotopes.
ISOMIX	integer array of dimension ISOMIX(NBISO) containing the mix number of each isotope.
INAM	integer array of dimension INAM(NTC-1,NDEPL) containing the depletion isotope names.
IDR	integer array of dimension IDR(MAXR,NDEPL) containing the depletion reaction.
RER	real array of dimension RER(MAXR,NDEPL) containing the depletion rates.
ISONFI	integer array of dimension ISONFI(NTC-1,NNFI) containing the fissile isotope names.

NIFIS integer array of dimension NIFIS(NBMIX,NNFI) containing the fission number.

EMEV real array of dimension EMEV(NBMIX,NNFI) containing the fission energy (MeV).

Called by

DRAGON routine(s) : LIBINP

8.2.25 LIBMIX

Purpose To transform of the isotope ordered microscopic cross sections to a group ordered format.

Syntax CALL LIBMIX(IPLIB, NGROUP, NBISO, ISONAM, MIX, DEN, MASK, MASKL, ITSTMP, TMPDAY)

Author(s) A. Hébert

Description of parameters

IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.

NGROUP integer scalar variable containing the number of energy groups.

NBISO integer scalar variable containing the number of isotopes present in the calculation domain.

ISONAM integer array of dimension ISONAM(3,NBISO) containing the name of each isotope.

MIX integer array of dimension MIX(NBISO) containing the mixture number of each isotope.

DEN real array of dimension DEN(NBISO) containing the density of each isotope.

MASK logical array of dimension MASK(*) that is set to `.TRUE.` if a mixture is to be created.

MASKL logical array of dimension MASKL(NGROUP) that is set to `.TRUE.` if an energy group is to be treated.

ITSTMP integer scalar variable containing the perturbation information.

TMPDAY real array of dimension TMPDAY(3) containing the current time in days, the burnup and the irradiation.

Called by

DRAGON routine(s) : EVODRV, LIBINP, LIBMAC, SHIDRV

Calling

DRAGON routine(s) : LIBDEN, LIBFIS, XDRNED

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

8.2.26 LIBNRG

Purpose To verify for energy compatibility between libraries.

Syntax CALL LIBNRG(IPLIB, CLIBNA, CFILNA, NGROUP, NGF, NGFR, NGT)

Author(s) G. Marleau

Description of parameters

IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.
 CLIBNA character*8 scalar variable containing the library type.
 CFILNA character*8 scalar variable containing the file name.
 NGROUP integer scalar variable containing the total number of groups.
 NGF integer scalar variable containing the number of fast groups.
 NGFR integer scalar variable containing the number of fast and resonance groups.
 NGT integer scalar variable containing the number of groups to test.

Called by

DRAGON routine(s) : LIBINP

Calling

DRAGON routine(s) :

UTILIB routine(s) : OPNIND, REDIND, CLSIND, XDREED

GANLIB routine(s) : KDROPN, KDRCLS, LCMCL, LCMGET, LCMLN, LCMOP, LCMPUT, SETARA, RL-SARA, XABORT

8.2.27 LIBSEC

Purpose To compute the values of the transfer macroscopic cross section for secondary neutrons in a specific group.

Syntax CALL LIBSEC(LLL, IANN, NGRO, IX, UUU, DELTA, SIGS, SIG1, PRI, NLET, STR, DEL, NRSTR, IANIS, ITY, NEXT, NEXU, NEXV, NEXW, III)

Author(s) A. Hébert

Description of input parameters

LLL integer scalar variable containing the group number for secondary neutrons.
 IANN integer scalar variable containing the type of transport correction.
 NGRO integer scalar variable containing the number of groups.
 IX integer scalar variable containing the number of groups with up-scattering.
 UUU real array of dimension UUU(*) containing the groups limits in lethargy units.
 DELTA real array of dimension DELTA(*) containing the groups width in lethargy units.
 SIGS real array of dimension SIGS(*) containing the P_0 diffusion microscopic cross sections.

SIG1	real array of dimension SIG1(*) containing the P_0 diffusion microscopic cross sections.
PRI	real array of dimension PRI(*) containing the transfer microscopic cross sections.
DEL	real scalar variable containing the elementary mesh element in lethargy.
NRSTR	integer scalar variable containing the number of cross section structures own by the isotope.
IANIS	integer array of dimension IANIS(*) containing the Legendre orders for scattering.
ITY	integer array of dimension ITY(*) containing the type of each cross section structure.
NEXT	integer array of dimension NEXT(*) containing the length of each cross section structure.
NEXU	integer array of dimension NEXU(*) containing the information related to each cross section structure.
NEXV	integer array of dimension NEXV(*) containing the information related to each cross section structure.
NEXW	integer array of dimension NEXW(*) containing the information related to each cross section structure.
III	integer array of dimension III(*) containing the offset in vector PRI of each cross section structure.

Description of output parameters

NLET	integer scalar variable containing the number of down-scattering groups.
STR	real array of dimension STR(*) containing the values of the transfer macroscopic cross section.

Called by

DRAGON routine(s) : LIBAPL

8.2.28 LIBTE2

Purpose To compute the Lagrange interpolation factors for temperature and dilution interpolation of cross sections using the TRANSX-2 algorithm.

Syntax CALL LIBTE2(NGRO, NSUBM, TMIX, SMIX, TN, SN, TERP, WORK)

Author(s) A. Hébert

Description of input parameters

NGRO	integer scalar variable containing the number of energy groups.
NSUBM	integer scalar variable containing the number of sub-materials (number of temperature/dilution collocation points).
TMIX	real array of dimension TMIX(*) containing the temperature of each sub-materials in the library.
SMIX	real array of dimension SMIX(*) containing the dilution of each sub-materials in the library. The sub-materials are ordered by decreasing dilution and then by increasing temperature.
TN	real scalar variable containing the temperature of the isotope.

SN real array of dimension SN(*) containing the dilution cross section in each energy group of the isotope.

Description of output parameters

TERP real array of dimension TERP(NGRO,*) containing the Lagrange interpolation factors.

Description of work parameters

WORK real array of dimension WORK(*) used for temporary storage.

Called by

DRAGON routine(s) : LIBTR2

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.29 LIBTER

Purpose To compute the Lagrange interpolation factors for temperature and dilution interpolation of cross sections.

Syntax CALL LIBTER(NGRO, NSUBM, TMIX, SMIX, TN, SN, TERP)

Author(s) A. Hébert

Description of input parameters

NGRO integer scalar variable containing the number of energy groups.

NSUBM integer scalar variable containing the number of sub-materials (number of temperature/dilution collocation points).

TMIX real array of dimension TMIX(*) containing the temperature of each sub-materials in the library.

SMIX real array of dimension SMIX(*) containing the dilution of each sub-materials in the library. The sub-materials are ordered by decreasing dilution and then by increasing temperature.

TN real scalar variable containing the temperature of the isotope.

SN real array of dimension SN(*) containing the dilution cross section in each energy group of the isotope.

Description of output parameters

TERP real array of dimension TERP(NGRO,*) containing the Lagrange interpolation factors.

Called by

DRAGON routine(s) : LIBTR1

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.30 LIBTR1

Purpose To interpolate microscopic cross section data from MATXS format library from NJOY-II or NJOY-89.

Syntax CALL LIBTR1(IPLIB, IMPX, CFILNA, NGRO, NBISO, NL, ISONAM, ISONRF, ICOHNA, IINCNA, NTFG, TN, AW, SN, SB, ILIB, ITISOM, DELTA, NGFR, ITRANC, NED, HVECT, IVECT, ITIME, NPROC, INDPRO, ITYPRO, XSREC, SCAT, IPR, GAR, NJJ, IJJ, CNORM)

Author(s) A. Hébert

Description of input parameters

IPLIB	integer scalar variable containing the pointer to the MICROLIB data structure.
IPRINT	integer scalar variable containing the print flag.
CFILNA	character*8 scalar variable name of the library file.
NGRO	integer scalar variable containing the number of energy group.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.
NL	integer scalar variable containing the number of Legendre orders for scattering required in the calculation.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the alias name of isotopes.
ISONRF	integer array of dimension ISONRF(3,NBISO) containing the reference name of isotopes.
ICOHNA	integer array of dimension ICOHNA(2,NBISO) containing the HCOH name.
IINCNA	integer array of dimension IINCNA(2,NBISO) containing the HINC name.
NTFG	integer array of dimension NTFG(NBISO) containing the number of thermal groups where thermal inelastic correction is applied.
TN	real array of dimension TN(NBISO) containing the temperature of each isotope.
AW	real array of dimension AW(NBISO) containing the atomic weight.
SN	real array of dimension SN(NGRO,NBISO) containing the dilution cross section in each energy group of each isotope.
SB	real array of dimension SB(NGRO,NBISO) containing the dilution cross section required in order to use the Livolant and Jeanpierre normalization.
ILIB	integer scalar variable containing the library to process.
ITISOM	integer array of dimension ITISOM(NBISO) containing the isotope with index ILIB is processed.
DELTA	real array of dimension DELTA(NGRO) containing the lethargy limits of groups.

NGFR	integer scalar variable containing the number of fast and resonance groups.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
NED	integer scalar variable containing the number of additional editing cross section.
HVECT	character array of dimension HVECT(NED)*6 containing the names of the extra vector edits.
IVECT	integer array of dimension IVECT(NED) containing the position of extra edit in XSREC vector.
ITIME	integer scalar variable that takes the value of 1 for steady-state calculations and 2 from prompt calculations.
NPROC	integer scalar variable containing the number of cross section type processed.
INDPRO	integer array of dimension INDPRO(NPROC) containing the flag for cross section type to processed.

Description of work parameters

ITYPRO	integer array of dimension ITYPRO(NPROC) used for temporary storage.
XSREC	real array of dimension XSREC(NGRO,NPROC) used for temporary storage.
SCAT	real array of dimension SCAT(NGRO,NGRO,NL) used for temporary storage.
IPR	integer array of dimension IPR(2,NBISO) used for temporary storage.
GAR	real array of dimension GAR(NGRO*NGRO) used for temporary storage.
NJJ	integer array of dimension NJJ(NGRO) used for temporary storage.
IJJ	integer array of dimension IJJ(NGRO) used for temporary storage.
CNORM	real array of dimension CNORM(NBISO,3) used for temporary storage.

Called by

DRAGON routine(s) : LIBLIB

Calling

DRAGON routine(s) : LIBTER, XDRLGS

UTILIB routine(s) : XDRCAS, XDREED, XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

8.2.31 LIBTR2

Purpose To interpolate microscopic cross section data from MATXS format library from NJOY-91.

Syntax CALL LIBTR2(IPLIB, IMPX, CFILNA, NGRO, NBISO, NL, ISONAM, ISONRF, ICOHNA, IINCNA, NTFG, TN, AW, SN, SB, ILIB, ITISOM, DELTA, NGFR, ITRANC, NED, HVECT, IVECT, ITIME, NPROC, INDPRO, ITYPRO, XSREC, SCAT, IPR, GAR, NJJ, IJJ, XSMAT)

Author(s) A. Hébert

Description of input parameters

IPLIB	integer scalar variable containing the pointer to the MICROLIB data structure.
IMPX	integer scalar variable containing the print flag.
CFILNA	character*8 scalar variable name of the library file.
NGRO	integer scalar variable containing the number of energy group.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.
NL	integer scalar variable containing the number of Legendre orders for scattering required in the calculation.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the alias name of isotopes.
ISONRF	integer array of dimension ISONRF(3,NBISO) containing the reference name of isotopes.
ICOHNA	integer array of dimension ICOHNA(2,NBISO) containing the HCOH name.
IINCNA	integer array of dimension IINCNA(2,NBISO) containing the HINC name.
NTFG	integer array of dimension NTFG(NBISO) containing the number of thermal groups where thermal inelastic correction is applied.
TN	real array of dimension TN(NBISO) containing the temperature of each isotope.
AW	real array of dimension AW(NBISO) containing the atomic weight.
SN	real array of dimension SN(NGRO,NBISO) containing the dilution cross section in each energy group of each isotope.
SB	real array of dimension SB(NGRO,NBISO) containing the dilution cross section required in order to use the Livolant and Jeanpierre normalization.
ILIB	integer scalar variable containing the library to process.
ITISOM	integer array of dimension ITISOM(NBISO) containing the isotope with index ILIB is processed.
DELTA	real array of dimension DELTA(NGRO) containing the lethargy limits of groups.
NGFR	integer scalar variable containing the number of fast and resonance groups.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
NED	integer scalar variable containing the number of additional editing cross section.
HVECT	character array of dimension HVECT(NED)*6 containing the names of the extra vector edits.
IVECT	integer array of dimension IVECT(NED) containing the position of extra edit in XSREC vector.
ITIME	integer scalar variable that takes the value of 1 for steady-state calculations and 2 from prompt calculations.
NPROC	integer scalar variable containing the number of cross section type processed.

INDPRO integer array of dimension INDPRO(NPROC) containing the flag for cross section type to processed.

Description of work parameters

ITYPRO integer array of dimension ITYPRO(NPROC) used for temporary storage.
 XSREC real array of dimension XSREC(NGRO,NPROC) used for temporary storage.
 SCAT real array of dimension SCAT(NGRO,NGRO,NL) used for temporary storage.
 IPR integer array of dimension IPR(NBISO) used for temporary storage.
 GAR real array of dimension GAR(NGRO*NGRO) used for temporary storage.
 NJJ integer array of dimension NJJ(NGRO) used for temporary storage.
 IJJ integer array of dimension IJJ(NGRO) used for temporary storage.
 CNORM real array of dimension CNORM(NBISO,3) used for temporary storage.
 XSMAT real array of dimension XSMAT(NGRO,NGRO,NL) used for temporary storage.

Called by

DRAGON routine(s) : LIBLIB

Calling

DRAGON routine(s) : LIBTE2, XDRLGS

UTILIB routine(s) : XDRCAS, XDREED, XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

8.2.32 LIBWD4

Purpose To interpolate microscopic cross section read from a library in WIMS-D4 format.

Syntax CALL LIBWD4(IPLIB, IPRINT, CFILNA, NGROUP, NBISO, NL, ISONAM, ISONRF, ISHINA, TN, AW, SN, SB, ILIB, ITISOM, DELTA, ITRANC, NPROC, INDPRO, ITYPRO, XSREC, SCAT, XSSCMP, NJJ, IJJ, XSOUT, ISORD)

Author(s) G. Marleau

Description of parameters

IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.
 IPRINT integer scalar variable containing the print flag.
 CFILNA character*8 scalar variable containing the WIMS-D4 file name.
 NGROUP integer scalar variable containing the number of groups.
 NBISO integer scalar variable containing the number of isotopes.
 NL integer scalar variable containing the number of Legendre scattering order.

ISONAM	integer array of dimension ISONAM(3,NBISO) containing the local isotope names.
ISONRF	integer array of dimension ISONRF(3,NBISO) containing the reference isotope names.
ISHINA	integer array of dimension ISHINA(2,NBISO) containing the shielding isotope names.
TN	real array of dimension TN(NBISO) containing the isotope temperature.
AW	real array of dimension AW(NBISO) containing the isotope atomic weight.
SN	real array of dimension SN(NGROUP,NBISO) containing the dilution cross section.
SB	real array of dimension SB(NGROUP,MAXISO) containing the dilution cross section of each group and each isotope used with Livolant-Jeanpierre normalization.
ILIB	integer scalar variable containing the library number to process.
ITISOM	integer array of dimension ITISOM(NBISO) containing the flag isotope processing.
DELTA	real array of dimension DELTA(NGROUP) containing the lethargy.
ITRANC	integer scalar variable containing the transport correction option. If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
NPROC	integer scalar variable containing the number of possible cross section to process.
INDPRO	integer array of dimension INDPRO(NPROC) containing the cross section to process.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing the cross section processed.
XSREC	real array of dimension XSREC(NGROUP,NPROC) containing the general cross section vector.
SCAT	real array of dimension SCAT(NGROUP,NGROUP,NL) containing the complete scattering matrix.
XSSCMP	real array of dimension XSSCMP(NGROUP*(NGROUP+2)) containing the compress scattering for transfer.
NJJ	integer array of dimension NJJ(NGROUP) containing the number of scattering group.
IJJ	integer array of dimension IJJ(NGROUP) containing the maximum scattering group.
XSOUT	real array of dimension XSOUT(NGROUP,7) containing the self-shielding parameter.
ISORD	integer array of dimension ISORD(NBISO) containing the local isotope flag.

Called by

DRAGON routine(s) : LIBLIB

Calling

DRAGON routine(s) : LIBLEX, LIBWRE, LIBWRG, LIBWRI, LIBWRP, LIBWSC, LIBWTE, XDRLGS, XDRLPR

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMSIX, SETARA, RLSARA, XABORT

8.2.33 LIBWED

Purpose To create MICROLIB records from WIMS-D4 and WIMS-AECL data.

Syntax CALL LIBWED(MAXR, NEL, NDEPL, NDFI, NDFP, NHEAVY, NLIGHT, NBXR, ITNAM, ITZEA, MATNO, KPAX, BPAX, HNADPL, IZEA, IDR, RER, KPAR, BPAR, YIELD)

Author(s) G. Marleau

Description of parameters

MAXR	integer scalar variable containing the number of reaction types.
NEL	integer scalar variable containing the number of isotopes on library.
NDEPL	integer scalar variable containing the number of depleting isotopes.
NDFI	integer scalar variable containing the number of direct fissile isotopes.
NDFP	integer scalar variable containing the number of direct fission product.
NHEAVY	integer scalar variable containing the number of heavy isotopes (fissile isotope and decay or capture product from fissile isotope).
NLIGHT	integer scalar variable containing the number of light isotopes (fission product and decay and capture product from fission product).
NBXR	integer scalar variable containing the maximum number of parent isotopes from decay and capture.
ITNAM	integer array of dimension ITNAM(2,NEL) containing the reactive isotope names in chain.
ITZEA	integer array of dimension ITZEA(NEL) containing the 6-digit nuclide identifier.
MATNO	integer array of dimension MATNO(NEL) containing the reaction material number.
KPAX	integer array of dimension KPAX(NEL+MAXR,NEL) containing the complete reaction type matrix.
BPAX	real array of dimension BPAX(NEL+MAXR,NEL) containing the complete branching ratio matrix.
HNADPL	integer array of dimension HNADPL(2,NDEPL) containing the reactive isotope names in chain.
IZEA	integer array of dimension IZEA(NDEPL) containing the 6-digit nuclide identifier.
IDR	integer array of dimension IDR(MAXR,NDEPL) containing the reaction identifier.
RER	real array of dimension RER(MAXR,NDEPL) containing the reaction constant.
KPAR	integer array of dimension KPAR(MAXR,NDEPL) containing the reduced reaction type matrix.
BPAR	real array of dimension BPAR(MAXR,NDEPL) containing the reduced branching ratio matrix .
YIELD	real array of dimension YIELD(NDFI,NDFP) containing the fission product yield.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.34 LIBWET

Purpose To identify WIMS-D4 and WIMS-AECL isotopes by type and name in depletion chain.

Syntax CALL LIBWET(MAXR, NEL, NSTATE, ISTATE, MATNO, KPAX, BPAX)

Author(s) G. Marleau

Description of input parameters

MAXR integer scalar variable containing the number of reaction types.

NEL integer scalar variable containing the number of isotopes on library.

NSTATE integer scalar variable containing the number of parameters.

Description of output parameters

ISTATE integer array of dimension ISTATE(NSTATE) containing the library parameters vector.

MATNO integer array of dimension MATNO(NEL) containing the reaction material number.

Description of input/output parameters

KPAX integer array of dimension KPAX(NEL+MAXR,NEL) containing the complete reaction type matrix.

BPAX real array of dimension BPAX(NEL+MAXR,NEL) containing the complete branching ratio matrix.

Called by

DRAGON routine(s) : LIBDEP

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) :

8.2.35 LIBWID

Purpose To find isotope number associated with isotope identifier on WIMS-D4 and WIMS-AECL library.

Syntax LIBWID=LIBWID(NEL, IWISO, ISOID)

Author(s) G. Marleau

Description of input parameters

NEL integer scalar variable containing the number of isotopes on the library.
 IWISO integer array of dimension IWISO(NEL) containing the id of isotope on the library.
 ISOID integer scalar variable containing the isotope identifier requested.

Description of output parameters

LIBWID integer scalar variable containing the isotope number associated with isotope identifier.

Called by

DRAGON routine(s) : LIBENR, LIBEWR

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) :

8.2.36 LIBWIM

Purpose To interpolate microscopic cross section read from a library in WIMS-AECL format.

Syntax CALL LIBWIM(IPLIB, IPRINT, CFILNA, NGROUP, NBISO, NL, ISONAM, ISONRF, ISHINA, TN, AW, SN, SB, ILIB, ITISOM, DELTA, ITRANC, NPROC, INDPRO, ITYPRO, XSREC, SCAT, XSSCMP, NJJ, IJJ, XSOUT)

Author(s) G. Marleau

Description of parameters

IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.
 IPRINT integer scalar variable containing the print flag.
 CFILNA character*8 scalar variable containing the WIMS-D4 file name.
 NGROUP integer scalar variable containing the number of groups.
 NBISO integer scalar variable containing the number of isotopes.
 NL integer scalar variable containing the number of Legendre scattering order.
 ISONAM integer array of dimension ISONAM(3,NBISO) containing the local isotope names.
 ISONRF integer array of dimension ISONRF(3,NBISO) containing the reference isotope names.
 ISHINA integer array of dimension ISHINA(2,NBISO) containing the shielding isotope names.
 TN real array of dimension TN(NBISO) containing the isotope temperature.
 AW real array of dimension AW(NBISO) containing the isotope atomic weight.
 SN real array of dimension SN(NGROUP,NBISO) containing the dilution cross section.
 SB real array of dimension SB(NGROUP,MAXISO) containing the dilution cross section of each group and each isotope used with Livolant-Jeanpierre normalization.

ILIB	integer scalar variable containing the library number to process.
ITISOM	integer array of dimension ITISOM(NBISO) containing the flag isotope processing.
DELTA	real array of dimension DELTA(NGROUP) containing the lethargy..
ITRANC	integer scalar variable containing the transport correction option If ITRANC=0, no transport correction is considered, if ITRANC=1, an APOLLO type transport correction is used and if ITRANC=2, a WIMS-AECL type correction is used.
NPROC	integer scalar variable containing the number of possible cross section to process.
INDPRO	integer array of dimension INDPRO(NPROC) containing the cross section to process.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing the cross section processed.
XSREC	real array of dimension XSREC(NGROUP,NPROC) containing the general cross section vector.
SCAT	real array of dimension SCAT(NGROUP,NGROUP,NL) containing the complete scattering matrix.
XSSCMP	real array of dimension XSSCMP(NGROUP*(NGROUP+2)) containing the compress scattering for transfer.
NJJ	integer array of dimension NJJ(NGROUP) containing the number of scattering group.
IJJ	integer array of dimension IJJ(NGROUP) containing the maximum scattering group.
XSOUT	real array of dimension XSOUT(NGROUP,7) containing the self-shielding parameter.

Called by

DRAGON routine(s) : LIBLIB

Calling

DRAGON routine(s) : LIBLEX, LIBWRE, LIBWRI, LIBWSC, LIBWTE, XDRLGS, XDRLPR

UTILIB routine(s) : OPNIND, REDIND, CLSIND, UPCKIC, XDRSET

GANLIB routine(s) : KDROPN, LCMLIB, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

8.2.37 LIBWRE

Purpose To perform the resonance integral dilution and temperature interpolation for WIMS-D4 and WIMS-AECL library.

Syntax CALL LIBWRE(NTYP, ITLIB, NGROUP, IGRF, IGRL, SCAT, SIGS, TOTAL, XSNG, SIGF, XSFI, XNU, DELTA, DIL, DLJ, XSOUT, XSCOR)

Author(s) G. Marleau

Description of parameters

NTYP integer scalar variable containing the type of resonance integral to interpolate, where:

- NTYP=1 for absorption;
- NTYP=2 for absorption and fission;
- NTYP=3 for absorption, fission and scattering.

ITLIB	integer scalar variable containing the type of library where: <ul style="list-style-type: none"> • ITLIB=1 for WIMS-AECL; • ITLIB=2 for WIMS-D4.
NGROUP	integer scalar variable containing the number of groups.
IGRF	integer scalar variable containing the first resonance group to treat.
IGRL	integer scalar variable containing the last resonance group to treat.
SCAT	real array of dimension SCAT(NGROUP,NGROUP) containing the complete scattering matrix.
SIGS	real array of dimension SIGS(NGROUP) containing the total scattering out of group.
TOTAL	real array of dimension TOTAL(NGROUP) containing the total cross section.
XSNG	real array of dimension XSNG(NGROUP) containing the NG cross section.
SIGF	real array of dimension SIGF(NGROUP) containing the $\nu\Sigma_f$ cross section.
XSFI	real array of dimension XSFI(NGROUP) containing the fission cross section.
XNU	real array of dimension XNU(NGROUP) containing $1/\nu$.
DELTA	real array of dimension DELTA(NGROUP) containing the lethargy.
DIL	real array of dimension DIL(NGROUP) containing the standard dilution.
DLJ	real array of dimension DLJ(NGROUP) containing the Livolant-Jeanpierre dilution.
XSOUT	real array of dimension XSOUT(NGROUP,7) containing the resonances integrals.
XSCOR	real array of dimension XSCOR(4) containing the total correction.

Called by

DRAGON routine(s) : LIBWD4, LIBWIM

8.2.38 LIBWRG

Purpose To read resonance information from a WIMS-D4 library.

Syntax CALL LIBWRG(IUNIT, NEL, NGR, NRTOT, MAXTEM, MAXDIL, NF, NSRES, RID, NTM, NDI, RTMP, RDIL, RESI, TMPT, DILT, REST)

Author(s) G. Marleau

Description of input/output parameters

IUNIT	integer scalar variable containing the file unit number associated with the WIMS-D4 library.
NEL	integer scalar variable containing the number of isotopes.
NGR	integer scalar variable containing the number of resonance groups.
NRTOT	integer scalar variable containing the number of resonance sets.
MAXTEM	integer scalar variable containing the max number temperatures.

MAXDIL	integer scalar variable containing the max number dilutions.
NF	integer array of dimension NF(NEL) containing the type of fission table.
NSRES	integer scalar variable containing the number of resonance set.
RID	real array of dimension RID(NRTOT) containing the resonance identifier.
NTM	integer array of dimension NTM(2,NRTOT,NGR) containing the number of temperatures.
NDI	integer array of dimension NDI(2,NRTOT,NGR) containing the number of dilutions.
RTMP	real array of dimension RTMP(MAXTEM,2,NRTOT,NGR) containing the resonance temperatures.
RDIL	real array of dimension RDIL(MAXDIL,2,NRTOT,NGR) containing the resonance dilutions.
RESI	real array of dimension RESI(MAXDIL,MAXTEM,2,NRTOT,NGR) containing the resonance integrals.

Description of work parameters

TMPT	real array of dimension TMPT(MAXTEM) containing the work temperatures.
DILT	real array of dimension DILT(MAXDIL) containing the work dilutions.
REST	real array of dimension REST(MAXDIL,MAXTEM) containing the work resonance integrals.

Called by

DRAGON routine(s) : LIBWD4

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

8.2.39 LIBWRI

Purpose To perform the resonance integral temperature and dilution interpolation.

Syntax CALL LIBWRI(NGR, NTMPR, NDILR, IGRR, TMPISO, DILISO, TMPT, DILT, REST, RIT, XSOUT, XSCOR)

Author(s) G. Marleau

Description of input parameters

NGR	integer scalar variable containing the number of resonance groups.
NTMPR	integer scalar variable containing the number of temperature tables.
NDILR	integer scalar variable containing the number of dilution tables.
IGRR	integer scalar variable containing the resonance group being treated.
TMPISO	real scalar variable containing the temperature T of isotope.

NDI integer array of dimension NDI(2,NRTOT,NGR) containing the number of dilutions.

RTMP real array of dimension RTMP(MAXTEM,2,NRTOT,NGR) containing the resonance temperature.

RDIL real array of dimension RDIL(MAXDIL,2,NRTOT,NGR) containing the resonance dilution.

RESI real array of dimension RESI(MAXDIL,MAXTEM,2,NRTOT,NGR) containing the resonance integrals.

Description of output parameters

NTMPR integer scalar variable containing the number of local temperatures.

NDILR integer scalar variable containing the number of local dilutions.

TMPT real array of dimension TMPT(MAXTEM) containing the work temperatures.

DILT real array of dimension DILT(MAXDIL) containing the work dilutions.

REST real array of dimension REST(MAXDIL*MAXTEM) containing the work resonance integrals.

Called by

DRAGON routine(s) : LIBWD4

8.2.41 LIBWSC

Purpose To expand the WIMS-AECL and WIMS-D4 format scattering cross section.

Syntax CALL LIBWSC(NGROUP, NGD, NGF, NSCT, CSCAT, XSCAT, SIGS)

Author(s) G. Marleau

Description of input parameters

NGROUP integer scalar variable containing the number of groups.

NGD integer scalar variable containing the starting group number.

NGF integer scalar variable containing the finishing group number.

NSCT integer scalar variable containing the number of elements in CSCAT.

CSCAT real array of dimension CSCAT(NSCT) containing the WIMS format condense scattering at input.

Description of output parameters

XSCAT real array of dimension XSCAT(NGROUP,NGROUP) containing the DRAGON format expanded scattering.

SIGS real array of dimension SIGS(NGROUP) containing the total scattering out of group.

Called by

DRAGON routine(s) : LIBWD4, LIBWIM

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : XABORT

8.2.42 LIBWTE

Purpose To perform temperature interpolation for WIMS-AECL or WIMS-D4 cross section.

Syntax CALL LIBWTE(IACT, ITXS, NGROUP, NGTHER, NTMP, NF, TERP, SCAT, SIGS, XSNG, SIGF, XSFI, TRAN, TMPXS, TMPSC)

Author(s) G. Marleau

Description of input parameters

IACT integer scalar variable containing the type of action to be performed by the routine where:

- IACT=1 to initialize before adding;
- IACT=2 to add only.

ITXS integer scalar variable containing the cross section type to process:

- ITXS=1 for all cross sections;
- ITXS=2 only for scattering cross section.

NGROUP integer scalar variable containing the number of groups.

NGTHER integer scalar variable containing the number of thermal groups.

NTMP integer scalar variable containing the number of temperatures.

NF integer scalar variable containing the fissile flag.

TERP double precision array of dimension TERP(NTMP) containing the temperature coefficients.

Description of input/output parameters

SCAT real array of dimension SCAT(NGROUP,NGROUP) containing the complete scattering matrix.

SIGS real array of dimension SIGS(NGROUP) containing the total scattering out of group.

XSNG real array of dimension XSNG(NGROUP) containing the NG cross section.

SIGF real array of dimension SIGF(NGROUP) containing the $\nu\Sigma_f$ cross section.

XSFI real array of dimension XSFI(NGROUP) containing the fission cross section.

TRAN real array of dimension TRAN(NGROUP) containing the transport cross section.

Description of work parameters

TMPXS real array of dimension TMPXS(NGROUP,5,NTMP) containing the temperature dependent vector cross section.

TMPSC real array of dimension TMPSC(NGROUP,NGROUP,NTMP) containing the temperature dependent scattering cross section.

Called by

DRAGON routine(s) : LIBWD4, LIBWIM

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

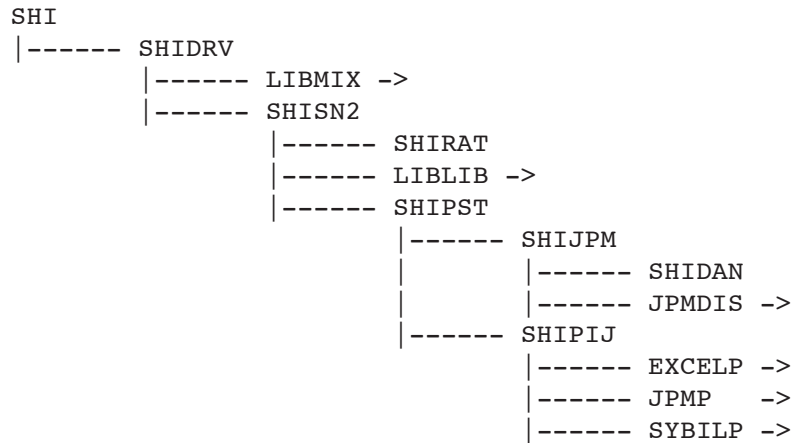
GANLIB routine(s) :

9 THE MODULE FOR RESONANCE SELF-SHIELDING

9.1 Structure of SHI :

The SHI : module can be represented by the following tree:

Structure of the resonance self-shielding module: SHI



One can find a description of the routines LIBMIX and LIBLIB in Section 8 while the subroutines EXCELP, SYBILP, JPMP and JPMDIS are described in Section 10.

9.2 General Routines Description

9.2.1 SHIDRV

Purpose To perform a multidimensional self-shielding calculation in order to compute the dilution cross section of each resonant isotope present in the domain.

Syntax CALL SHIDRV(IPLIB , IPTRK , IFTRAK , NGRO , NBISO , NBMIX , NREG , CDOOR , NRES , IPRINT , LEAKSW , TITR , IGRMIN , IGRMAX , MAXX0 , IBIEFF , IGC , ITRANZ , EPS , NEDMAC , HVECT , NL , ITIME , ITRANC , ISONAM , MIX , DEN , TN , SN , SB , LSHI , MAT , VOL , MASK , MASKL , SIGT1 , SIGT2 , SIGT3 , NOCONV , SIGE , IHLIB , NTFG , ISONRF , AWR)

Author(s) A. Hébert

Description of parameters

IPLIB	integer scalar variable containing the pointer to the internal MICROLIB.
IPTRK	integer scalar variable containing the pointer to the tracking TRACKING.
IFTRAK	integer scalar variable containing the unit number of the sequential binary tracking file.
NGRO	integer scalar variable containing the number of energy groups.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.

NBMIX	integer scalar variable containing the number of mixtures in the MACROLIB.
NREG	integer scalar variable containing the number of regions.
CDOOR	character*12 scalar variable containing the name of the geometry/solution module.
NRES	integer scalar variable containing the number of resonant mixtures.
IPRINT	integer scalar variable containing the print level.
LEAKSW	logical scalar variable that is <code>.TRUE.</code> if neutron leakage through external boundary is present and <code>.FALSE.</code> otherwise.
TITR	character*72 scalar variable containing the title.
IGRMIN	integer scalar variable containing the lowest group number where the self-shielding is applied.
IGRMAX	integer scalar variable containing the highest group number where the self-shielding is applied.
MAXX0	integer scalar variable containing the maximum number of self-shielding iterations.
IBIEFF	integer scalar variable that takes the value of IBIEFF=1 if a Livolant-Jeanpierre equivalence is requires and IBIEFF=0 otherwise.
IGC	integer scalar variable that takes the value of IGC=1 if the goldstein-cohen approximation is applied and IGC=1 otherwise.
ITRANZ	integer scalar variable containing the type of transport correction used in the self-shielding.
EPS	real scalar variable containing the convergence criterion for the self-shielding iterations.
NEDMAC	integer scalar variable containing the number of additional edition cross sections.
HVECT	character array of dimension HVECT(NEDMAC)*6 containing the names of the additional edition cross sections.
NL	integer scalar variable containing the maximum scattering Legendre order.
ITIME	integer scalar variable containing the maximum time step.
ITRANC	integer scalar variable containing the type of transport correction.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the name of isotope.
MIX	integer array of dimension MIX(NBISO) containing the mix number of each isotope.
DEN	real array of dimension DEN(NBISO) containing the density of each isotope.
TN	real array of dimension TN(NBISO) containing the temperature of each isotope.
SN	real array of dimension SN(NGRO,NBISO) containing the estimated (input) or computed (output) dilution cross section in each energy group for each isotope.
SB	real array of dimension SB(NGRO,NBISO) containing the computed (output) dilution cross section as used in the Livolant and Jeanpierre normalization.
LSHI	integer array of dimension LSHI(NBISO) containing the resonant region number associated with isotope.
MAT	integer array of dimension MAT(NREG) containing the index-number of the mixture type assigned to each volume.

VOL	real array of dimension VOL(NREG) containing the region volume.
MASK	logical array of dimension MASK(NBMIX) containing the mixture mask.
MASKL	logical array of dimension MASKL(NGRO) containing the group mask.
SIGT1	real array of dimension SIGT1(NBMIX,NGRO) used for temporary storage.
SIGT2	real array of dimension SIGT2(NBMIX,NGRO) used for temporary storage.
SIGT3	real array of dimension SIGT3(NBMIX,NGRO) used for temporary storage.
NOCONV	logical array of dimension NOCONV(NBMIX,NGRO) containing the group and mixture convergence vector.
SIGE	real array of dimension SIGE(NBMIX,NGRO) used for temporary storage.
IHLIB	integer array of dimension IHLIB(2,NBISO,5) containing the library names from which the isotope is taken.
NTFG	integer array of dimension NTFG(NBISO) containing the number of thermal group for incoherent scattering.
ISONRF	integer array of dimension ISONRF(3,NBISO) containing reference isotopes names.
AWR	real array of dimension AWR(NBISO) containing the isotope atomic weight.

Called by

DRAGON routine(s) : SHI

Calling

DRAGON routine(s) : LIBMIX, SHISN2

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

9.2.2 SHIDAN

Purpose To perform a fast calculation of the Dancoff matrix and the related escape matrix using the JPM method.

Syntax CALL SHIDAN(IMPX , DIAG , NMBLK , IFR , ALB , NMERGE, IJAT , INUM , VOL , MIX , DVX , MU1 , IMA , NGEN , IGEN , ISURF , CHORD , SIG0 , SIG1 , SIG2 , PII , PIS , PSS , NRES , IRES , PSTAR , PSSB , IGAT , IGAU , IGAU2 , OPTIC , PST , VST , WP , GAR , SSSS)

Author(s) A. Hébert

Description of parameters

IMPX	integer scalar variable containing the print level.
DIAG	logical scalar variable that takes the value. DIAG= .TRUE. when the diagonal approximation for P^* is to be considered and DIAG= .FALSE. otherwise.
NMBLK	integer scalar variable containing the total number of blocks in the domain.

IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific value of the neutron flux and reactions rates are required. Many blocks with different position in the domain can be merged before the neutron flux calculation if they own the same generating block. This allows some reduction in CPU time and memory.
IJAT	integer scalar variable containing the total number of distinct out-currents.
INUM	integer array of dimension INUM(NMBLK) containing the index-number of the merged block associated to each block.
VOL	real array of dimension VOL(NMERGE) containing the volumes.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in matrix $PSTAR = (I - P_{ss}A)$.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in matrix $PSTAR = (I - P_{ss}A)$.
NGEN	integer scalar variable containing the total number of generating blocks. A generating block is defined by its mixture and dimensions irrespective of its position in the domain.
IGEN	integer array of dimension IGEN(NMERGE) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(NGEN) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.
SIG0	real array of dimension SIG0(NGEN) containing the total macroscopic cross sections of the heavy isotopes.
SIG1	real array of dimension SIG1(NGEN) containing the total macroscopic cross sections of the light isotopes.
SIG2	real array of dimension SIG2(NGEN) containing the transport correction of the light isotopes.
PII	real array of dimension PII(NGEN) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.
PSS	real array of dimension PSS(*) containing the surface to surface collision probabilities.
NRES	integer scalar variable containing the number of resonant regions.
IRES	integer array of dimension IRES(NGEN) containing the index-number of resonant region associated with each generating block. It takes a value of zero in non resonant blocks.
PSTAR	real array of dimension PSTAR(NRES,NRES) containing the escape matrix.
PSSB	real array of dimension PSSB(*) used for temporary storage.

IGAT	integer array of dimension IGAT(NMERGE) used for temporary storage.
IGAU	integer array of dimension IGAU(NGEN) used for temporary storage.
IGAU2	integer array of dimension IGAU2(NGEN) used for temporary storage.
OPTIC	real array of dimension OPTIC(NGEN) used for temporary storage.
PST	real array of dimension PST(NRES,2*NRES) used for temporary storage.
VST	real array of dimension VST(NRES) used for temporary storage.
WP	real array of dimension WP(IJAT,NRES) used for temporary storage.
GAR	real array of dimension GAR(IJAT) used for temporary storage.
SSSS	real array of dimension SSSS(NRES) used for temporary storage.

Called by

DRAGON routine(s) : SHIJPM

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLUF , ALLUS , ALSB

GANLIB routine(s) : XABORT

9.2.3 SHIJPM

Purpose To calculate the escape matrix using JPM single block information.

Syntax CALL SHIJPM(IPSYS , IPTRK , IFTRAK, IPRINT, NBMIX , NREG , MAT , VOL , LEAKSW,
NRES , IRES , SIG0 , SIG1 , SIG2 , DIAG , PSTAR , SIGT0 , SIGT1 , SIGT2 ,
MASK2 , IRES2)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable containing the pointer to the ASMPIJ data structure.
IPTRK	integer scalar variable containing the pointer to the TRACKING data structure.
IFTRAK	integer scalar variable containing the unit number of the sequential binary tracking file.
IPRINT	integer scalar variable containing the print flag.
NBMIX	integer scalar variable containing the total number of mixtures.
NREG	integer scalar variable containing the total number of merged blocks for which specific values. of the neutron flux and reactions rates are required. Many blocks with different position in the domain can be merged before the neutron flux calculation if they own the same generating block. This allows some reduction in cpu time and memory.
MAT	integer array of dimension MAT(NREG) containing the index-number of the mixture type assigned to each volume.

VOL	real array of dimension VOL(NREG) containing the volumes.
LEAKSW	logical scalar variable that takes the value LEAKSW=.TRUE. if neutron leakage through external boundary is present and the value LEAKSW=.FALSE. otherwise.
NRES	integer scalar variable containing the number of resonant mixtures.
IRES	integer array of dimension IRES(NBMIX) containing the resonant mixture number assigned to each mixture.
SIG0	real array of dimension SIG0(NBMIX) containing the total macroscopic cross sections of the resonant materials in each mixture.
SIG1	real array of dimension SIG1(NBMIX) containing the total macroscopic cross sections of the light materials in each mixture.
SIG2	real array of dimension SIG2(NBMIX) containing the transport correction in each mixture.
DIAG	logical scalar variable that takes the value DIAG=.TRUE. when the diagonal approximation for P^* is to be considered and DIAG=.FALSE. otherwise.
PSTAR	real array of dimension PSTAR(NRES,NRES) containing the escape matrix.
SIGT0	real array of dimension SIGT0(NREG) used for temporary storage.
SIGT1	real array of dimension SIGT1(NREG) used for temporary storage.
SIGT2	real array of dimension SIGT2(NREG) used for temporary storage.
MASK2	logical array of dimension MASK2(NREG) used for temporary storage.
IRES2	integer array of dimension IRES2(NREG) used for temporary storage.

Called by

DRAGON routine(s) : SHIPST

Calling

DRAGON routine(s) : JPMDIS, SHIDAN

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMLen, LCMPUT, SETARA, RLSARA, XABORT

9.2.4 SHIPIJ

Purpose To calculate the escape matrix using standard collision probabilities.

Syntax CALL SHIPIJ(IPSYS , IPTRK , IFTRAK , CDOOR , IPRINT, NBMIX , NREG , MAT , VOL ,
LEAKSW, NRES , IRES , SIG0 , SIG1 , SIG2 , DIAG , TITR , PSTAR , PSGAR ,
PIJ , VST , SIGT , PIJSC)

Author(s) A. Hébert

Description of parameters

IPSYS integer scalar variable containing the pointer to the ASMPIJ data structure.

IPTRK	integer scalar variable containing the pointer to the TRACKING data structure.
IFTRAK	integer scalar variable containing the unit number of the sequential binary tracking file.
CDOOR	character*12 scalar variable containing the name of the geometry/solution module.
IPRINT	integer scalar variable containing the print flag.
NBMIX	integer scalar variable containing the number of mixtures.
NREG	integer scalar variable containing the total number of regions.
MAT	integer array of dimension MAT(NREG) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(NREG) containing the volumes.
LEAKSW	logical scalar variable that takes the value LEAKSW=.TRUE. If neutron leakage through external boundary is present and the value LEAKSW=.FALSE. otherwise.
NRES	integer scalar variable containing the number of resonant mixtures.
IRES	integer array of dimension IRES(NBMIX) containing the resonant mixture number assigned to each mixture.
SIG0	real array of dimension SIG0(NBMIX) containing the total macroscopic cross sections of the resonant materials in each mixture.
SIG1	real array of dimension SIG1(NBMIX) containing the total macroscopic cross sections of the light materials in each mixture.
SIG2	real array of dimension SIG2(NBMIX) containing the transport correction in each mixture.
DIAG	logical scalar variable that takes the value DIAG=.TRUE. when the diagonal approximation for P^* is to be considered and DIAG=.FALSE. otherwise.
TITR	character*72 scalar variable containing the title.
PSTAR	real array of dimension PSTAR(NRES,NRES) containing the escape matrix.
PSGAR	real array of dimension PSGAR(NRES,2*NRES) used for temporary storage.
PIJ	real array of dimension PIJ(NREG*(NREG+1)/2) used for temporary storage.
VST	real array of dimension VST(NRES) used for temporary storage.
SIGT	real array of dimension SIGT(0:NBMIX) used for temporary storage.
PIJSC	real array of dimension PIJSC(NREG,2*NREG) used for temporary storage.

Called by

DRAGON routine(s) : SHIPST

Calling

DRAGON routine(s) : EXCELP, JPMP, SYBILP

UTILIB routine(s) : ALSB

GANLIB routine(s) : XABORT

9.2.5 SHIPST

Purpose To compute the escape matrix for SHIBA.

Syntax CALL SHIPST(IPSYS , IPTRK , IFTRAK, CDOOR , IPRINT, NBMIX , NREG , MAT , VOL ,
LEAKSW, NRES , IRES , SIG0 , SIG1 , SIG2 , DIAG , TITR , PSTAR)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable containing the pointer to the ASMPIJ data structure.
IPTRK	integer scalar variable containing the pointer to the TRACKING data structure.
IFTRAK	integer scalar variable containing the unit number of the sequential binary tracking file.
CDOOR	character*12 scalar variable containing the name of the geometry/solution module.
IPRINT	integer scalar variable containing the print flag.
NBMIX	integer scalar variable containing the number of mixtures.
NREG	integer scalar variable containing the total number of regions.
MAT	integer array of dimension MAT(NREG) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(NREG) containing the volumes.
LEAKSW	logical scalar variable that takes the value LEAKSW=.TRUE. If neutron leakage through external boundary is present and the value LEAKSW=.FALSE. otherwise.
NRES	integer scalar variable containing the number of resonant mixtures.
IRES	integer array of dimension IRES(NBMIX) containing the resonant mixture number assigned to each mixture.
SIG0	real array of dimension SIG0(NBMIX) containing the total macroscopic cross sections of the resonant materials in each mixture.
SIG1	real array of dimension SIG1(NBMIX) containing the total macroscopic cross sections of the light materials in each mixture.
SIG2	real array of dimension SIG2(NBMIX) containing the transport correction in each mixture.
DIAG	logical scalar variable that takes the value DIAG=.TRUE. when the diagonal approximation for P^* is to be considered and DIAG=.FALSE. otherwise.
TITR	character*72 scalar variable containing the title.
PSTAR	real array of dimension PSTAR(NRES,NRES) containing the escape matrix.

Called by

DRAGON routine(s) : SHISN2

Calling

DRAGON routine(s) : SHIJPM, SHIPIJ

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA

9.2.6 SHIRAT

Purpose To compute the rational approximation coefficients for the fuel-to-fuel reduced collision probability in a closed cell.

Syntax CALL SHIRAT(IPRINT, NRAT , SIGX , DILUT , IGRP , SA , COEF , DENOM)

Author(s) A. Hébert

Description of parameters

IPRINT	integer scalar variable containing the print flag.
NRAT	integer scalar variable containing the order of the rational approximation.
SIGX	real array of dimension SIGX(2*NRAT-1) containing the interpolation values for the resonant cross section of the heavy nuclide.
DILUT	real array of dimension DILUT(2*NRAT-1) containing the interpolated macroscopic escape cross sections corresponding to SIGX.
IGRP	integer scalar variable containing the group index.
SA	real scalar variable containing the asymptotic macroscopic escape cross section.
COEF	complex array of dimension COEF(NRAT) containing the numerator coefficients for the rational approximation of fuel-to-fuel reduced collision probability.
DENOM	complex array of dimension DENOM(NRAT) containing the denominator coefficients. for the rational approximation of fuel-to-fuel reduced collision probability

Called by

DRAGON routine(s) : SHISN2

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALPLSF, ALPOLY, ALROOT

GANLIB routine(s) : XABORT

9.2.7 SHISN2

Purpose to perform one multidimensional self-shielding iteration using the generalized Stamm'ler algorithm with PIC approximation.

Syntax CALL SHISN2(IPLIB , IPTRK , IFTRAK, NGRO , NBISO , NBMIX , NREG , CDOOR , NRES ,
 IPRINT, ISONAM, MIX , DEN , TN , SN , SB , LSHI , MAT , VOL , LEAKSW,
 TITR , START , SIGT , SIGT3 , NOCONV, BIEFF , LGC , SIGE , IHLIB , NTFG ,
 ISONRF, AWR , NEDMAC, HVECT , NL , ITIME , ITRANC, NPROC , NBRMIX,
 IRES , SIG0 , SIG3 , TOTAL , SIGOLD, GAR , MIX2 , IRNBM , SIGRES, MASKI
 , ITISOM, DELTA , ITYPRO)

Author(s) A. Hébert

Description of parameters

IPLIB	integer scalar variable containing the pointer to the internal MICROLIB.
IPTRK	integer scalar variable containing the pointer to the tracking TRACKING.
IFTRAK	integer scalar variable containing the unit number of the sequential binary tracking file.
NGRO	integer scalar variable containing the number of energy groups.
NBISO	integer scalar variable containing the number of isotopes present in the calculation domain.
NBMIX	integer scalar variable containing the number of mixtures in the MACROLIB.
NREG	integer scalar variable containing the number of regions.
CDOOR	character*12 scalar variable containing the name of the geometry/solution module.
NRES	integer scalar variable containing the number of resonant mixtures.
IPRINT	integer scalar variable containing the print level.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the name of isotope.
MIX	integer array of dimension MIX(NBISO) containing the mix number of each isotope.
DEN	real array of dimension DEN(NBISO) containing the density of each isotope.
TN	real array of dimension TN(NBISO) containing the temperature of each isotope.
SN	real array of dimension SN(NGRO,NBISO) containing the estimated (input) or computed (output) dilution cross section in each energy group for each isotope.
SB	real array of dimension SB(NGRO,NBISO) containing the computed (output) dilution cross section as used in the Livolant and Jeanpierre normalization.
LSHI	integer array of dimension LSHI(NBISO) containing the resonant region number associated with isotope.
MAT	integer array of dimension MAT(NREG) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(NREG) containing the region volume.
LEAKSW	logical scalar variable that is .TRUE. if neutron leakage through external boundary is present and .FALSE. otherwise.
TITR	character*72 scalar variable containing the title.
START	logical scalar variable that takes the value START=.TRUE. if SHISN2 is called for the first time and takes the value START=.FALSE. otherwise.

SIGT	real array of dimension SIGT(NBMIX,NGRO) containing the total macroscopic cross sections.
SIGT3	real array of dimension SIGT3(NBMIX,NGRO) containing the transport correction.
NOCONV	logical array of dimension NOCONV(NBMIX,NGRO) containing that indicates if a mixture and group is converged (NOCONV=.FALSE.) or nor (NOCONV=.TRUE.).
BIEFF	logical scalar variable that takes the value BIEFF=.TRUE. if the Livolant and Jeanpierre equivalence is to be activated and takes the value BIEFF=.FALSE. otherwise.
LGC	logical scalar variable that takes the value LGC=.TRUE. if the Goldstein-Cohen approximation is to be activated and takes the value LGC=.FALSE. otherwise.
SIGE	real array of dimension SIGE(NRES,NGRO) containing the computed macroscopic dilution cross section in each resonant mixture and each energy group.
IHLIB	integer array of dimension IHLIB(2,NBISO,5) use for temporary storage.
NTFG	integer array of dimension NTFG(NBISO) use for temporary storage.
ISONRF	integer array of dimension ISONRF(3,NBISO) use for temporary storage.
AWR	real array of dimension AWR(NBISO) use for temporary storage.
NEDMAC	integer scalar variable containing the number of additional editing cross section.
HVECT	character array of dimension HVECT(NEDMAC)*6 containing the name of additional editing cross section.
NL	integer scalar variable containing the Legendre order of scattering.
ITIME	integer scalar variable containing the time step.
ITRANC	integer scalar variable containing the type of transport correction.
NPROC	integer scalar variable containing the number of vector cross section.
NBRMIX	integer scalar variable containing the number of resonance mixtures.
IRES	integer array of dimension IRES(NBMIX) use for temporary storage.
SIG0	real array of dimension SIG0(NBMIX) use for temporary storage.
SIG3	real array of dimension SIG3(NBMIX) use for temporary storage.
TOTAL	real array of dimension TOTAL(NGRO,NBRMIX) use for temporary storage.
SIGOLD	real array of dimension SIGOLD(NGRO,NBRMIX) use for temporary storage.
GAR	real array of dimension GAR(NGRO) use for temporary storage.
MIX2	integer array of dimension MIX2(NBISO) use for temporary storage.
IRNBM	integer array of dimension IRNBM(NBMIX) use for temporary storage.
SIGRES	real array of dimension SIGRES(NBMIX) use for temporary storage.
MASKI	logical array of dimension MASKI(NBISO) use for temporary storage.
ITISOM	integer array of dimension ITISOM(NBISO) use for temporary storage.
DELTA	real array of dimension DELTA(NGRO) use for temporary storage.

ITYPRO integer array of dimension ITYPRO(NPROC) use for temporary storage.

Called by

DRAGON routine(s) : SHIDRV

Calling

DRAGON routine(s) : LIBLIB, SHIPST, SHIRAT

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMSIX, XABORT

10 THE MODULE FOR CP INTEGRATION

10.1 Structure of ASM:

The main routine that controls this module is called ASM (see Section 2.2.8). It requires up to NENTRY=4 data structures. The first structure must be of type linked list or XSM file (IENTRY(*i*)=1 or 2) and will contain an ASMPIJ data structure. This data structure must be in creation or modification mode (JENTRY(*i*)=0 or 1). The second data structure will contain the multigroup cross sections required for the CP evaluation in the form of a read-only MACROLIB or MICROLIB data structure (linked list or XSM file). The third data structure must be of type IENTRY(*i*)=1 (linked list) and will contain a TRACKING data structure. Finally, the last data structure will contain the binary tracking file (IENTRY(*i*)=3). In fact the presence of this last data structure is required for all computations relying on the EXCELT: tracking module.

The ASM: module can be represented by the following tree:

Structure of the flux module: ASM

```

ASM
|----- ASMDRV
|         |----- PIJCPL
|         |----- PIJNOS
|         |----- PIJNRM
|         |----- PIJSMD
|         |----- EXCELP  ->
|         |----- JPMA    ->
|         |----- JPMP    ->
|         |----- SYBILP  ->

```

10.2 General Routines Description

10.2.1 ASMDRV

Purpose Main driver for the CP integrator or the response matrix integrator when the J_{\pm} method is used.

Syntax CALL ASMDRV(IPSYS, IPTRK, IPMACR, IFTRAK, CDOOR, IPRNTP,
NGROUP, NBMIX, NREGIO, NANI, LEAKSW, ITRANC,
TITRE, LNORM, LALBS, LR2, IPHASE, ISCATR,
KNORM, CNAME, MATCOD, VOLUME, XSSIGT,
XSSIGW)

Author(s) R. Roy, G. Marleau and A. Hébert

Description of parameters

IPSYS integer scalar variable for accessing the ASMPIJ data structure to be created.

IPTRK integer scalar variable for accessing the TRACKING data structure to be analyzed.

IPMACR integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.

IFTRAK integer scalar variable for accessing the binary tracking file to be analyzed.

CDOOR character*12 scalar variable containing the name of the CP calculation module.

IPRNTP	integer scalar variable describing the amount of information printed by this routine. A value of IPRNTP=0 means that no information will be transferred to the output file. For IPRNTP>1, the region volumes and mixtures will be provided while for IPRNTP>2, the multigroup cross section used are also transferred to the output file.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NANI	integer scalar variable describing the anisotropy level of the flux solution.
LEAKSW	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
ITRANC	integer scalar variable describing the transport correction processing option: <ul style="list-style-type: none"> • ITRANC=0 means that the transport correction is not taken into account; • ITRANC=1 means that the transport correction is computed; • ITRANC=2 means that the transport correction is taken from the MACROLIB or MICROLIB data structure.
TITRE	character*72 scalar variable describing the title of the problem.
LNORM	logical scalar variable defining the option for removing leakage from CP matrix.
LALBS	logical scalar variable defining the option for saving the leakage probabilities.
LR2	logical scalar variable defining the option for keeping the information required for the L_2 norm of the solution.
IPHASE	integer scalar variable describing the type of calculations performed: <ul style="list-style-type: none"> • IPHASE=-1 means that response matrices are computed (possible only for the JPMT: module); • IPHASE=0 means that only standard collision probabilities are computed; • IPHASE=1 means that standard and directional collision probabilities are computed or MICROLIB data structure.
ISCATR	integer scalar variable describing the type of CP matrices saved on the ASMPIJ data structure: <ul style="list-style-type: none"> • ISCATR=0 means that scattering reduced collision probabilities are saved; • ISCATR=1 means that standard collision probabilities are saved or MICROLIB data structure.
KNORM	integer scalar variable describing the type of CP normalization considered: <ul style="list-style-type: none"> • KNORM=0 means that the HELIOS normalization scheme is used; • KNORM=1 means that the Gelbard normalization scheme is used; • KNORM=2 means that the diagonal normalization scheme is used; • KNORM=3 means that the non-linear normalization scheme is used.
CNAME	character*12 scalar variable defining the record name where the CP matrices may be stored when ISCATR=0.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.

VOLUME	real array of dimension VOLUME(NREGION) containing the volume associated with each region in the problem.
XSSIGT	real array of dimension XSSIGT(0:NBMIX) containing the total cross section in a specific energy group associated with the mixtures.
XSSIGW	real array of dimension XSSIGW(0:NBMIX,NANI) containing the within group scattering cross section in a specific energy group associated with the mixtures.

Called by

DRAGON routine(s) : ASM

Calling

DRAGON routine(s) : EXCELP, JPMA, JPMP, PIJCPL, PIJNOS, PIJNRM,
PIJSMD, SYBILP

UTILIB routine(s) : XDRSDB, XDRSET

GANLIB routine(s) : LCMGET, LCMLN, LCMLIB, LCMPUT, LCMSIX, SETARA,
RLSARA, XABORT

10.2.2 PIJCPL

Purpose To compute the total leakage matrix.

Syntax CALL PIJCPL(NREGION, NBMIX, NELPIJ, MATCOD, VOLUME, XSSIGT,
PIJSYM, PIS)

Author(s) G. Marleau

Description of input parameters

NREGION	integer scalar variable describing the number of regions.
NBMIX	integer scalar variable describing the number of mixtures.
NELPIJ	integer scalar variable the number of elements in the symmetric CP matrix.
MATCOD	integer array of dimension MATCOD(NREGION) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGION) containing the volume associated with each region in the problem.
XSSIGT	real array of dimension XSSIGT(0:NBMIX) containing the total cross section in a specific energy group associated with the mixtures.
PIJSYM	real array of dimension PIJSYM(NELPIJ) containing the symmetric CP matrix.

Description of output parameters

PIS real array of dimension PIS(NREGION) containing the total leakage probability.

Called by

DRAGON routine(s) : ASMDRV

10.2.3 PIJNOS

Purpose To compute the reduced CP matrix.

Syntax CALL PIJNOS(NREGION, VOLUME, PIJSYM, PIJSCT)

Author(s) R. Roy

Description of input parameters

NREGION integer scalar variable describing the number of regions.

VOLUME real array of dimension VOLUME(NREGION) containing the volume associated with each region in the problem.

PIJSYM real array of dimension PIJSYM(NELPIJ) containing the symmetric CP matrix.

Description of output parameters

PIJSCT real array of dimension PIJSCT(NREGION,NREGION) containing the reduced CP matrix.

Called by

DRAGON routine(s) : ASMDRV

10.2.4 PIJNRM

Purpose To normalize the CP matrix to force neutron conservation even for leakage cases.

Syntax CALL PIJNRM(NREGION, MATCOD, VOLUME, XSSIGT, PIJSYM, PIS)

Author(s) A. Hébert

Description of input parameters

NREGION integer scalar variable describing the number of regions.

MATCOD integer array of dimension MATCOD(NREGION) containing the mixture associated with each region in the problem.

VOLUME real array of dimension VOLUME(NREGION) containing the volume associated with each region in the problem.

XSSIGT real array of dimension XSSIGT(0:NBMIX) containing the total cross section in a specific energy group associated with the mixtures.

Description of input/output parameters

PIJSYM real array of dimension PIJSYM(NELPIJ) containing the symmetric CP matrix.

Description of work parameters

PIS real array of dimension PIS(NREGION) containing the leakage probability.

Called by

DRAGON routine(s) : ASMDRV

10.2.5 PIJSMD

Purpose To compute the scattering modified CP matrix.

Syntax CALL PIJSMD(IMPX, NBMIX, NREGIO, MATCOD, VOLUME, XSSIGW,
XSSIGT, ILK, PIJSYM, PIJSCT, IOP)

Author(s) G. Marleau

Description of input parameters

IMPX	integer scalar variable describing the amount of information printed by this routine. A value of IMPX=0 means that no information will be transferred to the output file. For IMPX>1, the symmetric and scattering reduced CP matrices are transferred to the output file.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
XSSIGW	real array of dimension XSSIGW(0:NBMIX,NANI) containing the within group scattering cross section in a specific energy group associated with the mixtures.
XSSIGT	real array of dimension XSSIGT(0:NBMIX) containing the total cross section in a specific energy group associated with the mixtures.
ILK	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
PIJSYM	real array of dimension PIJSYM(NELPIJ) containing the symmetric CP matrix.
IOP	integer scalar variable to define the type of collision probabilities: <ul style="list-style-type: none"> • IOP=1 means standard CP matrices; • IOP=4 means directional CP matrices.

Description of output parameters

PIJSCT real array of dimension PIJSCT(NREGIO,NREGIO) containing the scattering modified CP matrix.

Called by

DRAGON routine(s) : ASMDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALSBD

GANLIB routine(s) : XABORT

10.3 Complete Collision Probability Integration Routines

The complete Collision Probability integration routines can be represented by the following tree:

Structure of the complete CP integration routines: STREXCELP

```

EXCELP
|----- PIJAAA
|----- PIJABC
|----- PIJCMP
|----- PIJI2D
|----- PIJI3D
|----- PIJKST
|----- PIJRDG
|----- PIJRGL
|----- PIJRHL
|----- PIJRNL
|----- PIJS2D
|----- PIJS3D
|----- PIJWPR

```

10.3.1 EXCELP

Purpose To compute of the collision probabilities matrix for the complete tracking method.

Syntax CALL EXCELP(IPSYS, IPTRK, IFTRAK, IPRNTP, NREGIO, MATCOD,
VOLUME, NRENOR, NELPIJ, IPIJK, LEAKSW, TITREC,
XSSIGT, PIJ)

Author(s) R. Roy

Description of input parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be created.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
IPRNTP	integer scalar variable describing the amount of information printed by this routine. A value of IPRNTP=0 means that no information will be transferred to the output file. For IPRNTP>1, the region volumes and mixtures will be provided while for IPRNTP>2, the multigroup cross section used are also transferred to the output file.
NREGIO	integer scalar variable describing the number of regions.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
NRENOR	integer scalar variable describing the type of CP normalization considered: <ul style="list-style-type: none"> • NRENOR=0 means that the HELIOS normalization scheme is used; • NRENOR=1 means that the Gelbard normalization scheme is used; • NRENOR=2 means that the diagonal normalization scheme is used; • NRENOR=3 means that the non-linear normalization scheme is used.

NELPIJ	integer scalar variable containing the number of elements in the symmetric CP matrix.
IPIJK	integer scalar variable to define the type of collision probabilities: <ul style="list-style-type: none"> • IPIJK=1 means standard CP matrices; • IPIJK=4 means directional CP matrices.
LEAKSW	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
TITREC	character*72 scalar variable describing the title of the problem.
XSSIGT	real array of dimension XSSIGT(0:NBMIX) containing the total cross section in a specific energy group associated with the mixtures.

Description of output parameters

PIJ	real array of dimension PIJ(NELPIJ,IPIJK) containing the symmetric CP matrix.
-----	---

Called by

DRAGON routine(s) : ASMDRV, SHIPIJ, SPHTRA

Calling

DRAGON routine(s) : PIJAAA, PIJABC, PIJCMP, PIJI2D, PIJI3D, PIJKST,
PIJRDG, PIJRGL, PIJRHL, PIJRNL, PIJS2D, PIJS3D,
PIJWPR

UTILIB routine(s) : ALGPT, XDRSET

GANLIB routine(s) : LCMGET, LCMLN, LCMPUT, SETARA, RLSARA, XABORT

10.3.2 PIJAAA

Purpose To compute the directional CP for all zones eliminating surfaces from the system.

Syntax CALL PIJAAA(NREG, NSOUT, SIGTAL, PROB, PSVT, PROBS)

Author(s) I. Petrovic

Description of input parameters

NREG	integer scalar variable describing the number of zones in the geometry.
NSOUT	integer scalar variable containing the number of surfaces in the geometry.
SIGTAL	real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.
PROB	real array of dimension PROB(NPRB) containing the directional symmetric escape, leakage and collision probability matrix.

Description of output parameters

PROBS	real array of dimension PROBS(3*NNREG) containing the directional CP matrix.
-------	--

Description of work parameters

PSVT double precision array of dimension PSVT(NSOUT,NREG) the leakage matrix.

Called by

DRAGON routine(s) : EXCELP

10.3.3 PIJABC

Purpose To compute the complete standard CP for all zones eliminating surfaces from the system using the boundary conditions.

Syntax CALL PIJABC(NREG, NSOUT, NPRB, SIGTAL, MATRT, PROB,
IDL, PSST, PSVT)

Author(s) R. Roy

Description of input parameters

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT integer scalar variable describing the number of surfaces in the geometry.

NPRB integer scalar variable describing the number of elements in the escape, leakage and collision probability matrix.

SIGTAL real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.

MATRT integer array of dimension MATRT(NSOUT) containing the reflection/transmission vector.

Description of input/output parameters

PROB real array of dimension PROB(NPRB) containing the symmetric escape, leakage and collision probability matrix.

Description of work parameters

IDL integer array of dimension IDL(NSOUT) containing the position in the diagonal elements in the CP matrix.

PSST double precision array of dimension PSST(NSOUT,NSOUT) containing the escape matrix.

PSVT double precision array of dimension PSVT(NSOUT,NREG) containing the leakage matrix.

Called by

DRAGON routine(s) : EXCELP

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALINVD

GANLIB routine(s) : XABORT

10.3.4 PIJCMP

Purpose To compress the CP matrix in its symmetric format.

Syntax CALL PIJCMP(NREG, NSOUT, NCOR, DPR, PROB)

Author(s) R. Roy

Description of parameters

NREG integer scalar variable describing the number of zones in the geometry.
 NSOUT integer scalar variable describing the number of surfaces in the geometry.
 NCOR integer scalar variable describing the maximum number of corners.
 DPR double precision array of dimension DPR(-NSOUT:NREG,-NSOUT:NREG) containing the escape, leakage and collision probability matrix.

Description of input/output parameters

PROB real array of dimension PROB(NPRB) containing symmetric escape, leakage and collision probability matrix.

Called by

DRAGON routine(s) : EXCELP

10.3.5 PIJI2D

Purpose To integrate the general 2–D CP matrices with isotropic tracking using Bickley functions of order 1,2,3 for the standard CP matrices and the Bickley functions of order 3,4,5 for the directional CP matrices.

Syntax CALL PIJI2D(IFTRAK, NREG, NSOUT, NTRK, MXSEG, NCOR,
 SWVOID, SIGTAL, SEGLEN, NRSEG, SEGPAT, DPR,
 MKI0, BIN0, PAS0, XLM0, L0, MKI1, BIN1,
 PAS1, XLM1, L1, MKI2, BIN2, PAS2,
 XLM2, L2)

Author(s) G. Marleau and R. Roy

Description of input parameters

IFTRAK integer scalar variable for accessing the binary tracking file to be analyzed.
 NREG integer scalar variable describing the number of zones in the geometry.
 NSOUT integer scalar variable describing the number of surfaces in the geometry.
 NTRK integer scalar variable describing the number of integration lines on the binary tracking file.
 MXSEG integer scalar variable describing the maximum length of the integration lines on the binary tracking file.
 NCOR integer scalar variable describing the maximum number of corners.
 SWVOID logical scalar variable indicating the presence (.TRUE.) or absence (.FALSE.) of voided zones.

SIGTAL	real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.
MKI0	integer scalar variable containing the number of elements in the first quadratic Bickley table.
BIN0	real array of dimension BIN0(0:MKI0,3) containing the first quadratic Bickley table.
PAS0	real scalar variable containing the spacing the first quadratic Bickley table.
XLM0	real scalar variable containing the maximum value for logarithmic expansion in the first quadratic Bickley table.
L0	integer scalar variable the order for logarithmic expansion in the first quadratic Bickley table.
MKI1	integer scalar variable containing the number of elements in the second quadratic Bickley table.
BIN1	real array of dimension BIN1(0:MKI1,3) containing the second quadratic Bickley table.
PAS1	real scalar variable containing the spacing of the second quadratic Bickley table.
XLM1	real scalar variable the maximum value for logarithmic expansion in the second quadratic Bickley table.
L1	integer scalar variable the order for logarithmic expansion in the second quadratic Bickley table.
MKI2	integer scalar variable containing the number of elements in the second quadratic Bickley table.
BIN2	real array of dimension BIN2(0:MKI2,3) containing the third quadratic Bickley table.
PAS2	real scalar variable containing the spacing of the third quadratic Bickley table.
XLM2	real scalar variable the maximum value for logarithmic expansion in the third quadratic Bickley table.
L2	integer scalar variable for logarithmic expansion in the third quadratic Bickley table.

Description of output parameters

DPR	double precision array of dimension DPR(-NSOUT:NREG,-NSOUT:NREG) containing the escape, leakage and collision probability matrix.
-----	---

Description of work parameters

SEGLN	real array of dimension SEGLN(MXSEG) containing the segment length for an integration line.
NRSEG	integer array of dimension NRSEG(MXSEG) containing surfaces and zone identification for an integration line.
SEGPAT	real array of dimension SEGPAT(MXSEG) containing the optical path for an integration line.

Called by

DRAGON routine(s) : EXCELP

10.3.6 PIJ3D

Purpose To integrate the general 3-D CP matrices with isotropic tracking.

Syntax CALL PIJ3D(IFTRAK, NREG, NSOUT, NTRK, MXSEG, NCOR,
 SWVOID, SIGTAL, PROB, SEGLEN, NRSEG, STAYIN,
 GOSOUT, DPR)

Author(s) R. Roy and G. Marleau

Description of input parameters

IFTRAK integer scalar variable for accessing the binary tracking file to be analyzed.

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT integer scalar variable describing the number of surfaces in the geometry.

NTRK integer scalar variable describing the number of integration lines on the binary tracking file.

MXSEG integer scalar variable describing the maximum length of the integration lines on the binary tracking file.

NCOR integer scalar variable describing the maximum number of corners.

SWVOID logical scalar variable indicating the presence (**.TRUE.**) or absence (**.FALSE.**) of voided zones.

SIGTAL real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.

Description of output parameters

PROB real array of dimension PROB(NPLEN) containing the symmetrized escape, leakage and collision probability matrix.

Description of work parameters

SEGLEN real array of dimension SEGLEN(MXSEG) containing the segment length for an integration line.

NRSEG integer array of dimension NRSEG(MXSEG) containing the surfaces and zone identification for an integration line.

STAYIN real array of dimension STAYIN(MXSEG) containing the stay-in zone probability.

GOSOUT real array of dimension GOSOUT(MXSEG) containing the goes-in zone probability.

DPR double precision array of dimension DPR(-NSOUT:NREG,-NSOUT:NREG) containing the escape, leakage and collision probability matrix.

Called by

DRAGON routine(s) : EXCELP

10.3.7 PIJKST

Purpose To evaluate the PIJK* directional collision probability.

Syntax CALL PIJKST(IMPX, NREGIO, PIJSYM, PIJKS, PIJSCT)

Author(s) G. Marleau and I. Petrovic

Description of input parameters

IMPX integer scalar variable describing the amount of information printed by this routine. A value of IMPX=0 means that no information will be transferred to the output file. For IMPX>7, the PIJK* are transferred to the output file.

NREGIO integer scalar variable describing the number of regions.

PIJSYM real array of dimension PIJSYM(NELPIJ) containing the symmetric CP matrix.

Description of output parameters

PIJKS real array of dimension PIJKS(NREGIO,NREGIO,3) containing the PIJK* directional collision probability.

Description of work parameters

PIJSCT real array of dimension PIJSCT(NREGIO,2*NREGIO) used for temporary storage.

Called by

DRAGON routine(s) : EXCELP

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALSBD

GANLIB routine(s) : XABORT

10.3.8 PIJRDG

Purpose To normalize the collision probabilities using the diagonal scheme.

Syntax CALL PIJRDG(IPRT, NREG, NSOUT, SIGTAL, PROB)

Author(s) R. Roy

Description of input parameters

IPRT integer scalar variable describing the amount of information printed by this routine. Not used in the routine.

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT integer scalar variable describing the number of surfaces in the geometry.

SIGTAL real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.

Description of input/output parameters

PROB real array of dimension PROB(NPLEN) containing the symmetrized escape, leakage and collision probability matrix.

Called by

DRAGON routine(s) : EXCELP

10.3.9 PIJRGL

Purpose To normalize the collision probabilities using the Gelbard scheme.

Syntax CALL PIJRGL(IPRT, NREG, NSOUT, SIGTAL, PROB, RI)

Author(s) R. Roy

Description of input parameters

IPRT integer scalar variable describing the amount of information printed by this routine. The normalization factor computed are transferred to the output file if $IPRT > 3$.

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT integer scalar variable describing the number of surfaces in the geometry.

SIGTAL real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.

Description of input/output parameters

PROB real array of dimension PROB(NPLEN) containing the symmetrized escape, leakage and collision probability matrix.

Description of work parameters

RI real array of dimension RI(-NSOUT:NREG) used for temporary storage.

Called by

DRAGON routine(s) : EXCELP

10.3.10 PIJRHL

Purpose To normalize the collision probabilities using the HELIOS scheme.

Syntax CALL PIJRHL(IPRT, NREG, NSOUT, SIGTAL, PROB, CHI, WEIG)

Author(s) R. Roy

Description of input parameters

IPRT integer scalar variable describing the amount of information printed by this routine. The normalization factor computed are transferred to the output file if $IPRT > 2$.

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT integer scalar variable describing the number of surfaces in the geometry.

SIGTAL real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.

Description of input/output parameters

PROB real array of dimension PROB(NPLEN) containing the symmetrized escape, leakage and collision probability matrix.

Description of work parameters

CHI real array of dimension CHI(-NSOUT:NREG) used for temporary storage.

WEIG real array of dimension WEIG(-NSOUT:NREG,3) used for temporary storage.

Called by

DRAGON routine(s) : EXCELP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

10.3.11 PIJRNL

Purpose To normalize the collision probabilities using the non-linear scheme.

Syntax CALL PIJRNL(IPRT, NREG, NSOUT, SIGTAL, PROB, CIJ,
 WSPACE, WFSP, IDL, WEIG)

Author(s) R. Roy

Description of input parameters

IPRT integer scalar variable describing the amount of information printed by this routine. The normalization factor computed are transferred to the output file if IPRT>100.

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT integer scalar variable describing the number of surfaces in the geometry.

SIGTAL real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.

Description of input/output parameters

PROB real array of dimension PROB(NPLEN) containing the symmetrized escape, leakage and collision probability matrix.

Description of work parameters

CIJ real array of dimension CIJ(NPLEN) used for temporary storage.

WSPACE real array of dimension WSPACE(NPLEN) used for temporary storage.

WFSP real array of dimension WFSP(-NSOUT:NREG) used for temporary storage.

IDL integer array of dimension IDL(NPLEN) used for temporary storage.

WEIG real array of dimension WEIG(-NSOUT:NREG) used for temporary storage.

Called by

DRAGON routine(s) : EXCELP

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLDLF, ALLDLS

GANLIB routine(s) :

10.3.12 PIJS2D

Purpose To integrate the general 2–D CP matrices with specular tracking.

Syntax CALL PIJS2D(IFTRAK, NREG, NSOUT, NTRK, MXSEG, RCUTOF,
NGSS, SIGANG, XGSS, WGSS, PROB, SEGLEN,
NRSEG, STAYIN, GOSOUT, DPR)

Author(s) R. Roy

Description of input parameters

IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
NREG	integer scalar variable describing the number of zones in the geometry.
NSOUT	integer scalar variable describing the number of surfaces in the geometry.
NTRK	integer scalar variable describing the number of integration lines on the binary tracking file.
MXSEG	integer scalar variable describing the maximum length of the integration lines on the binary tracking file.
RCUTOF	real scalar variable describing the mean free path cutoff factor.
NGSS	integer scalar variable describing the number of Gauss integration points.
SIGANG	real array of dimension SIGANG(NGSS,-NSOUT:NREG) containing the albedo and the transport corrected total cross section.
XGSS	real array of dimension XGSS(MXGAUS) containing the Gauss integration points.
WGSS	real array of dimension WGSS(MXGAUS) containing the Gauss integration weights.

Description of output parameters

PROB	real array of dimension PROB(NPLEN) containing the symmetrized escape, leakage and collision probability matrix.
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Description of work parameters

SEGLEN	real array of dimension SEGLEN(MXSEG) containing the segment length for an integration line.
NRSEG	integer array of dimension NRSEG(MXSEG) containing surfaces and zone identification for an integration line.
STAYIN	real array of dimension STAYIN(MXSEG) containing the stay-in zone probability.
GOSOUT	real array of dimension GOSOUT(MXSEG) containing the goes-in zone probability.

DPR double precision array of dimension DPR(-NSOUT:NREG,-NSOUT:NREG) containing the escape, leakage and collision probability matrix.

Called by

DRAGON routine(s) : EXCELP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

10.3.13 PIJS3D

Purpose To integrate the general 3-D CP matrices with specular tracking.

Syntax CALL PIJS3D(IFTRAK, NREG, NSOUT, NTRK, MXSEG, RCUTOF,
SIGTAL, PROB, SEGLEN, NRSEG, STAYIN, GOSOUT,
DPR)

Author(s) R. Roy

Description of input parameters

IFTRAK integer scalar variable for accessing the binary tracking file to be analyzed.

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT integer scalar variable describing the number of surfaces in the geometry.

NTRK integer scalar variable describing the number of integration lines on the binary tracking file.

MXSEG integer scalar variable describing the maximum length of the integration lines on the binary tracking file.

RCUTOF real scalar variable describing the mean free path cutoff factor.

SIGTAL real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.

Description of output parameters

PROB real array of dimension PROB(NPLEN) containing the symmetrized escape, leakage and collision probability matrix.

Description of work parameters

SEGLEN real array of dimension SEGLEN(MXSEG) containing the segment length for an integration line.

NRSEG integer array of dimension NRSEG(MXSEG) containing surfaces and zone identification for an integration line.

STAYIN real array of dimension STAYIN(MXSEG) containing the stay-in zone probability.

GOSOUT real array of dimension GOSOUT(MXSEG) containing the goes-in zone probability.

DPR double precision array of dimension DPR(-NSOUT:NREG,-NSOUT:NREG) containing the escape, leakage and collision probability matrix.

Called by

DRAGON routine(s) : EXCELP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

10.3.14 PIJWPR

Purpose To print the escape, leakage and collision probability matrices.

Syntax CALL PIJWPR(LOPT, NREG, NSOUT, SIGTAL, PROB, SIGVOL, MSYM)

Author(s) R. Roy

Description of input parameters

LOPT	integer scalar variable describing the printing format: <ul style="list-style-type: none"> • LOPT=0 print escape, leakage and collision probability matrix; • LOPT=1 print only collision probability matrix.
NREG	integer scalar variable describing the number of zones in the geometry.
NSOUT	integer scalar variable describing the number of surfaces in the geometry.
SIGTAL	real array of dimension SIGTAL(-NSOUT:NREG) containing the albedo and the transport corrected total cross section.
PROB	real array of dimension PROB(NPLEN) containing the symmetrized escape, leakage and collision probability matrix.
SIGVOL	real array of dimension SIGVOL(NREG) containing the product of the region volume and the transport corrected total cross section.
MSYM	integer scalar variable describing the type of probabilities matrix considered: <ul style="list-style-type: none"> • MSYM=0 means that the matrix is symmetric; • MSYM=1 means that the matrix is full.

Called by

DRAGON routine(s) : EXCELP

10.4 Interface Current Integration Routines

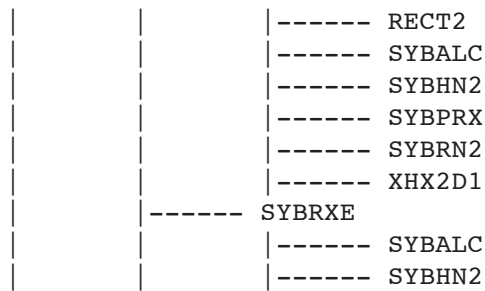
The interface current integration routines can be represented by the following tree:

Structure of the interface current CP integration routines: STRSYBILP

```

SYBILP
|----- SYBCP1
|
|----- SYBALC
|----- SYBALP
|----- SYBALS
|----- SYBHT1
|
|----- SYBALC
|----- SYBALS
|
|----- SYBHT2
|----- SYBRX2
|
|----- SYBALC
|----- SYBPRX
|
|----- SYBRX3
|
|----- SYBALC
|----- SYBPRX
|
|----- SYBRX4
|
|----- RECT1
|----- SYBALC
|----- SYBHN1
|----- SYBPRX
|----- SYBRN1
|----- XHX2D0
|
|----- SYBRX5
|
|----- RECT2
|----- SYBALC
|----- SYBHN2
|----- SYBPRX
|----- SYBRN2
|----- XHX2D1
|
|----- SYBRXE
|
|----- SYBALC
|----- SYBHN2
|
|----- SYBCP2
|
|----- SYBALC
|----- SYBALP
|----- SYBALS
|----- SYBRX2
|
|----- SYBALC
|----- SYBPRX
|
|----- SYBRX3
|
|----- SYBALC
|----- SYBPRX
|
|----- SYBRX4
|
|----- RECT1
|----- SYBALC
|----- SYBHN1
|----- SYBPRX
|----- SYBRN1
|----- XHX2D0
|
|----- SYBRX5

```



10.4.1 SYBILP

Purpose To compute of the collision probabilities matrix using the interface current method.

Syntax CALL SYBILP(IPSYS , IPTRK , IFTRAK, IMPX , NREG , MAT , VOL , KNORM , NELPIJ, IPIJK , ILK , TITR , SIGT0 , PIJ)

Author(s) A. Hébert

Description of input parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be created.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
IMPX	integer scalar variable containing the print flag.
NREG	integer scalar variable describing the number of regions.
MAT	integer array of dimension MAT(NREG) containing the mixture associated with each region in the problem.
VOL	real array of dimension VOL(NREG) containing the volume associated with each region in the problem.
KNORM	integer scalar variable that is not used.
NELPIJ	integer scalar variable containing the number of elements in the symmetric CP matrix.
IPIJK	integer scalar variable to define the type of collision probabilities: <ul style="list-style-type: none"> • IPIJK=1 means standard CP matrices; • IPIJK=4 means directional CP matrices.
ILK	logical scalar variable containing the flag (. TRUE .) for neutron leakage through external boundary.
TITR	character*(72) scalar variable containing the title.
SIGT0	real array of dimension SIGT0(*) containing the total macroscopic cross sections ordered by mixture.
PIJ	real array of dimension PIJ(NELPIJ) containing the reduced and symmetric collision probabilities.

Called by

DRAGON routine(s) : ASMDRV, SHIPIJ, SPHTRA

Calling

DRAGON routine(s) : SYBCP1

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, RLSARA, SETARA

10.4.2 SYBALC

Purpose To compute the collision probability using the method of Kavenoky in annular geometry.

Syntax CALL SYBALC(NPIJ, MAXPTS, RAYRE, SIGT, PIJ, MR,
ALBEDO, AUXI)

Author(s) A. Hébert

Description of input parameters

NPIJ integer scalar variable containing the number of regions.
 MAXPTS integer scalar variable containing the first dimension of the reduced collision probability matrix.
 RAYRE real array of dimension RAYRE(*) containing the radius of regions.
 SIGT real array of dimension SIGT(*) containing the total cross section.
 MR integer scalar variable containing the containing the number of gauss points.
 ALBEDO real scalar variable containing the containing the outside albedo.

Description of output parameters

PIJ real array of dimension PIJ(MAXPTS,NPIJ) containing the reduced collision probability matrix.

Description of work parameters

AUXI real array of dimension AUXI(*) used for temporary storage.

Called by

DRAGON routine(s) : SYBCP1, SYBCP2, SYBHT1, SYBRX2, SYBRX3, SYBRX4, SYBRX5, SYBRXE

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGPT, TABKI

GANLIB routine(s) : XABORT

10.4.3 SYBALP

Purpose To compute the collision probability using the method of Kavenoky in slab geometry.

Syntax CALL SYBALP(NPIJ, MAXPTS, Y, SIGT, PIJ, ALBG,
 ALBD, AUXI, X, IND, INDV)

Author(s) A. Hébert

Description of input parameters

NPIJ integer scalar variable containing the number of regions.
MAXPTS integer scalar variable containing the first dimension of the reduced collision probability matrix.
Y real array of dimension Y(*) containing the 1-D Cartesian mesh.
SIGT real array of dimension SIGT(*) containing the total cross section.
MR integer scalar variable containing the containing the number of gauss points.
ALBEDO real scalar variable containing the containing the outside albedo.
ALBG real scalar variable containing the containing the left albedo.
ALBD real scalar variable containing the containing the right albedo.

Description of output parameters

PIJ real array of dimension PIJ(MAXPTS,NPIJ) containing the reduced collision probability matrix.

Description of work parameters

AUXI real array of dimension AUXI(*) used for temporary storage.
X real array of dimension X(NPIJ+1) used for temporary storage.
IND integer array of dimension IND(NPIJ+1) used for temporary storage.
INDV integer array of dimension INDV(NPIJ+1) used for temporary storage.

Called by

DRAGON routine(s) : SYBCP1, SYBCP2

Calling

DRAGON routine(s) :

UTILIB routine(s) : TABEN

GANLIB routine(s) : XABORT

10.4.4 SYBALS

Purpose To compute the collision probability using the method of Kavenoky in spherical geometry.

Syntax CALL SYBALS(N, MAXPTS, R, SIGT, PIJ, MR,
 ALBG, S)

Author(s) A. Hébert

Description of input parameters

N	integer scalar variable containing the number of regions.
MAXPTS	integer scalar variable containing the first dimension of the reduced collision probability matrix.
R	real array of dimension R(*) containing the radius of regions.
SIGT	real array of dimension SIGT(*) containing the total cross section.
MR	integer scalar variable containing the containing the number of gauss points.
ALBG	real scalar variable containing the containing the outside albedo.

Description of output parameters

PIJ	real array of dimension PIJ(MAXPTS,N) containing the reduced collision probability matrix.
-----	--

Description of work parameters

S	real array of dimension S(*) used for temporary storage.
---	--

Called by

DRAGON routine(s) : SYBCP1, SYBCP2, SYBHT1

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGPT

GANLIB routine(s) : XABORT

10.4.5 SYBCP1

Purpose To compute the collision probabilities for SYBIL.

Syntax CALL SYBCP1(IPTRK, ITG, IMPX, NREG, SIGT, PIJ)

Author(s) A. Hébert

Description of parameters

IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
ITG	integer scalar variable containing the type of SYBIL module.
IMPX	integer scalar variable containing the print flag.
NREG	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections ordered by volume.
PIJ	real array of dimension PIJ(NREG,*) containing the reduced collision probabilities matrix.

Called by

DRAGON routine(s) : SYBILP

Calling

DRAGON routine(s) : SYBALC, SYBALP, SYBALS, SYBCP2, SYBHT1, SYBHT2, SYBRX2, SYBRX3, SYBRX4, SYBRX5, SYBRXE

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMSIX, SETARA, RLSARA, XABORT

10.4.6 SYBCP2

Purpose To compute the collision probabilities for SYBIL.

Syntax CALL SYBCP2(IPTRK, ITG, IMPX, NREG, SIGT, PIJ)

Author(s) A. Hébert

Description of parameters

IPTRK integer scalar variable for accessing the TRACKING data structure to be analyzed.

ITG integer scalar variable containing the type of SYBIL module.

IMPX integer scalar variable containing the print flag.

NREG integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.

SIGT real array of dimension SIGT(*) containing the total macroscopic cross sections ordered by volume.

PIJ real array of dimension PIJ(NREG,*) containing the reduced collision probabilities matrix.

Called by

DRAGON routine(s) : SYBCP1

Calling

DRAGON routine(s) : SYBALC, SYBALP, SYBALS, SYBRX2, SYBRX3, SYBRX4, SYBRX5, SYBRXE

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMSIX, SETARA, RLSARA, XABORT

10.4.7 SYBHN1

Purpose To compute the DP_0 leakage and transmission probabilities for heterogeneous hexagonal 2-D geometries.

Syntax CALL SYBHN1(NR, Z, ZI, COTE, SIGT, TRONC, R, LGZERO, PIS, PSS)

Author(s) M. Ouisloumen

Description of input parameters

NR integer scalar variable containing the number regions in the cell.

Z real array of dimension Z(*) containing the real integration information.

ZI integer array of dimension ZI(*) containing the integer integration information.
COTE real scalar variable containing the length of one of sides of the hexagon.
SIGT real array of dimension SIGT(*) containing the total cross sections.
TRONC real scalar variable containing the voided block cutoff criterion.
R real array of dimension R(*) containing the radius of the tubes.

Description of output parameters

PIS real array of dimension PIS(6,*) containing the leakage probability.
PSS real array of dimension PSS(6,*) containing the transmission probability.

Description of work parameters

LGZERO logical array of dimension LGZERO(*) containing the flag (.TRUE.) for voided regions.

Called by

DRAGON routine(s) : SYBRX4

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) :

10.4.8 SYBHN2

Purpose To compute the DP_1 leakage and transmission probabilities for heterogeneous hexagonal 2-D geometries.

Syntax CALL SYBHN2(NR, Z, ZI, COTE, SIGT, TRONC, R, LGZERO, PIS, PSS)

Author(s) M. Ouisloumen

Description of input parameters

NR integer scalar variable containing the number regions in the cell.
Z real array of dimension Z(*) containing the real integration information.
ZI integer array of dimension ZI(*) containing the integer integration information.
COTE real scalar variable containing the length of one of sides of the hexagon.
SIGT real array of dimension SIGT(*) containing the total cross sections.
TRONC real scalar variable containing the voided block cutoff criterion.
R real array of dimension R(*) containing the radius of the tubes.

Description of output parameters

PIS real array of dimension PIS(6,*) containing the leakage probability.

PSS real array of dimension PSS(6,*) containing the transmission probability.

Description of work parameters

LGZERO logical array of dimension LGZERO(*) containing the flag (.TRUE.) for voided regions.

Called by

DRAGON routine(s) : SYBRX5

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) :

10.4.9 SYBHT1

Purpose To begin the calculation of the the reduced collision probabilities for the double heterogeneity option of SYBIL.

Syntax CALL SYBHT1(IR, IPAS, SIGT, IPAS2, NG, NSMAX,
MICRO, IQUAD, NS, IBI, RS, FRACT,
VOLK, P, RRRR, SIGT0, QKDEL, QKN)

Author(s) A. Hébert

Description of input/output parameters

IR integer scalar variable containing the number of mixtures in the domain.

IPAS integer scalar variable containing the number of volumes in the composite geometry.

SIGT real array of dimension SIGT(*) containing the total macroscopic cross sections in each volume of the composite geometry.

IPAS2 integer scalar variable containing the number of volumes in the macro geometry.

NG integer scalar variable containing the number of different kind of micro structures.

NSMAX integer scalar variable containing the maximum number of volumes in each kind of micro structure.

MICRO integer scalar variable containing the type of micro volumes.

IQUAD integer scalar variable containing the quadrature parameter for the treatment of the micro volumes.

NS integer array of dimension NS(*) containing the number of volumes in each kind of micro structure.

IBI integer array of dimension IBI(*) containing the type of mixture in each volume of the macro geometry.

RS real array of dimension RS(NSMAX+1,*) containing the radius of the micro volumes.

FRACT real array of dimension FRACT(NG,*) containing the volume fractions of the micro volumes.

VOLK real array of dimension VOLK(NG,*) containing the volume fractions of the tubes or shells in the micro volumes.

P	real array of dimension P(IPAS,*) containing the reduced collision probabilities for the composite geometry.
SIGT0	real array of dimension SIGT0(*) containing the equivalent macroscopic cross section in each macro volume.

Description of work parameters

RRRR	real array of dimension RRRR(*) used for temporary storage.
QKDEL	real array of dimension QKDEL(NG,*) used for temporary storage.
QKN	real array of dimension QKN(NSMAX,*) used for temporary storage.

Called by

DRAGON routine(s) : SYBCP1

Calling

DRAGON routine(s) : SYBALC, SYBALS

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

10.4.10 SYBHT2

Purpose To finish the calculation of the the reduced collision probabilities for the double heterogeneity option of SYBIL

Syntax CALL SYBHT2(IR, IPAS, IPAS2, NG, NSMAX, NS,
IBI, FRACT, VOLK, P, RRRR, SIGT0,
QKDEL, PIL)

Author(s) A. Hébert

Description of input/output parameters

IR	integer scalar variable containing the number of mixtures in the domain.
IPAS	integer scalar variable containing the number of volumes in the composite geometry.
IPAS2	integer scalar variable containing the number of volumes in the macro geometry.
NG	integer scalar variable containing the number of different kind of micro structures.
NSMAX	integer scalar variable containing the maximum number of volumes in each kind of micro structure.
NS	integer array of dimension NS(*) containing the number of volumes in each kind of micro structure.
IBI	integer array of dimension IBI(*) containing the type of mixture in each volume of the macro geometry.
FRACT	real array of dimension FRACT(NG,*) containing the volume fractions of the micro volumes.
VOLK	real array of dimension VOLK(NG,*) containing the volume fractions of the tubes or shells in the micro volumes.

P	real array of dimension P(IPAS,*) containing the reduced collision probabilities for the composite geometry.
SIGT0	real array of dimension SIGT0(*) containing the equivalent macroscopic cross section in each macro volume.
PIL	real array of dimension PIL(IPAS2,*) containing the reduced collision probabilities between the macro volumes.

Description of work parameters

RRRR	real array of dimension RRRR(*) used for temporary storage.
QKDEL	real array of dimension QKDEL(NG,*) used for temporary storage.

Called by

DRAGON routine(s) : SYBCP1

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) :

10.4.11 SYBPRX

Purpose To print the cell-wise collision probabilities in SYBIL module.

Syntax CALL SYBPRX(NCOUR, IPAS, IKG, SIGT, P, PIS, PSS)

Author(s) A. Hébert

Description of parameters

NCOUR	integer scalar variable containing the number of outer surfaces.
IPAS	integer scalar variable containing the total number of volumes.
IKG	integer scalar variable containing the generating cell number.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
P	real array of dimension P(IPAS,*) containing the reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface probabilities.
PSS	real array of dimension PSS(NCOUR,*) containing the surface to surface probabilities.

Called by

DRAGON routine(s) : SYBRX2, SYBRX3, SYBRX4, SYBRX5, SYBRXE

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) :

10.4.12 SYBRN1

Purpose To integrate the escape and transmission probabilities of a 2-D Cartesian crown with DP_0 surface angular flux expansion on the external boundary.

Syntax CALL SYBRN1(NZ, A, B, Z, IZ, RAYRE,
SIGT, TRONC, PVS, PSS)

Author(s) A. Hébert

Description of input parameters

NZ	integer scalar variable containing the number of regions in the cell.
A	real scalar variable containing the dimension of the external x side.
B	real scalar variable containing the dimension of the external y side.
Z	real array of dimension Z(*) containing the real tracking information.
IZ	integer array of dimension IZ(*) containing the integer tracking information.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross section.
TRONC	real scalar variable containing the voided block criterion.

Description of output parameters

PVS	real array of dimension PVS(4,*) containing the volume to surface probabilities.
PSS	real array of dimension PSS(4,*) containing the surface to surface probabilities.

Called by

DRAGON routine(s) : SYBRX4

Calling

DRAGON routine(s) :

UTILIB routine(s) : TABKI

GANLIB routine(s) :

10.4.13 SYBRN2

Purpose To integrate the escape and transmission probabilities of a 2-D Cartesian crown with DP_1 surface angular flux expansion on the external boundary.

Syntax CALL SYBRN2(NZ, A, B, Z, IZ, RAYRE,
 SIGT, TRONC, PVS, PSS)

Author(s) A. Hébert

Description of input parameters

NZ integer scalar variable containing the number of regions in the cell.
A real scalar variable containing the dimension of the external x side.
B real scalar variable containing the dimension of the external y side.
Z real array of dimension Z(*) containing the real tracking information.
IZ integer array of dimension IZ(*) containing the integer tracking information.
RAYRE real array of dimension RAYRE(*) containing the radius of the tubes.
SIGT real array of dimension SIGT(*) containing the total macroscopic cross section.
TRONC real scalar variable containing the voided block criterion.

Description of output parameters

PVS real array of dimension PVS(12,*) containing the volume to surface probabilities.
PSS real array of dimension PSS(12,*) containing the surface to surface probabilities.

Called by

DRAGON routine(s) : SYBRX4

Called by

DRAGON routine(s) : SYBRX5

Calling

DRAGON routine(s) :

UTILIB routine(s) : TABKI

GANLIB routine(s) :

10.4.14 SYBRX2

Purpose To compute the reduced collision probabilities in a 2-D Cartesian or hexagonal assembly using the interface current method with Roth approximation.

Syntax CALL SYBRX2(IPAS, SIGT, P, IMPX, NCOUR, IWIGN,
 NMCEL, NMERGE, NGEN, IQUAD, XX, YY,
 NMC, RAYRE, IFR, ALB, INUM, MIX, DVX,
 IGEN, PIS, PSS, PSSB, SIGT2, SCALE1,
 SCALE2, ROUT)

Author(s) A. Hébert

Description of input/output parameters

IPAS	integer scalar variable containing the total number of volumes.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
P	real array of dimension P(IPAS,*) containing the reduced collision probabilities.
IMPX	integer scalar variable containing the print flag.
NCOUR	integer scalar variable containing the number of outer surfaces.
IWIGN	integer scalar variable containing the type of cylinderization.
NMCEL	integer scalar variable containing the total number of cells in the domain.
NMERGE	integer scalar variable containing the total number of merged cells for which. specific values of the neutron flux and reactions rates are required.
NGEN	integer scalar variable containing the total number of generating cells.
IQUAD	integer array of dimension IQUAD(*) containing the quadrature parameters.
XX	real array of dimension XX(*) containing the x thickness of the generating cells.
YY	real array of dimension YY(*) containing the y thickness of the generating cells.
NMC	integer array of dimension NMC(*) containing the offset of the first volume in each generating cell.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in each generating cell.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.
INUM	integer array of dimension INUM(*) containing the index-number of the merged cell associated to each cell.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating cell associated with each merged cell.

Description of work parameters

PIS	real array of dimension PIS(*) used for temporary storage.
PSS	real array of dimension PSS(*) used for temporary storage.
PSSB	real array of dimension PSSB(NMERGE,*) used for temporary storage.
SIGT2	real array of dimension SIGT2(*) used for temporary storage.
SCALE1	real array of dimension SCALE1(*) used for temporary storage.
SCALE2	real array of dimension SCALE2(*) used for temporary storage.
ROUT	real array of dimension ROUT(*) used for temporary storage.

Called by

DRAGON routine(s) : SYBCP1, SYBCP2

Calling

DRAGON routine(s) : SYBALC, SYBPRX

UTILIB routine(s) : ALSB

GANLIB routine(s) : SETARA, RLSARA, XABORT

10.4.15 SYBRX3

Purpose To compute the reduced collision probabilities in a 2-D Cartesian or hexagonal assembly using the interface current method with Roth-4 or Roth-6 approximation.

Syntax CALL SYBRX3(IPAS, SIGT, P, IMPX, NCOUR, IWIGN,
NMCEL, NMERGE, NGEN, IJAT, IQUAD, XX,
YY, NMC, RAYRE, IFR, ALB, INUM, MIX,
DVX, IGEN, PIS, PSS, PSSB, SIGT2,
SCALE1, SCALE2, ROUT)

Author(s) A. Hébert

Description of input/output parameters

IPAS	integer scalar variable containing the total number of volumes.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
P	real array of dimension P(IPAS,*) containing the reduced collision probabilities.
IMPX	integer scalar variable containing the print flag.
NCOUR	integer scalar variable containing the number of outer surfaces.
IWIGN	integer scalar variable containing the type of cylinderization.
NMCEL	integer scalar variable containing the total number of cells in the domain.
NMERGE	integer scalar variable containing the total number of merged cells for which specific values of the neutron flux and reactions rates are required.
NGEN	integer scalar variable containing the total number of generating cells.
IJAT	integer scalar variable containing the total number of distinct out-currents.
IQUAD	integer array of dimension IQUAD(*) containing the quadrature parameters.
XX	real array of dimension XX(*) containing the x thickness of the generating cells.
YY	real array of dimension YY(*) containing the y thickness of the generating cells.
NMC	integer array of dimension NMC(*) containing the offset of the first volume in each generating cell.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in each generating cell.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.

INUM	integer array of dimension INUM(*) containing the index-number of the merged cell associated to each cell.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating cell associated with each merged cell.

Description of work parameters

PIS	real array of dimension PIS(*) used for temporary storage.
PSS	real array of dimension PSS(*) used for temporary storage.
PSSB	real array of dimension PSSB(IJAT,*) used for temporary storage.
SIGT2	real array of dimension SIGT2(*) used for temporary storage.
SCALE1	real array of dimension SCALE1(*) used for temporary storage.
SCALE2	real array of dimension SCALE2(*) used for temporary storage.
ROUT	real array of dimension ROUT(*) used for temporary storage.

Called by

DRAGON routine(s) : SYBCP1, SYBCP2

Calling

DRAGON routine(s) : SYBALC, SYBPRX

UTILIB routine(s) : ALSB

GANLIB routine(s) : SETARA, RLSARA, XABORT

10.4.16 SYBRX4

Purpose To compute the reduced collision probabilities in a 2-D Cartesian or hexagonal assembly using the interface current method with DP_0 approximation.

Syntax CALL SYBRX4(IPAS, SIGT, P, IMPX, NCOUR, NMCEL,
NMERGE, NGEN, IJAT, IQUAD, XX, YY,
NMC, RAYRE, MAIL, IZMAIL, RZMAIL, IFR, ALB,
INUM, MIX, DVX, IGEN, PIS, PSS,
PSSB, SIGT2)

Author(s) A. Hébert

Description of input/output parameters

IPAS	integer scalar variable containing the total number of volumes.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
P	real array of dimension P(IPAS,*) containing the reduced collision probabilities.

IMPX	integer scalar variable containing the print flag.
NCOUR	integer scalar variable containing the number of outer surfaces.
NMCEL	integer scalar variable containing the total number of cells in the domain.
NMERGE	integer scalar variable containing the total number of merged cells for which specific values of the neutron flux and reactions rates are required.
NGEN	integer scalar variable containing the total number of generating cells.
IJAT	integer scalar variable containing the total number of distinct out-currents.
IQUAD	integer array of dimension IQUAD(*) containing the quadrature parameters.
XX	real array of dimension XX(*) containing the x thickness of the generating cells.
YY	real array of dimension YY(*) containing the y thickness of the generating cells.
NMC	integer array of dimension NMC(*) containing the offset of the first volume in each generating cell.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in each generating cell.
MAIL	integer array of dimension MAIL(*) containing the offset of the first tracking information in each generating cell.
IZMAIL	integer array of dimension IZMAIL(*) containing the integer tracking information.
RZMAIL	real array of dimension RZMAIL(*) containing the real tracking information.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.
INUM	integer array of dimension INUM(*) containing the index-number of the merged cell associated to each cell.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating cell associated with each merged cell.

Description of work parameters

PIS	real array of dimension PIS(NCOUR,*) used for temporary storage.
PSS	real array of dimension PSS(NCOUR,*) used for temporary storage.
PSSB	real array of dimension PSSB(IJAT,*) used for temporary storage.
SIGT2	real array of dimension SIGT2(*) used for temporary storage.

Called by

DRAGON routine(s) : SYBCP1, SYBCP2

Calling

DRAGON routine(s) : RECT1, SYBALC, SYBHN1, SYBPRX, SYBRN1, XHX2D0

UTILIB routine(s) : ALGPT, ALSB

GANLIB routine(s) : SETARA, RLSARA, XABORT

10.4.17 SYBRX5

Purpose To compute the reduced collision probabilities in a 2-D Cartesian or hexagonal assembly using the interface current method with DP_1 approximation.

Syntax CALL SYBRX5(IPAS, SIGT, P, IMPX, NCOUR, NMCEL,
NMERGE, NGEN, IJAT, IQUAD, XX, YY,
NMC, RAYRE, MAIL, IZMAIL, RZMAIL, IFR, ALB,
INUM, MIX, DVX, IGEN, PIS, PSS,
PSSB, SIGT2)

Author(s) A. Hébert

Description of input/output parameters

IPAS	integer scalar variable containing the total number of volumes.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
P	real array of dimension P(IPAS,*) containing the reduced collision probabilities.
IMPX	integer scalar variable containing the print flag.
NCOUR	integer scalar variable containing the number of outer surfaces.
NMCEL	integer scalar variable containing the total number of cells in the domain.
NMERGE	integer scalar variable containing the total number of merged cells for which specific values of the neutron flux and reactions rates are required.
NGEN	integer scalar variable containing the total number of generating cells.
IJAT	integer scalar variable containing the total number of distinct out-currents.
IQUAD	integer array of dimension IQUAD(*) containing the quadrature parameters.
XX	real array of dimension XX(*) containing the x thickness of the generating cells.
YY	real array of dimension YY(*) containing the y thickness of the generating cells.
NMC	integer array of dimension NMC(*) containing the offset of the first volume in each generating cell.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in each generating cell.
MAIL	integer array of dimension MAIL(*) containing the offset of the first tracking information in each generating cell.
IZMAIL	integer array of dimension IZMAIL(*) containing the integer tracking information.
RZMAIL	real array of dimension RZMAIL(*) containing the real tracking information.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.

INUM	integer array of dimension INUM(*) containing the index-number of the merged cell associated to each cell.
MIX	integer array of dimension MIX(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating cell associated with each merged cell.

Description of work parameters

PIS	real array of dimension PIS(NCOUR,*) used for temporary storage.
PSS	real array of dimension PSS(NCOUR,*) used for temporary storage.
PSSB	real array of dimension PSSB(IJAT,*) used for temporary storage.
SIGT2	real array of dimension SIGT2(*) used for temporary storage.

Called by

DRAGON routine(s) : SYBCP1, SYBCP2

Calling

DRAGON routine(s) : RECT2, SYBALC, SYBHN2, SYBPRX, SYBRN2, XHX2D1

UTILIB routine(s) : ALGPT, ALSB

GANLIB routine(s) : SETARA, RLSARA, XABORT

10.4.18 SYBRXE

Purpose To compute the reduced collision probabilities for the do-it-yourself approach.

Syntax CALL SYBRXE(IPAS, NSUPCE, RAYRE, SIGT, P, IQUAD,
ISTAT, NMC, PROCEL, SURFA, POURCE, IMPX,
IAPPAR, PIB, PBI, PSS, PBB)

Author(s) A. Hébert

Description of input/output parameters

IPAS	integer scalar variable containing the total number of volumes.
NSUPCE	integer scalar variable containing the number of cells.
RAYRE	real array of dimension RAYRE(*) containing the radius of the tubes in each generating cell.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
P	real array of dimension P(IPAS,*) containing the reduced collision probabilities.
IQUAD	integer scalar variable containing the quadrature parameters.
ISTAT	integer scalar variable containing the flag for statistical approximation.
NMC	integer array of dimension NMC(*) containing the offset of the first volume in each generating cell.

PROCEL real array of dimension PROCEL(NSUPCE,*) containing the user supplied geometrical matrix.
 SURFA real array of dimension SURFA(*) used for temporary storage.
 POURCE real array of dimension POURCE(*) used for temporary storage.
 IMPX integer scalar variable containing the print flag.

Description of work parameters

IAPPAR real array of dimension IAPPAR(*) used for temporary storage.
 PIB real array of dimension PIB(*) used for temporary storage.
 PBI real array of dimension PBI(*) used for temporary storage.
 PSS real array of dimension PSS(NSUPCE,*) used for temporary storage.
 PBB real array of dimension PBB(*) used for temporary storage.

Description of parameters

IMPX

Called by

DRAGON routine(s) : SYBCP1, SYBCP2

Calling

DRAGON routine(s) : SYBALC, SYBPRX

UTILIB routine(s) : ALSB

GANLIB routine(s) : SETARA, RLSARA, XABORT

10.5 J_{\pm} Integration Routines

The J_{\pm} integration routines can be represented by the following tree:

Structure of the J_{\pm} CP integration routines: STRJPMP

```
JPMA
|----- JPMASB
|----- JPMDIS ->
```

```
JPMP
|----- JPMCP
|----- JPMDIS ->
```

```
JPMDIS
|----- JPM2    ->
|----- JPM3    ->
|----- JPM4    ->
|----- JPMDIT
|         |----- JPM2    ->
|         |----- JPM3    ->
```

```

|          |----- JPM4    ->
|          |----- XCSPIJ  ->
|----- JPMGR1
|          |----- SHELL1
|          |----- TUBE1
|----- JPMGR2
|          |----- JPM2    ->
|----- XCSPIJ

```

JPM2

```

|----- RECT1
|----- RECT2
|----- SHELL1
|----- SHELL2
|----- SLAB
|----- TUBE1
|----- TUBE2
|----- TUBE3D
|----- XELPA3 ->

```

JPM3

```

|----- TUBE1
|----- TUBE2

```

JPM4

```

|----- CROWH1
|----- CROWH2
|----- CROWR1
|----- CROWR2
|----- RECT1
|----- RECT2
|----- TUBE1
|----- TUBE2
|----- XHX2D0
|----- XHX2D1

```

SLAB

```

|----- XELPA0
|----- XELPA1

```

XCSPIJ

```

|----- CROWH1
|----- CROWH2
|----- CROWR1
|----- CROWR2
|----- TUBE1
|----- TUBE2
|----- XCSINT
|          |----- XCSCVS

```

```

|----- XCSRNU

XELPA3
|----- XELPA0
|----- XELPA1

```

10.5.1 JPMMA

Purpose To compute of the block-wise collision probabilities matrix for the JPM method with *LU* factorization of the scattering modified collision probability matrix.

Syntax CALL JPMMA (IPSYS, IPTRK, IFTRAK, IMPX, LR2, NMERGE,
NBMIX, NANI, MAT, VOL, KNORM, SIGT0,
SIGS0, ILK, TITR)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be created.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
IMPX	integer scalar variable containing the print flag.
LR2	logical scalar variable for storing (. TRUE .) the residual matrix.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
NBMIX	integer scalar variable containing the number of mixtures.
NANI	integer scalar variable containing the number of Legendre scattering order.
MAT	integer array of dimension MAT(NMERGE) containing the index-number of the mixture type assigned to each volume.
VOL	real array of dimension VOL(NMERGE) containing the volumes.
KNORM	integer scalar variable that is not used.
SIGT0	real array of dimension SIGT0(0:NBMIX) containing the total macroscopic cross sections ordered by mixture.
SIGS0	real array of dimension SIGS0(0:NBMIX,NANI) containing the within group scattering macroscopic cross sections ordered by mixture.
ILK	logical scalar variable containing the flag (. TRUE .) for neutron leakage through external boundary.
TITR	character*(72) scalar variable containing the title.

Called by

DRAGON routine(s) : ASMDRV

Calling

DRAGON routine(s) : JPMASB, JPMDIS

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMIOF, LCMLLEN, LCMPUT, SETARA, RLSARA

10.5.2 JPMP

Purpose To compute of the collision probabilities matrix for the JPM method.

Syntax CALL JPMP (IPSYS, IPTRK, IFTRAK, IMPX, NMERGE, MAT, VOL, KNORM, NELPIJ, IPIJK, ILK, TITR, SIGT0, PIJ)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be created.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
IMPX	integer scalar variable containing the print flag
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required
MAT	integer array of dimension MAT(NMERGE) containing the index-number of the mixture type assigned to each volume
VOL	real array of dimension VOL(NMERGE) containing the volumes
KNORM	integer scalar variable that is not used
NELPIJ	integer scalar variable containing the number of elements in collision probability matrix
IPIJK	integer scalar variable containing the option directional collision probability calculation (IPIJK=4)
ILK	logical scalar variable containing the flag (. TRUE .) for neutron leakage through external boundary
TITR	character*(72) scalar variable containing the title
SIGT0	real array of dimension SIGT0(*) containing the total macroscopic cross sections ordered by mixture
PIJ	real array of dimension PIJ(NELPIJ) containing the reduced and symmetric collision probabilities

Called by

DRAGON routine(s) : ASMDRV, SHIPIJ, SPHTRA

Calling

DRAGON routine(s) : JPMCP, JPMDIS

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMLLEN, LCMPUT, SETARA, RLSARA

10.5.3 JPMASB

Purpose To compute the scattering modified collision probability matrix and to perform its *LU* decomposition in compressed diagonal storage mode.

Syntax CALL JPMASB(IPSYS, LR2, NMBLK, IFR, ALB, NMERGE,
IJAT, INUM, MIX, DVX, MU1, IMA,
NGEN, IGEN, ISURF, CHORD, SIGS, PII, PIS,
PSS, WSSB, IGAT, IGAU, IGAU2)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be created.
LR2	logical scalar variable for storing (. TRUE .) the residual matrix.
NMBLK	integer scalar variable containing the total number of blocks in the domain.
IFR	integer array of dimension IFR(*) containing the index-number of in-currents.
ALB	real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.
NMERGE	integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.
IJAT	integer scalar variable containing the total number of distinct out-currents.
INUM	integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MAT(*) containing the index-number of out-currents.
DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in collision probability matrix.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in collision probability matrix.
NGEN	integer scalar variable containing the total number of generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.
SIGS	real array of dimension SIGS(*) containing the within group macroscopic scattering cross sections ordered by mixture.
PII	real array of dimension PII(*) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.

PSS real array of dimension PSS(*) containing the surface to surface collision probabilities.

Description of work parameters

WSSB real array of dimension WSSB(*) used for temporary storage.

IGAT integer array of dimension IGAT(*) used for temporary storage.

IGAU integer array of dimension IGAU(*) used for temporary storage.

IGAU2 integer array of dimension IGAU2(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMMA

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLUF

GANLIB routine(s) : LCMPUT

10.5.4 JPMCP

Purpose To compute the complete reduced collision probability matrix using the JPM method.

Syntax CALL JPMCP (ILK, IMPX, NMBLK, IFR, ALB, NMERGE,
IJAT, INUM, VOL, MIX, DVX, NGEN,
IGEN, ISURF, CHORD, SIGT, PII, PIS, PSS,
P, PSSB, IGAT, IGAU, IGAU2)

Author(s) A. Hébert

Description of input parameters

ILK logical scalar variable containing the flag (. TRUE .) for neutron leakage through external boundary.

IMPX integer scalar variable containing the print flag.

NMBLK integer scalar variable containing the total number of blocks in the domain.

IFR integer array of dimension IFR(*) containing the index-number of in-currents.

ALB real array of dimension ALB(*) containing the transmission/albedo associated with each in-current.

NMERGE integer scalar variable containing the total number of merged blocks for which specific values of the neutron flux and reactions rates are required.

IJAT integer scalar variable containing the total number of distinct out-currents.

INUM integer array of dimension INUM(*) containing the index-number of the merged block associated to each block.

VOL real array of dimension VOL(*) containing the volumes.

MIX integer array of dimension MAT(*) containing the index-number of out-currents.

DVX	real array of dimension DVX(*) containing the weight associated with each out-current.
NGEN	integer scalar variable containing the total number of generating blocks.
IGEN	integer array of dimension IGEN(*) containing the index-number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections ordered by mixture.
PII	real array of dimension PII(*) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.
PSS	real array of dimension PSS(*) containing the surface to surface collision probabilities.

Description of output parameters

P	real array of dimension P(NMERGE,*) containing the reduced collision probability matrix.
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Description of work parameters

PSSB	real array of dimension PSSB(IJAT,*) used for temporary storage.
IGAT	integer array of dimension IGAT(*) used for temporary storage.
IGAU	integer array of dimension IGAU(*) used for temporary storage.
IGAU2	integer array of dimension IGAU2(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMP

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALSB

GANLIB routine(s) : XABORT

10.5.5 JPMDIS

Purpose To compute the collision probabilities for the JPM method in an arbitrary geometry.

Syntax CALL JPMDIS(IPTRK, ITG, IMPX, NGEN, IFTRAK, ISURF,
CHORD, SIGT, MASK, PII, PIS, PSS)

Author(s) A. Hébert

Description of input parameters

IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
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ITG	integer scalar variable containing the type of geometry.
IMPX	integer scalar variable containing the print flag.
NGEN	integer scalar variable containing the total number of generating blocks.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections ordered by mixture.
MASK	logical array of dimension MASK(*) containing the flag for collision probability treatment in generating block i (MASK(i)= .TRUE.).

Description of output parameters

PII	real array of dimension PII(*) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.
PSS	real array of dimension PSS(*) containing the surface to surface collision probabilities.

Called by

DRAGON routine(s) : JPMA, JPMP, SHIJPM

Calling

DRAGON routine(s) : JPM2, JPM3, JPM4, JPMDIT, JPMGR1, JPMGR2,
XCSPIJ

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMSIX, SETARA, RLSARA

10.5.6 JPM2

Purpose To compute the collision probabilities for the JPM method in a 1-D, 2-D or 3-D Cartesian, cylindrical or spherical domain.

Syntax CALL JPM2 (ITYPE, IAPP, IQUAD, XX, YY, ZZ,
NGEN, ISURF, SIGT, MASK, PII, PIS,
PSS)

Author(s) A. Hébert

Description of parameters

ITYPE	integer scalar variable containing the type of geometry.
IAPP	integer scalar variable containing the type of angular flux expansion between the blocks.
IQUAD	integer scalar variable containing the quadrature parameter.

XX	real array of dimension XX(*) containing the x thickness of the generating blocks.
YY	real array of dimension YY(*) containing the y thickness of the generating blocks.
ZZ	real array of dimension ZZ(*) containing the z thickness of the generating blocks.
NGEN	integer scalar variable containing the total number of generating blocks.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces surrounding each generating block.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
MASK	logical array of dimension MASK(*) containing the flag for collision probability treatment in generating block i (MASK(i)= .TRUE.).

Description of output parameters

PII	real array of dimension PII(*) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.
PSS	real array of dimension PSS(*) containing the surface to surface collision probabilities.

Called by

DRAGON routine(s) : JPMDIS, JPMDIT, JPMGR2

Calling

DRAGON routine(s) : RECT1, RECT2, SHELL1, SHELL2, SLAB, TUBE1, TUBE2, TUBE3D, XELPA3

UTILIB routine(s) : ALGPT

GANLIB routine(s) : XABORT

10.5.7 JPM3

Purpose To compute the collision probabilities for the JPM method in the do-it-yourself multicell option.

Syntax CALL JPM3 (NSUPCE, IAPP, IQUAD, NMC, RAYRE, PROCEL,
NGEN, ISURF, SIGT, MASK, PII, PIS,
PSS)

Author(s) A. Hébert

Description of parameters

NSUPCE	integer scalar variable containing the total number of cells.
IAPP	integer scalar variable containing the type of multicell approximation.
IQUAD	integer array of dimension IQUAD(*) quadrature parameter.
NMC	integer array of dimension NMC(*) offset of the first block in each cell.
RAYRE	real array of dimension RAYRE(*) radius of the tubes in each cell.

PROCEL	real array of dimension PROCEL(NSUPCE,*) user supplied geometrical matrix.
NGEN	integer scalar variable containing the total number of generating blocks.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces surrounding each generating block.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
MASK	logical array of dimension MASK(*) containing the flag for collision probability treatment in generating block i (MASK(i)= .TRUE.).

Description of output parameters

PII	real array of dimension PII(*) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.
PSS	real array of dimension PSS(*) containing the surface to surface collision probabilities.

Called by

DRAGON routine(s) : JPMDIS, JPMDIT

Calling

DRAGON routine(s) : TUBE1, TUBE2

UTILIB routine(s) :

GANLIB routine(s) :

10.5.8 JPM4

Purpose To compute the collision probabilities for the JPM method for an assembly of homogeneous or heterogeneous cells.

Syntax CALL JPM4 (IWIGN, LMAIL, IQUAD, ITGEN, COORD, MAIL,
ZMAILI, ZMAILR, NGEN, ISURF, SIGT, MASK,
PII, PIS, PSS)

Author(s) A. Hébert

Description of parameters

IWIGN	integer scalar variable containing the type of cylinderization.
LMAIL	integer scalar variable containing the space required to store the tracking information.
IQUAD	integer array of dimension IQUAD(*) containing the quadrature parameters.
ITGEN	integer array of dimension ITGEN(*) containing the type of each generating block.
COORD	real array of dimension COORD(3,*) containing the dimensions of each generating block.
MAIL	integer array of dimension MAIL(*) containing the offset of the first tracking information in each generating block.
ZMAILI	real array of dimension ZMAILI(*) containing the integer tracking information.

ZMAILR	real array of dimension ZMAILR(*) containing the real tracking information.
NGEN	integer scalar variable containing the total number of generating blocks.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces surrounding each generating block.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
MASK	logical array of dimension MASK(*) containing the flag for collision probability treatment in generating block i (MASK(i)= .TRUE.).

Description of output parameters

PII	real array of dimension PII(*) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.
PSS	real array of dimension PSS(*) containing the surface to surface collision probabilities.

Called by

DRAGON routine(s) : JPMDIS, JPMDIT

Calling

DRAGON routine(s) : CROWH1, CROWH2, CROWR1, CROWR2, RECT1, RECT2,
TUBE1, TUBE2, XHX2D0, XHX2D1

UTILIB routine(s) : ALGPT

GANLIB routine(s) : XABORT

10.5.9 JPMDIT

Purpose To compute the collision probabilities for the JPM method for a bi-heterogeneous geometry.

Syntax CALL JPMDIT(IPTRK, ITG, IMPX, NGEN, IFTRAK, ISURF,
CHORD, SIGT, MASK, PII, PIS, PSS)

Author(s) A. Hébert

Description of input parameters

IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
ITG	integer scalar variable containing the type of geometry.
IMPX	integer scalar variable containing the print flag.
NGEN	integer scalar variable containing the total number of generating blocks.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(*) containing the mean chord length associated with each surface.

SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections ordered by mixture.
MASK	logical array of dimension MASK(*) containing the flag for collision probability treatment in generating block i (MASK(i)= .TRUE.).

Description of output parameters

PII	real array of dimension PII(*) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.
PSS	real array of dimension PSS(*) containing the surface to surface collision probabilities.

Called by

DRAGON routine(s) : JPMDIS

Calling

DRAGON routine(s) : JPM2, JPM3, JPM4, XCSPIJ

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMSIX, SETARA, RLSARA

10.5.10 JPMGR1

Purpose To start the computation of the block collision probabilities for the double heterogeneity option of JPM.

Syntax CALL JPMGR1(NGEN2, NG, NSMAX, MICRO, IQUAD, NS,
IGI, RS, FRACT, SIGT, MASK, SIG2,
RRRR)

Author(s) A. Hébert

Description of input parameters

NGEN2	integer scalar variable containing the number of generating blocks in the macro geometry.
NG	integer scalar variable containing the number of different kind of micro structures.
NSMAX	integer scalar variable containing the maximum number of tubes or shells in a micro block.
MICRO	integer scalar variable containing the type of micro blocks.
IQUAD	integer scalar variable containing the quadrature parameter for the collision probability calculation of the micro blocks.
NS	integer array of dimension NS(*) containing the number of micro blocks in each kind of micro structure.
IGI	integer array of dimension IGI(*) containing the type of mixture in each generating block of the macro geometry.
RS	real array of dimension RS(NSMAX+1,*) containing the radius of the micro blocks.
FRACT	real array of dimension FRACT(NG,*) containing the volume fraction of the micro blocks.

SIGT real array of dimension SIGT(*) containing the total macroscopic cross sections.

MASK logical array of dimension MASK(*) containing the flag for collision probability treatment in generating block *i* (MASK(*i*)= .TRUE.).

Description of output parameters

SIG2 real array of dimension SIG2(*) containing the modified total macroscopic cross sections.

RRRR real array of dimension RRRR(*) containing the volume self-shielded factor.

Called by

DRAGON routine(s) : JPMDIS

Calling

DRAGON routine(s) : SHELL1, TUBE1

UTILIB routine(s) :

GANLIB routine(s) :

10.5.11 JPMGR2

Purpose To compute the block collision probabilities for the double heterogeneity option of JPM.

Syntax CALL JPMGR2(NGEN2, NG, NSMAX, MICRO, IQUAD, IAPP,
NS, IGI, RS, FRACT, JSURF2, CHORD2,
JSURF, SIGT, MASK, PII, PIS, PSS, SIG2,
RRRR, PIS2, PSS2, XX, YY, ZZ,
JSURF)

Author(s) A. Hébert

Description of input parameters

NGEN2 integer scalar variable containing the number of generating blocks in the macro geometry.

NG integer scalar variable containing the number of different kind of micro structures.

NSMAX integer scalar variable containing the maximum number of tubes or shells in a micro block.

MICRO integer scalar variable containing the type of micro blocks.

IQUAD integer scalar variable containing the quadrature parameter for the collision probability calculation of the micro blocks.

IAPP integer scalar variable containing the type of angular flux expansion between the micro blocks.

NS integer array of dimension NS(*) containing the number of micro blocks in each kind of micro structure.

IGI integer array of dimension IGI(*) containing the type of mixture in each generating block of the macro geometry.

RS real array of dimension RS(NSMAX+1,*) containing the radius of the micro blocks.

FRACT	real array of dimension FRACT(NG,*) containing the volume fraction of the micro blocks.
ISURF2	integer array of dimension ISURF2(*) containing the number of surfaces surrounding each generating block of the macro geometry.
CHORD2	real array of dimension CHORD2(*) containing the mean chord length associated with each surface of the macro geometry.
ISURF	integer array of dimension ISURF(*) containing the number of surfaces surrounding each generating block.
SIGT	real array of dimension SIGT(*) containing the total macroscopic cross sections.
MASK	logical array of dimension MASK(*) containing the flag for collision probability treatment in generating block i (MASK(i)=.TRUE.).
SIG2	real array of dimension SIG2(*) containing the modified total macroscopic cross sections.
RRRR	real array of dimension RRRR(*) containing the volume self-shielded factor.
PIS2	real array of dimension PIS2(*) containing the volume to surface collision probabilities in the macro geometry.
PSS2	real array of dimension PSS2(*) containing the surface to surface collision probabilities in the macro geometry.

Description of output parameters

PII	real array of dimension PII(*) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(*) containing the volume to surface collision probabilities.
PSS	real array of dimension PSS(*) containing the surface to surface collision probabilities.

Description of work parameters

XX	real array of dimension XX(*) used for temporary storage.
YY	real array of dimension YY(*) used for temporary storage.
ZZ	real array of dimension ZZ(*) used for temporary storage.
JSURF	integer array of dimension JSURF(*) used for temporary storage.

Called by

DRAGON routine(s) : JPMDIS

Calling

DRAGON routine(s) : JPM2

UTILIB routine(s) :

GANLIB routine(s) :

10.6 Additional Integration Routines

10.6.1 CROWH1

Purpose To integrate the DP_0 collision probabilities of an homogeneous 2-D hexagonal crown.

Syntax CALL CROWH1(Z, ZI, COTE, SIGT, R, IAPP, TRONC, PIS, PSS, PII)

Author(s) M. Ouisloumen

Description of input parameters

Z real array of dimension Z(*) used for temporary storage.
 ZI integer array of dimension ZI(*) used for temporary storage.
 COTE real scalar variable containing the length of one sides of the hexagon.
 SIGT real scalar variable containing the total macroscopic cross section.
 R real scalar variable containing the radius of internal tube.
 IAPP integer scalar variable containing the type of angular flux expansion on the internal surface.
 TRONC real scalar variable containing the voided region criterion.

Description of output parameters

PIS real array of dimension PIS(*) containing the volume to surface probabilities P_{is} .
 PSS real array of dimension PSS(6+IAPP,*) containing the surface to surface probabilities P_{ss} .
 PII real scalar variable containing the volume to volume reduced probability P_{ii} .

Called by

DRAGON routine(s) : JPM4, XCSPIJ

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) :

10.6.2 CROWH2

Purpose To integrate the DP_1 collision probabilities of an homogeneous 2-D hexagonal crown.

Syntax CALL CROWH2(Z, ZI, COTE, SIGT, R, IAPP, TRONC, PIS, PSS, PII)

Author(s) M. Ouisloumen

Description of input parameters

Z real array of dimension Z(*) used for temporary storage.

ZI	integer array of dimension ZI(*) used for temporary storage.
COTE	real scalar variable containing the length of one sides of the hexagon.
SIGT	real scalar variable containing the total macroscopic cross section.
R	real scalar variable containing the radius of internal tube.
IAPP	integer scalar variable containing the type of angular flux expansion on the internal surface.
TRONC	real scalar variable containing the voided region criterion.

Description of output parameters

PIS	real array of dimension PIS(*) containing the volume to surface probabilities P_{is} .
PSS	real array of dimension PSS(18+IAPP,*) containing the surface to surface probabilities P_{ss} .
PII	real scalar variable containing the volume to volume reduced probability P_{ii} .

Called by

DRAGON routine(s) : JPM4, XCSPIJ

10.6.3 CROWR1

Purpose To integrate the DP_0 collision probabilities of an homogeneous 2-D rectangular crown.

Syntax CALL CROWR1(IAPP, COORD, Z, IZ, SIGT, TRONC, PVV, PVS, PSS)

Author(s) A. Hébert

Description of input parameters

IAPP	integer scalar variable containing the type of angular flux expansion on the internal surface.
COORD	real array of dimension COORD(*) containing the radius of the internal tube (COORD(1)), the dimensions of the external x sides (COORD(2)), and the dimensions of the external y sides (COORD(3)).
Z	real array of dimension Z(*) used for temporary storage.
IZ	integer array of dimension IZ(*) used for temporary storage.
SIGT	real scalar variable containing the total macroscopic cross section.
TRONC	real scalar variable containing the voided block criterion.

Description of output parameters

PVV	real scalar variable containing the volume to volume reduced probability P_{ii} .
PVS	real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
PSS	real array of dimension PSS(IAPP+4,*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM4, XCSPIJ

10.6.4 CROWR2

Purpose To integrate the DP_1 collision probabilities of an homogeneous 2-D rectangular crown.

Syntax CALL CROWR2(IAPP, COORD, Z, IZ, SIGT, TRONC, PVV, PVS, PSS)

Author(s) A. Hébert

Description of input parameters

IAPP	integer scalar variable containing the type of angular flux expansion on the internal surface.
COORD	real array of dimension COORD(*) containing the radius of the internal tube (COORD(1)), the dimensions of the external x sides (COORD(2)), and the dimensions of the external y sides (COORD(3)).
Z	real array of dimension Z(*) used for temporary storage.
IZ	integer array of dimension IZ(*) used for temporary storage.
SIGT	real scalar variable containing the total macroscopic cross section.
TRONC	real scalar variable containing the voided block criterion.

Description of output parameters

PVV	real scalar variable containing the volume to volume reduced probability P_{ii} .
PVS	real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
PSS	real array of dimension PSS(IAPP+12,*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM4, XCSPIJ

10.6.5 RECT1

Purpose To integrate the DP_0 collision probabilities of an homogeneous 2-D rectangle.

Syntax CALL RECT1 (NA, A, B, SIGT, TRONC, PII, PVS, PSS, ALPA, PWA)

Author(s) A. Hébert

Description of parameters

NA	integer scalar variable containing the number of Gauss-Legendre integration points.
A	real scalar variable containing the x width of the rectangle.
B	real scalar variable containing the y width of the rectangle.
SIGT	real scalar variable containing the total cross section.
TRONC	real scalar variable containing the voided block criterion.
PII	real scalar variable containing the volume to volume reduced probability P_{ii} .

PVS real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
PSS real array of dimension PSS(4,*) containing the surface to surface probabilities P_{ss} .
ALPA real array of dimension ALPA(*) containing the Gauss-Legendre integration points.
PWA real array of dimension PWA(*) containing the Gauss-Legendre integration weights.

Called by

DRAGON routine(s) : JPM2, JPM4, SYBRX4

10.6.6 RECT2

Purpose To integrate the DP_1 collision probabilities of an homogeneous 2-D rectangle.

Syntax CALL RECT2 (NA, A, B, SIGT, TRONC, PVV, PVS, PSS, ALPA, PWA)

Author(s) A. Hébert

Description of parameters

NA integer scalar variable containing the number of Gauss-Legendre integration points.
A real scalar variable containing the x width of the rectangle.
B real scalar variable containing the y width of the rectangle.
SIGT real scalar variable containing the total cross section.
TRONC real scalar variable containing the voided block criterion.
PVV real scalar variable containing the volume to volume reduced probability P_{ii} .
PVS real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
PSS real array of dimension PSS(12,*) containing the surface to surface probabilities P_{ss} .
ALPA real array of dimension ALPA(*) containing the Gauss-Legendre integration points.
PWA real array of dimension PWA(*) containing the Gauss-Legendre integration weights.

Called by

DRAGON routine(s) : JPM2, JPM4, SYBRX5

10.6.7 SHELL1

Purpose To integrate the DP_0 collision probabilities of an homogeneous spherical shell.

Syntax CALL SHELL1(NGPT, RAYRE, SIGT, PETIT, PVV, PVS, PSS)

Author(s) A. Hébert

Description of input parameters

NGPT integer scalar variable containing the number of Gauss-Legendre integration points.

RAYRE real array of dimension RAYRE(2) containing the radius of the spherical rings.
 SIGT real scalar variable containing the total cross section.
 PETIT real scalar variable containing the voided block criterion .

Description of output parameters

PVV real scalar variable containing the volume to volume reduced probability P_{ii} .
 PVS real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
 PSS real array of dimension PSS(*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM2, JPMGR1

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGJP

GANLIB routine(s) :

10.6.8 SHELL2

Purpose To integrate the DP_1 collision probabilities of an homogeneous spherical shell.

Syntax CALL SHELL2(NGPT, RAYRE, SIGT, PETIT, PVV, PVS, PSS)

Author(s) A. Hébert

Description of input parameters

NGPT integer scalar variable containing the number of Gauss-Legendre integration points.
 RAYRE real array of dimension RAYRE(2) containing the radius of the spherical rings.
 SIGT real scalar variable containing the total cross section.
 PETIT real scalar variable containing the voided block criterion.

Description of output parameters

PVV real scalar variable containing the volume to volume reduced probability P_{ii} .
 PVS real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
 PSS real array of dimension PSS(*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM2

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGJP

GANLIB routine(s) :

10.6.9 SLAB

Purpose To integrate the DP_0 or DP_1 collision probabilities of an homogeneous 1-D slab.

Syntax CALL SLAB (IAPP, XX, SIGT, TRONC, PVV, PVS, PSS)

Author(s) A. Hébert

Description of input parameters

IAPP integer scalar variable containing the type of angular flux expansion on the internal surface.

XX real scalar variable containing the external x dimension.

SIGT real scalar variable containing the total macroscopic cross section.

TRONC real scalar variable containing the voided block criterion.

Description of output parameters

PVV real scalar variable containing the volume to volume reduced probability P_{ii} .

PVS real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .

PSS real array of dimension PSS(*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM2

Calling

DRAGON routine(s) :

UTILIB routine(s) : TABEN

GANLIB routine(s) :

10.6.10 TUBE1

Purpose To integrate the collision probabilities of an homogeneous 1-D cylinder or tube with DP_0 angular flux approximation.

Syntax CALL TUBE1 (NGPT, RAYRE, SIGT, TRONC, PVV, PVS, PSS)

Author(s) G. Marleau

Description of input parameters

NGPT integer scalar variable containing the number of Gauss-Jacobi integration points.

RAYRE real array of dimension RAYRE(2) containing the radius of tube.

SIGT real scalar variable containing the total cross section.
 TRONC real scalar variable containing the voided block criterion.

Description of output parameters

PVV real scalar variable containing the volume to volume reduced probability P_{ii} .
 PVS real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
 PSS real array of dimension PSS(*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM2, JPM3, JPM4, JPMGR1, XCSPIJ

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGJP

GANLIB routine(s) :

10.6.11 TUBE2

Purpose To integrate the collision probabilities of an homogeneous 1-D cylinder or tube with DP_1 angular flux approximation.

Syntax CALL TUBE2 (NGPT, RAYRE, SIGT, TRONC, PVV, PVS, PSS)

Author(s) G. Marleau

Description of input parameters

NGPT integer scalar variable containing the number of Gauss-Jacobi integration points.
 RAYRE real array of dimension RAYRE(2) containing the radius of tube.
 SIGT real scalar variable containing the total cross section.
 TRONC real scalar variable containing the voided block criterion.

Description of output parameters

PVV real scalar variable containing the volume to volume reduced probability P_{ii} .
 PVS real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
 PSS real array of dimension PSS(*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM2, JPM3, JPM4, XCSPIJ

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGJP

GANLIB routine(s) :

10.6.12 TUBE3D

Purpose To integrate of the collision probabilities of an homogeneous 3-D cylinder or tube.

Syntax CALL TUBE3D(NGPT, RAYRE, HAUT, SIGT, TRONC, PVV, PVS, PSS)

Author(s) R. Roy

Description of input parameters

NGPT integer scalar variable containing the number of Gauss-Legendre integration points.
 RAYRE real array of dimension RAYRE(2) containing the radius of tube.
 HAUT real scalar variable containing the height of tube.
 SIGT real scalar variable containing the total cross section.
 TRONC real scalar variable containing the voided block criterion.

Description of output parameters

PVV real scalar variable containing the volume to volume reduced probability P_{ii} .
 PVS real array of dimension PVS(*) containing the volume to surface probabilities P_{is} .
 PSS real array of dimension PSS(*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM2

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGPT, TABEN

GANLIB routine(s) :

10.6.13 XCSCVS

Purpose To complete P_{ss} and evaluate P_{is} and P_{ii} from symmetry and conservation for cluster geometry.

Syntax CALL XCSCVS(IAPPR, IROT, IOR, IVAR, NSURF, CHORD, SIGT, PII, PIS, PSS)

Author(s) G. Marleau

Description of parameters

IAPPR integer scalar variable containing the angular expansion order.
 IROT integer scalar variable containing the type of reconstruction.
 IOR integer scalar variable containing the level of conservation used.

IVAR	integer scalar variable containing the type of sub-geometry.
NSURF	integer scalar variable containing the number of surfaces.
CHORD	real array of dimension CHORD(NSURF) containing the chord per surface ($4V/S$).
SIGT	real scalar variable containing the region total cross section.
PII	real scalar variable containing the collision probability P_{ii} .
PIS	real array of dimension PIS(*) containing the leakage probability P_{is} .
PSS	real array of dimension PSS(*) containing the transmission probability P_{ss} .

Called by

DRAGON routine(s) : XCSINT

10.6.14 XCSINT

Purpose To integrate rod cluster transmission probability P_{ss} .

Syntax CALL XCSINT(IAPPR, IROT, NRODS, NSURF, CHORD, IVAR, NTRAK, TRAK, VD, SIGT, TRONC, PII, PIS, PSS)

Author(s) G. Marleau

Description of input parameters

IAPPR	integer scalar variable containing the angular expansion order.
IROT	integer scalar variable containing the type of reconstruction.
NRODS	integer scalar variable containing the number of rods.
NSURF	integer scalar variable containing the number of surfaces.
CHORD	real array of dimension CHORD(NSURF) containing the chord per surface ($4V/S$).
IVAR	integer scalar variable containing the type of sub-geometry.
NTRAK	integer array of dimension NTRAK(NTYP) containing the number of track for each of the 5 types of probabilities.
TRAK	real array of dimension TRAK(4,*) containing the tracks and weight for integration.
VD	real array of dimension VD(NTYP,NDIR,NDIR,NOR) containing the series expansion of Bickley functions contribution.
SIGT	real scalar variable containing the region total cross section.
TRONC	real scalar variable containing the series expansion truncation for near void regions.

Description of output parameters

PII	real scalar variable containing the collision probability P_{ii} .
PIS	real array of dimension PIS(*) containing the leakage probability P_{is} .

PSS real array of dimension PSS(*) containing the transmission probability P_{ss} .

Called by

DRAGON routine(s) : XCSPIJ

Calling

DRAGON routine(s) : XCSCVS

UTILIB routine(s) :

GANLIB routine(s) :

10.6.15 XCSPIJ

Purpose To compute all probabilities associated with a cluster geometry.

Syntax CALL XCSPIJ(IAPP, IROT, NGEN, NBAN, NRT, MSROD, NRINFO, RAN, NRODS, RODS, RODR, NINT, IFTRAK, CHORD, NSURF, ISURF, NSOUT, COTE, MASK, TRAK, SIGT, PII, PIS, PSS, IMPX)

Author(s) G. Marleau

Description of parameters

IAPP	integer scalar variable containing the angular expansion order.
IROT	integer scalar variable containing the type of reconstruction.
NGEN	integer scalar variable containing the total number of regions.
NBAN	integer scalar variable containing the number of concentric regions.
NRT	integer scalar variable containing the number of rod types.
MSROD	integer scalar variable containing the maximum number of sub-rod per rods.
NRINFO	integer array of dimension NRINFO(2,NBAN) containing the type of concentric region.
RAN	real array of dimension RAN(NBAN) containing the radius or lattice side of concentric region.
NRODS	integer array of dimension NRODS(3,NRT) containing the integer description of rod of a given type.
RODS	real array of dimension RODS(2,NRT) containing the real description of rod of a given type.
RODR	real array of dimension RODR(MSROD,NRT) containing the sub-rod radius.
NINT	integer array of dimension NINT(3) containing the integration parameters.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
CHORD	real array of dimension CHORD(NSURF) containing the mean chord for each current.
NSURF	integer scalar variable containing the number of currents.
ISURF	integer array of dimension ISURF(NGEN) containing the number of surfaces per regions.

NSOUT	integer scalar variable containing the number of outer surfaces.
COTE	real scalar variable containing the dimension of y side for rectangle.
MASK	logical array of dimension MASK(NGEN) containing the flag MASK(i)=.TRUE. to compute probabilities in each cell i .
TRAK	real array of dimension TRAK(*) containing the vector to store tracks.
SIGT	real array of dimension SIGT(NGEN) containing the mixture cross sections.
PII	real array of dimension PII(NGEN) containing the collision probability P_{ii} .
PIS	real array of dimension PIS(*) containing the leakage probability P_{is} .
PSS	real array of dimension PSS(*) containing the transmission probability P_{ss} .
IMPX	integer scalar variable containing the print flag.

Called by

DRAGON routine(s) : JPMDIS, JPMDIT

Calling

DRAGON routine(s) : CROWH1, CROWH2, CROWR1, CROWR2, TUBE1, TUBE2, XCSINT, XCSRNU

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA

10.6.16 XCSRNU

Purpose To renumber transmission and leakage probability matrix for surface doubling option

Syntax CALL XCSRNU(IAPPR, NSURF, PIS, PSS)

Author(s) G. Marleau

Description of parameters

IAPPR	integer scalar variable containing the angular expansion order.
NSURF	integer scalar variable containing the number of surfaces.
PIS	real array of dimension PIS(*) containing the leakage probability P_{is} .
PSS	real array of dimension PSS(*) containing the transmission probability P_{ss} .

Called by

DRAGON routine(s) : XCSPIJ

10.6.17 XELPA0

Purpose To compute surface to surface probabilities (P_{ss}) for a rectangular voided block, using Gauss integration points.

Syntax CALL XELPA0(NGAUSS, XGAUSS, WGAUSS, A, B, C, SURFC, PCC, PCB, PCA, PVC, PVVC)

Author(s) R. Roy

Description of input parameters

NGAUSS integer scalar variable containing the number of Gauss integration points and weights.
 XGAUSS real array of dimension XGAUSS(NGAUSS) containing the gauss points.
 WGAUSS real array of dimension WGAUSS(NGAUSS) containing the gauss weights.
 A real scalar variable containing the x side of a rectangle.
 B real scalar variable containing the y side of a rectangle.
 C real scalar variable containing the z side of a rectangle.
 SURFC real scalar variable containing the total surface.

Description of output parameters

PCC real scalar variable containing the P_{ss} for surface normal to z to surface normal to z .
 PCB real scalar variable containing the P_{ss} for surface normal to z to surface normal to y .
 PCA real scalar variable containing the P_{ss} for surface normal to z to surface normal to z .
 PVC real scalar variable containing the P_{is} for region to surface normal to z .
 PVVC real scalar variable containing the P_{ii} for region to region.

Called by

DRAGON routine(s) : XELPA3

10.6.18 XELPA1

Purpose To compute surface to surface probabilities (P_{ss}) for a rectangular non-voided block, using Gauss integration points.

Syntax CALL XELPA1(NGAUSS, XGAUSS, WGAUSS, A, B, C, PARR, PERPB, PERPA)

Author(s) R. Roy

Description of input parameters

NGAUSS integer scalar variable containing the number of Gauss integration points and weights.
 XGAUSS real array of dimension XGAUSS(NGAUSS) containing the gauss points.
 WGAUSS real array of dimension WGAUSS(NGAUSS) containing the gauss weights.
 A real scalar variable containing the x side of a rectangle.
 B real scalar variable containing the y side of a rectangle.
 C real scalar variable containing the z side of a rectangle.

Description of output parameters

PARR real scalar variable containing the P_{ss} for surface normal to z to surface normal to z .
 PERPB real scalar variable containing the P_{ss} for surface normal to z to surface normal to y .
 PERPA real scalar variable containing the P_{ss} for surface normal to z to surface normal to z .

Called by

DRAGON routine(s) : XELPA3

Calling

DRAGON routine(s) :

UTILIB routine(s) : TABEN

GANLIB routine(s) :

10.6.19 XELPA3

Purpose To compute the full collision probability matrix for a homogeneous 3-D rectangular block.

Syntax CALL XELPA3(NGAUSS, XGAUSS, WGAUSS, SIGMAT, DELTA, PART)

Author(s) R. Roy

Description of input parameters

NGAUSS integer scalar variable containing the number of Gauss integration points and weights.
 XGAUSS real array of dimension XGAUSS(NGAUSS) containing the gauss points.
 WGAUSS real array of dimension WGAUSS(NGAUSS) containing the gauss weights.
 SIGMAT real scalar variable containing the total cross section.
 DELTA real array of dimension DELTA(3) containing the dimensions of the 3-D rectangle (x, y, z) .

Description of output parameters

PART real array of dimension PART(36) containing the collision probability matrix.

Called by

DRAGON routine(s) : JPM2

Calling

DRAGON routine(s) : XELPA0, XELPA1

UTILIB routine(s) : TABEN

GANLIB routine(s) :

10.6.20 XHX2D0

Purpose To compute the DP_0 collision, leakage and transmission probabilities for hexagonal 2-D geometries.

Syntax CALL XHX2D0(NGPT, ZGAUS, WGAUS, COTE, SIGT, TRONC, PII, PIS, PSS)

Author(s) M. Ouisloumen

Description of input parameters

NGPT integer scalar variable containing the number of gauss integration points.
 ZGAUS real array of dimension ZGAUS(NGPT) containing the Gauss-Legendre integration points.
 WGAUS real array of dimension WGAUS(NGPT) containing the Gauss-Legendre integration weights.
 COTE real scalar variable containing the length of one of sides of the hexagon.
 SIGT real scalar variable containing the total cross section.
 TRONC real scalar variable containing the voided block cutoff criterion.

Description of output parameters

PII real scalar variable containing the volume to volume reduced probability P_{ii} .
 PIS real array of dimension PIS(6) containing the volume to surface probabilities P_{is} .
 PSS real array of dimension PSS(6,*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM4, SYBRX4

10.6.21 XHX2D1

Purpose To compute the DP_1 collision, leakage and transmission probabilities for hexagonal 2-D geometries.

Syntax CALL XHX2D1(NGPT, ZGAUS, WGAUS, COTE, SIGT, TRONC, PII, PIS, PSS)

Author(s) M. Ouisloumen

Description of input parameters

NGPT integer scalar variable containing the number of gauss integration points.
 ZGAUS real array of dimension ZGAUS(NGPT) containing the Gauss-Legendre integration points.
 WGAUS real array of dimension WGAUS(NGPT) containing the Gauss-Legendre integration weights.
 COTE real scalar variable containing the length of one of sides of the hexagon.
 SIGT real scalar variable containing the total cross section.
 TRONC real scalar variable containing the voided block cutoff criterion.

Description of output parameters

PII real scalar variable containing the volume to volume reduced probability P_{ii} .
 PIS real array of dimension PIS(18) containing the volume to surface probabilities P_{is} .
 PSS real array of dimension PSS(18,*) containing the surface to surface probabilities P_{ss} .

Called by

DRAGON routine(s) : JPM4, SYBRX5

11 THE GENERAL CP TRACKING AND INTEGRATION MODULE

11.1 Structure of EXCELL:

The main routine that controls this module is called XL3 (see Section 2.2.9). It requires up to NENTRY=4 data structures. The first structure must be of type linked list or XSM file (IENTRY(*i*)=1 or 2) and will contain an ASMPIJ data structure. The second structure must be of type linked list (IENTRY(*i*)=1) and will contain an TRACKING data structure. Both of these data structure must be in creation mode (JENTRY(*i*)=0). The third data structure must be of type IENTRY(*i*)=1 or 2 (linked list or XSM file) and will contain a GEOMETRY data structure. Finally, the fourth data structure will contain the multigroup cross sections required for the CP evaluation in the form of a read-only MACROLIB or MICROLIB data structure (linked list or XSM file).

The EXCELL: module can be represented by the following tree:

Structure of module: EXCELL

```

XL3
|----- LDRASS ->
|----- XL3MAC
|----- XL3DRV
|----- XL3TRK
|           |----- XELBIN
|           |----- XELCMP
|           |----- XELDCL ->
|           |----- XELEDCL
|           |----- XELETR
|           |----- XELGPR
|           |----- XELMRG
|           |----- XELPRP
|           |----- XELTRP ->
|           |----- XL3NTR
|           |----- XL3SIG
|           |----- XL3TI3
|           |           |----- XELEQN
|           |           |----- XELLIN
|           |           |----- XELLSR
|           |           |----- QIJI3D
|           |----- QIJABC
|           |----- QIJCMP
|           |----- QIJCPL
|           |----- QIJNOS
|           |----- QIJNRM
|           |----- QIJPRL
|           |----- QIJPRT
|           |----- QIJRDG
|           |----- QIJRGL
|           |----- QIJRHL
|           |----- QIJRNL
|           |----- QIJSMD
|           |----- QIJWPR

```

11.2 General Routines Description

11.2.1 XL3DRV

Purpose To generate a TRACKING data structure.

Syntax CALL XL3DRV(IPSYS, IPTRK, IPGEOM, IPRT, MAXPTS, NORE, TITLE, CUTOFX,
NGRP, MAXMIX, XSSIGT, XSSIGW, MATCOD, VOLUME, KEYFLX)

Author(s) R. Roy

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be created.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be created.
IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT > 0 implies that a general description of the geometry is provided on the output file.
MAXPTS	integer scalar variable describing the user provided maximum number of zones.
NORE	integer scalar variable describing the track normalization option. A value of NORE=0 implies track normalization while a value of NORE=1 implies no track normalization.
TITLE	character*72 scalar variable describing the title of the problem.
CUTOFX	real scalar variable describing the mean free path cutoff for specular tracking.
NGRP	integer scalar variable describing the number of groups.
MAXMIX	integer scalar variable describing the number of mixtures.
XSSIGT	real array of dimension XSSIGT(0:MAXMIX,NGRP) containing the transport corrected total cross section.
XSSIGW	real array of dimension XSSIGW(0:MAXMIX,NGRP) containing the transport corrected within group scattering cross section.

Description of output parameters

MATCOD	integer array of dimension MATCOD(MAXPTS) containing the mixture number associated with each zone in the geometry.
VOLUME	real array of dimension VOLUME(MAXPTS) containing the volume of each zone in the geometry.
KEYFLX	integer array of dimension KEYFLX(MAXPTS) containing the region number associated with each zone in the geometry.

Called by

DRAGON routine(s) : XL3

Calling

DRAGON routine(s) : XL3TRK

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMNXT, LCMPUT, XABORT

11.2.2 XL3MAC

Purpose To read the transport corrected cross-section from the MACROLIB data structure.

Syntax CALL XL3MAC(IPMACR, IPSYS, NGROUP, NBMIX, ITRANC, XSSIGT, XSSIGW, XSSIG1, IPRNTM)

Author(s) R. Roy

Description of parameters

IPMACR integer scalar variable for accessing the MACROLIB data structure to be read.

IPSYS integer scalar variable for accessing the ASMPIJ data structure to be created.

NGROUP integer scalar variable describing the number of groups.

NBMIX integer scalar variable describing the number of mixtures.

ITRANC integer scalar variable describing the transport correction processing option:

- ITRANC=0 means that the transport correction is not taken into account;
- ITRANC=1 means that the transport correction is computed;
- ITRANC=2 means that the transport correction is taken from the MACROLIB or MICROLIB data structure.

XSSIGT real array of dimension XSSIGT(0:NBMIX,NGROUP) containing the transport corrected total cross section.

XSSIGW real array of dimension XSSIGW(0:NBMIX,NGROUP) containing the transport corrected within group scattering cross section.

XSSIG1 real array of dimension XSSIG1(0:NBMIX,NGROUP) containing the cross section for the transport correction.

IPRNTM integer scalar variable controlling the amount of information transferred to the output file.

Called by

DRAGON routine(s) : XL3

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMLIB, LCMPUT, LCMSIX, XABORT

11.2.3 XL3NTR

Purpose To compute the track normalization factors.

Syntax CALL XL3NTR(IPRT, NDIM, ISPEC, NS, NV, NORE, VOLIN, MRGIN, MATIN, NANGL, VOLTRK, DENSTY)

Author(s) R. Roy

Description of parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT \geq 999 will print the description of each tracking line.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
ISPEC	integer scalar variable describing the kind of tracking: <ul style="list-style-type: none"> • ISPEC=0 for isotropic tracking; • ISPEC=1 for specular tracking.
NS	integer scalar variable describing the number of surfaces before merging.
NV	integer scalar variable describing the number of regions before merging.
NORE	integer scalar variable describing the track normalization option. A value of NORE=0 implies track normalization while a value of NORE=1 implies no track normalization.
VOLIN	real array of dimension VOLIN(-NS:NV) containing the volumes and surfaces before merging.
MRGIN	integer array of dimension MRGIN(-NS:NV) containing the merging indices.
MATIN	integer array of dimension MATIN(-NS:NV) containing the mixtures and boundary conditions before merging.
NANGL	integer scalar variable describing the number of tracking angles.
VOLTRK	double precision array of dimension VOLTRK(-NS:NV,0:NANGL) containing the surface and volume computed for individual line directions.
DENSTY	real array of dimension DENSTY(NANGL) containing the track density for each line direction.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

11.2.4 XL3SIG

Purpose To prepare the cross section by group-set.

Syntax CALL XL3SIG(NGRT, MAXMIX, XSSIGT, XSSIGW, ALBEDO, LGRP, NGRP, NS, NR, MATALB, SIGTAL, SIGINV, SIGSS, SWVOID, SWNZBC)

Author(s) R. Roy

Description of parameters

NGRT	integer scalar variable describing the total number of groups.
MAXMIX	integer scalar variable describing the number of mixtures.
XSSIGT	real array of dimension XSSIGT(0:MAXMIX,NGRT) containing the transport corrected total cross section.
XSSIGW	real array of dimension XSSIGW(0:MAXMIX,NGRT) containing the transport corrected within group scattering cross section.
ALBEDO	real array of dimension ALBEDO(6) containing the geometric albedo.
LGRP	integer array of dimension LGRP(NGRP) containing the group numbers in the subset.
NGRP	integer scalar variable describing the number of groups in the subset.
NS	integer scalar variable describing the negative value of number of surfaces before merging.
NV	integer scalar variable describing the number of regions before merging.
MATALB	integer array of dimension MATALB(NS:NR) containing the albedo and mixture index in the exact geometry.
SIGTAL	real array of dimension SIGTAL(NGRP,NS:NR) containing the albedo and total cross section for the group subset.
SIGINV	real array of dimension SIGINV(NGRP,NR) containing the inverse of the total cross section by region.
SIGSS	real array of dimension SIGSS(NGRP,NR) containing the within group scattering cross section by region for the group subset.
SWVOID	logical scalar variable describing the presence (.TRUE.) or absence (.FALSE.) of voided regions.
SWNZBC	logical scalar variable describing the presence (.TRUE.) or absence (.FALSE.) of non-zero boundary conditions.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

11.2.5 XL3TI3

Purpose To generate the integration lines for a 3-D geometry using isotropic tracking.

Syntax CALL XL3TI3(IPRT, NANGLE, DENUSR, LSYMXY, ANGLES, DENSTY, NTOTCL, NEXTGE, MAXR, REMESH, LINMAX, RCUTOF, NSUR, NVOL, INDEL, MINDIM, MAXDIM, ICOORD, INCR, ICUR, TRKBEG, CONV, TRKDIR, LENGHT, NUMERO, NGRP, SIGTAL, SWVOID, NRSEG, SEGLEN, STAYIN, GOSOUT, PRODUC, DSCBEG, DSCEND, NORE, NRMV, VOLTRK, KEYMRG, NSOUT, NREG, DBLPIJ)

Author(s) R. Roy

Description of parameters

IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT=1 results in a description of the tracking parameters used. For IPRT>10000, each of the tracking line generated is also printed.
NANGLE	integer scalar variable describing the number of angles used in the tracking process.
DENUSR	real scalar variable describing density of lines in a plane normal to the track direction used in the tracking process.
LSYMXY	logical scalar variable describing the presence (.TRUE.) or absence (.FALSE.) of x - y symmetry.
ANGLES	real array of dimension ANGLES(3,NANGLE) containing the tracking angles used.
DENSTY	real array of dimension DENSTY(NANGLE) containing the effective line density used.
NTOTCL	integer scalar variable describing the total number of cylindrical regions +3 in exact geometry.
NEXTGE	integer scalar variable describing the type of boundary. It takes the value of 0 for rectangular boundary and 1 for cylindrical boundary.
MAXR	integer scalar variable describing the number of elements in the REMESH array.
REMESH	real array of dimension REMESH(MAXR) containing the real mesh for the exact geometry.
LINMAX	integer scalar variable describing the maximum number of track segments in a single track.
RCUTOF	real scalar variable describing the cutoff for corner tracking.
NSUR	integer scalar variable describing the negative value of the exact number of surfaces for a geometry.
NVOL	integer scalar variable describing the exact number of regions for a geometry.
INDEL	integer array of dimension INDEL(4,NVOL-NSUR+1) containing the numbering of surfaces and zones.
MINDIM	integer array of dimension MINDIM(NTOTCL) containing the minimum location in a REMESH array associated with a Cartesian or cylindrical region.
MAXDIM	integer array of dimension MAXDIM(NTOTCL) containing the maximum location in a REMESH array associated with a Cartesian or cylindrical region.
ICOORD	integer array of dimension ICOORD(NTOTCL) containing the coordinates in a REMESH array associated with a Cartesian or cylindrical region.
INCR	integer array of dimension INCR(NCP) describing increment direction for next track segment.
ICUR	integer array of dimension ICUR(NCP) describing current zonal location for a track segment.

TRKBEG	real array of dimension TRKBEG(NCP) describing position where a track begins.
CONV	real array of dimension CONV(NCP) containing the segment length of a track.
TRKDIR	real array of dimension TRKDIR(NCP) containing the direction of a track.
LENGHT	real array of dimension LENGHT(LINMAX) containing the length of each track segments in a single track.
NUMERO	integer array of dimension NUMERO(LINMAX) containing the region number crossed by each track segments in a single track.
NGRP	integer scalar variable describing the number of groups in the subset.
SIGTAL	real array of dimension SIGTAL(NGRP,NS:NR) containing the albedo and total cross section for the group subset.
SWVOID	logical scalar variable describing the presence (. TRUE .) or absence (. FALSE .) of voided regions.
SEGLN	real array of dimension SEGLN(LINMAX) containing the segment length for an integration line.
NRSEG	integer array of dimension NRSEG(LINMAX) containing the surfaces and zone identification for an integration line.
STAYIN	real array of dimension STAYIN(NGRP,LINMAX) containing the stay-in zone probability.
GOSOUT	real array of dimension GOSOUT(NGRP,LINMAX) containing the goes-in zone probability.
PRODUC	real array of dimension PRODUC(NGRP) used for temporary storage.
DSCBEG	real array of dimension DSCBEG(NGRP) used for temporary storage.
DSCEND	real array of dimension DSCEND(NGRP) used for temporary storage.
NORE	integer scalar variable describing the track normalization option. A value of NORE=0 implies track normalization while a value of NORE=1 implies no track normalization.
NRMV	integer scalar variable describing the presence of volume renormalization factor.
VOLTRK	double precision array of dimension VOLTRK(NSUR:NVOL,0:*) containing the surface and volume computed for individual line directions.
KEYMRG	integer array of dimension KEYMRG(NSUR:NVOL) containing the merging index for exact geometry. Here NUNK is computed by routine XELTRK.
NSOUT	integer scalar variable describing the number of outer surfaces.
NREG	integer scalar variable describing the final number of regions.
DBLPIJ	double precision array of dimension DBLPIJ(NGRP,NSOUT:NREG,NSOUT:NREG) containing the collision probability matrices.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) : QIJ3D, XELEQN, XELLIN, XELLSR

UTILIB routine(s) :

GANLIB routine(s) : XABORT

11.2.6 XL3TRK

Purpose To analyze the geometry and perform the tracking.

Syntax CALL XL3TRK(IPSYS, IPGEOM, IPTRK, GEONAM, MREGIO, IPRT, NDIM, ISPEC, NVO, NSO, NV, NS, NANGLE, ISYMM, DENUSR, RCUTOF, MXSEG, ALBEDO, ICODE, NORE, NGRT, MAXMIX, XSSIGT, XSSIGW, TITREC, MAXPTS, MATCOD, VOLUME, KEYFLX, LEAKSW, IUSED)

Author(s) R. Roy

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be created.
IPGEOM	integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be created or read.
GEONAM	character*12 scalar variable containing the name of the GEOMETRY data structure to be analyzed.
MREGIO	integer scalar variable describing the user defined maximum number of region for all geometry.
IPRT	integer scalar variable describing the amount of information printed by this routine. A value of IPRT=0 means that no information will be transferred to the output file while a value of IPRT>1 a description of the global geometry is produced on the output file.
NDIM	integer scalar variable describing the dimension of the problem to be analyzed. For the case of 2-D problems, NDIM=2 while for 3-D problems NDIM=3.
ISPEC	integer scalar variable describing the kind of tracking: <ul style="list-style-type: none"> • ISPEC=0 for isotropic tracking; • ISPEC=1 for specular tracking.
NVO	integer scalar variable describing the old number of regions.
NSO	integer scalar variable describing the old number of surfaces.
NV	integer scalar variable describing the number of regions.
NS	integer scalar variable describing the number of surfaces.
NANGLE	integer scalar variable describing the number of angles used in the tracking process.
ISYMM	integer scalar variable describing the symmetry factor for cluster cell tracking.
DENUSR	real scalar variable describing density of lines in a plane normal to the track direction used in the tracking process.
RCUTOF	real scalar variable describing the cutoff for corner tracking.
MXSEG	integer scalar variable describing the maximum number of track segments in a single track.
ALBEDO	real array of dimension ALBEDO(6) containing the albedos.

ICODE	integer array of dimension ICODE(6) containing the boundary condition types.
NORE	integer scalar variable describing the track normalization option. A value of NORE=0 implies track normalization while a value of NORE=1 implies no track normalization.
NGRT	integer scalar variable describing the total number of groups.
MAXMIX	integer scalar variable describing the number of mixtures.
XSSIGT	real array of dimension XSSIGT(0:MAXMIX,NGRT) containing the transport corrected total cross section.
XSSIGW	real array of dimension XSSIGW(0:MAXMIX,NGRT) containing the transport corrected within group scattering cross section.
TITREC	character*72 scalar variable describing the title of the problem.
MAXPTS	integer scalar variable describing the user provided maximum number of zones.
MATCOD	integer array of dimension MATCOD(MAXPTS) containing the mixture number associated with each zone in the geometry.
VOLUME	real array of dimension VOLUME(MAXPTS) containing the volume of each zone in the geometry.
KEYFLX	integer array of dimension KEYFLX(MAXPTS) containing the region number associated with each zone in the geometry.
LEAKSW	logical scalar variable describing the presence (. TRUE .) or the absence (. FALSE .) of leakage.
IUSED	integer array of dimension IUSED(6) describing the index for boundary conditions used.

Called by

DRAGON routine(s) : XL3DRV

Calling

DRAGON routine(s) : QIJABC, QIJCMP, QIJCPL, QIJNOS, QIJNRM, QIJPRL, QIJPRT, QIJRDG, QIJRGL, QIJRHL, QIJRNL, QIJSMD, QIJWPR, XELBIN, XELCMP, XELDCL, XELEDC, XELETR, XELGPR, XELMRG, XELPRP, XELTRP, XL3NTR, XL3SIG, XL3TI3

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMPUT, LCMSIX, REDGET, SETARA, RLSARA, XABORT

11.2.7 QIJABC

Purpose To compute the complete standard CP for all zones eliminating surfaces from the system using the boundary conditions.

Syntax CALL QIJABC(NREG, NSOUT, NPRB, NGRP, SIGTAL, MATRT, PROB, IDL, PSST, PSVT)

Author(s) R. Roy

Description of input parameters

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT	integer scalar variable describing the number of surfaces in the geometry.
NPRB	integer scalar variable describing the number of elements in the escape, leakage and collision probability matrix.
NGRP	integer scalar variable describing the number of groups.
SIGTAL	real array of dimension SIGTAL(NGRP,-NSOUT:NREG) containing the albedo and the transport corrected total cross section.
MATRT	integer array of dimension MATRT(NSOUT) containing the reflection/transmission vector.

Description of input/output parameters

PROB	double precision array of dimension PROB(NGRP,NPRB) containing the symmetric escape, leakage and collision probability matrix.
------	--

Description of work parameters

IDL	integer array of dimension IDL(NSOUT) containing the position in the diagonal elements in the CP matrix.
PSST	double precision array of dimension PSST(NSOUT,NSOUT) containing the escape matrix.
PSVT	double precision array of dimension PSVT(NSOUT,NREG) containing the leakage matrix.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALINVD

GANLIB routine(s) : XABORT

11.2.8 QIJCMP

Purpose To compress the CP matrix in its symmetric format.

Syntax CALL QIJCMP(NREG, NSOUT, NGRP, NCOR, VOLSUR, SIGTAL,DPR)

Author(s) R. Roy

Description of parameters

NREG	integer scalar variable describing the number of zones in the geometry.
NSOUT	integer scalar variable describing the negative value of the number of surfaces in the geometry.
NGRP	integer scalar variable describing the number of groups.
NCOR	integer scalar variable describing the maximum number of corners.
VOLSUR	real array of dimension VOLSO(NSOUT:NREG) containing the volumes and surfaces as a function of position in REMESH. Here NUNK is computed by routine XELTRK.

SIGTAL real array of dimension SIGTAL(NGRP,NSOUT:NREG) containing the albedo and the transport corrected total cross section.

DPR double precision array of dimension DPR(NGRP,NPRB) containing the escape, leakage and collision probability matrix.

Description of input/output parameters

PROB real array of dimension PROB(NPRB) containing symmetric escape, leakage and collision probability matrix.

Called by

DRAGON routine(s) : XL3TRK

11.2.9 QIJCPL

Purpose To compute the total leakage matrix.

Syntax CALL QIJCPL(NREG, NSOUT, NELPIJ, NGRP, MATCOD, VOLUME, SIGINV, PIJSYM, PIS, DD)

Author(s) R. Roy

Description of input parameters

NREG integer scalar variable describing the number of regions.

NSOUT integer scalar variable describing the number of surfaces in the geometry.

NELPIJ integer scalar variable describing the number of elements in the symmetric CP matrix.

NGRP integer scalar variable describing the number of groups.

MATCOD integer array of dimension MATCOD(NREG) containing the mixture associated with each region in the problem.

VOLUME real array of dimension VOLUME(NREG) containing the volume associated with each region in the problem.

SIGINV real array of dimension SIGINV(NGRP,NREG) containing the inverse of the total cross section by region.

PIJSYM double precision array of dimension PIJSYM(NGRP,NELPIJ) containing the symmetric CP matrix.

Description of output parameters

PIS double precision array of dimension PIS(NGRP,NREG) containing the total leakage probability.

Description of work parameters

DD double precision array of dimension DD(NGRP) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

11.2.10 QIJI3D

Purpose To integrate the general 3–D CP matrices with isotropic tracking.

Syntax CALL QIJI3D(NREG, NSOUT, NGRP, MXSEG, NCOR, SWVOID, IANG, LINE, WEIGHT,
NUMERO, LENGHT, SIGTAL, SEGLEN, NRSEG, STAYIN, GOSOUT,
PRODUC, DSCBEG, DSCEND, DPR)

Author(s) R. Roy

Description of input parameters

NREG	integer scalar variable describing the number of zones in the geometry.
NSOUT	integer scalar variable describing the number of surfaces in the geometry.
NGRP	integer scalar variable describing the number of groups.
MXSEG	integer scalar variable describing the maximum length of the integration lines on the binary tracking file.
NCOR	integer scalar variable describing the maximum number of corners.
SWVOID	logical scalar variable indicating the presence (.TRUE.) or absence (.FALSE.) of voided zones.
IANG	integer scalar variable describing the angle number.
LINE	integer scalar variable describing the line number.
WEIGHT	real scalar variable describing the line number weight.
NUMERO	integer array of dimension NUMERO(LINMAX) containing the region number crossed by each track segments in a single track.
LENGHT	real array of dimension LENGHT(LINMAX) containing the length of each track segments in a single track.
SIGTAL	real array of dimension SIGTAL(NGRP,NSOUT:NREG) containing the albedo and the transport corrected total cross section.

Description of output parameters

PROB	real array of dimension PROB(NGRP,NPLEN) containing the symmetrized escape, leakage and collision probability matrix.
------	---

Description of work parameters

SEGLEN	real array of dimension SEGLEN(MXSEG) containing the segment length for an integration line.
NRSEG	integer array of dimension NRSEG(MXSEG) containing the surfaces and zone identification for an integration line.
STAYIN	real array of dimension STAYIN(NGRP,MXSEG) containing the stay-in zone probability.
GOSOUT	real array of dimension GOSOUT(NGRP,MXSEG) containing the goes-in zone probability.
PRODUC	real array of dimension PRODUC(NGRP) used for temporary storage.
DSCBEG	real array of dimension DSCBEG(NGRP) used for temporary storage.

DSCEND real array of dimension DSCEND(NGRP) used for temporary storage.

DPR double precision array of dimension DPR(NGRP,*) containing the escape, leakage and collision probability matrix.

Called by

DRAGON routine(s) : XL3TI3

11.2.11 QIJNOS

Purpose To compute the reduced CP matrix.

Syntax CALL QIJNOS(NREG, NSNEG, NPRB, NGRP, SIGINV, PROB, VOLUME, ARRAY)

Author(s) R. Roy

Description of parameters

NREG integer scalar variable describing the number of zones in the geometry.

NSNEG integer scalar variable describing the negative value of the number of surfaces in the geometry.

NPRB integer scalar variable describing the number of elements in the escape, leakage and collision probability matrix.

NGRP integer scalar variable describing the number of groups.

SIGINV real array of dimension SIGINV(NGRP,NREG) containing the inverse of the total cross section by region.

PROB double precision array of dimension PROB(NGRP,NPLEN) containing the symmetrized escape, leakage and collision probability matrix.

VOLUME real array of dimension VOLUME(NREG) containing the volume associated with each region in the problem.

ARRAY double precision array of dimension ARRAY(NREG) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

11.2.12 QIJNRM

Purpose To normalize the CP matrix to force neutron conservation even for leakage cases.

Syntax CALL QIJNRM(NREG, NSOUT, NGRP, MATCOD, VOLUME, SIGINV, PIJSYM, PIS, DD)

Author(s) R. Roy

Description of parameters

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT	integer scalar variable describing the number of surfaces in the geometry.
NGRP	integer scalar variable describing the number of groups.
MATCOD	integer array of dimension MATCOD(NREG) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREG) containing the volume associated with each region in the problem.
SIGINV	real array of dimension SIGINV(NGRP,NREG) containing the inverse of the total cross section by region.
PIJSYM	double precision array of dimension PIJSYM(NGRP,LENPIJ) containing the symmetric CP matrix.
PIS	double precision array of dimension PIS(NGRP,LENPIJ) containing the total leakage probability.
DD	double precision array of dimension DD(*) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

11.2.13 QIJPRL

Purpose To save the leakage probabilities on the ASMPIJ data structure.

Syntax CALL QIJPRL(IPSYS, NREG, NGRP, NGRT, LGRP, VOLUME, SIGINV, PIS, ARRAY)

Author(s) R. Roy

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be created.
NREG	integer scalar variable describing the number of zones in the geometry.
NGRP	integer scalar variable describing the number of groups.
NGRT	integer scalar variable describing the total number of groups.
LGRP	integer array of dimension LGRP(NGRP) containing the group numbers in the subset.
VOLUME	real array of dimension VOLUME(NREG) containing the volume associated with each region in the problem.
SIGINV	real array of dimension SIGINV(NGRP,NREG) containing the inverse of the total cross section by region.
PIS	double precision array of dimension PIS(NGRP,LENPIJ) containing the total leakage probability.
ARRAY	real array of dimension ARRAY(NREG) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMPUT, LCMSIX

11.2.14 QIJPRT

Purpose To save the collision probabilities on the ASMPIJ data structure.

Syntax CALL QIJPRT(IPSYS, LGRP, NGRP, NGRT, NREG, PROB, ARRAY, IPRT)

Author(s) R. Roy

Description of parameters

IPSYS integer scalar variable for accessing the ASMPIJ data structure to be created.

LGRP integer array of dimension LGRP(NGRP) containing the group numbers in the subset.

NGRP integer scalar variable describing the number of groups.

NGRT integer scalar variable describing the total number of groups.

NREG integer scalar variable describing the number of zones in the geometry.

ARRAY real array of dimension ARRAY(NREG) used for temporary storage.

PROB double precision array of dimension PROB(NGRP,NPRB) containing the symmetric escape, leakage and collision probability matrix.

IPRT integer scalar variable describing the amount of information printed by this routine.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMPUT, LCMSIX

11.2.15 QIJDG

Purpose To normalize the collision probabilities using the diagonal scheme.

Syntax CALL QIJDG(NREG, NSOUT, NGRP, SIGTAL, PROB, BILAN)

Author(s) R. Roy

Description of parameters

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT	integer scalar variable describing the negative value of the number of surfaces in the geometry.
NGRP	integer scalar variable describing the number of groups.
SIGTAL	real array of dimension SIGTAL(NGRP,NSOUT:NREG) containing the albedo and the transport corrected total cross section.
PROB	double precision array of dimension PROB(NGRP,NPRB) containing the symmetric escape, leakage and collision probability matrix.
BILAN	double precision array of dimension BILAN(NGRP) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

11.2.16 QIJRGL

Purpose To normalize the collision probabilities using the Gelbard scheme.

Syntax CALL QIJRGL(NREG, NSOUT, NGRP, SIGTAL, PROB, RI, RBARRE, GBARRE)

Author(s) R. Roy

Description of parameters

NREG	integer scalar variable describing the number of zones in the geometry.
NSOUT	integer scalar variable describing the negative value of the number of surfaces in the geometry.
NGRP	integer scalar variable describing the number of groups.
SIGTAL	real array of dimension SIGTAL(NGRP,NSOUT:NREG) containing the albedo and the transport corrected total cross section.
PROB	double precision array of dimension PROB(NGRP,NPRB) containing the symmetric escape, leakage and collision probability matrix.
RI	double precision array of dimension RI(NGRP,NSOUT:NREG) used for temporary storage.
RBARRE	double precision array of dimension RBARRE(NGRP) used for temporary storage.
GBARRE	double precision array of dimension GBARRE(NGRP) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

11.2.17 QIJRHL

Purpose To normalize the collision probabilities using the HELIOS scheme.

Syntax CALL QIJRHL(NREG, NSNEG, LGRP, NGRP, SIGTAL, PROB, CHI, WFSP, WEIG,
WFSPAD)

Author(s) R. Roy

Description of parameters

NREG	integer scalar variable describing the number of zones in the geometry.
NSNEG	integer scalar variable describing the negative value of the number of surfaces in the geometry.
LGRP	integer array of dimension LGRP(NGRP) containing the group numbers in the subset.
NGRP	integer scalar variable describing the number of groups.
SIGTAL	real array of dimension SIGTAL(NGRP,NSNEG:NREG) containing the albedo and the transport corrected total cross section.
PROB	double precision array of dimension PROB(NGRP,NPRB) containing the symmetric escape, leakage and collision probability matrix.
CHI	double precision array of dimension CHI(NGRP,NSNEG:NREG) used for temporary storage.
WFSP	double precision array of dimension WFSP(NGRP) used for temporary storage.
WEIG	double precision array of dimension WEIG(NGRP,NSNEG:NREG,3) used for temporary storage.
WFSPAD	double precision array of dimension WFSPAD(NGRP) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

11.2.18 QIJRNL

Purpose To normalize the collision probabilities using the non-linear scheme.

Syntax CALL QIJRNL(NREG, NSNEG, LGRP, NGRP, SIGTAL, PROB, CIJ, WSPACE, WFSP, IDL, WEIG, WFSPAD, T)

Author(s) R. Roy

Description of parameters

NREG	integer scalar variable describing the number of zones in the geometry.
NSNEG	integer scalar variable describing the negative value of the number of surfaces in the geometry.
LGRP	integer array of dimension LGRP(NGRP) containing the group numbers in the subset.
NGRP	integer scalar variable describing the number of groups.
SIGTAL	real array of dimension SIGTAL(NGRP,NSNEG:NREG) containing the albedo and the transport corrected total cross section.

PROB	double precision array of dimension PROB(NGRP,NPRB) containing the symmetric escape, leakage and collision probability matrix.
CIJ	double precision array of dimension CIJ(NGRP,*) used for temporary storage.
WSPACE	double precision array of dimension WSPACE(NGRP,*) used for temporary storage.
WFSP	double precision array of dimension WFSP(NGRP,NSNEG:NREG) used for temporary storage.
IDL	integer array of dimension IDL(*) used for temporary storage.
WEIG	double precision array of dimension WEIG(NGRP,NSNEG:NREG) used for temporary storage.
WFSPAD	double precision array of dimension WFSPAD(NGRP) used for temporary storage.
T	double precision array of dimension T(NGRP,2) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALDLFV, ALDLSV

GANLIB routine(s) :

11.2.19 QIJSMD

Purpose To compute the scattering modified CP matrix.

Syntax CALL QIJSMD(NREG, NSNEG, NPRB, NGRP, SIGINV, SIGSS, PROB, VOLUME, PIJSCT)

Author(s) R. Roy

Description of parameters

NREG	integer scalar variable describing the number of zones in the geometry.
NSNEG	integer scalar variable describing the negative value of the number of surfaces in the geometry.
NPRB	integer scalar variable describing the number of elements in the escape, leakage and collision probability matrix.
NGRP	integer scalar variable describing the number of groups.
SIGINV	real array of dimension SIGINV(NGRP,NREG) containing the inverse of the total cross section by region.
SIGSS	real array of dimension SIGSS(NGRP,NREG) containing the within group scattering cross section by region.
PROB	double precision array of dimension PROB(NGRP,NPLEN) containing the symmetrized escape, leakage and collision probability matrix.
VOLUME	real array of dimension VOLUME(NREG) containing the volume associated with each region in the problem.

PIJSCT double precision array of dimension PIJSCT(NREG,2*NREG) used for temporary storage.

Called by

DRAGON routine(s) : XL3TRK

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALSBD

GANLIB routine(s) :

11.2.20 QIJWPR

Purpose To print the escape, leakage and collision probability matrices.

Syntax CALL QIJWPR(LOPT, NREG, NSOUT, LGRP, NGRP, SIGTAL, PROB)

Author(s) R. Roy

Description of parameters

LOPT integer scalar variable describing the printing format:

- LOPT=0 print escape, leakage and collision probability matrix;
- LOPT=1 print only collision probability matrix.

NREG integer scalar variable describing the number of zones in the geometry.

NSOUT integer scalar variable describing the negative value of the number of surfaces in the geometry.

LGRP integer array of dimension LGRP(NGRP) containing the group numbers in the subset.

NGRP integer scalar variable describing the number of groups in the subset.

SIGTAL real array of dimension SIGTAL(NGRP, NSOUT:NREG) containing the albedo and the transport corrected total cross section.

PROB double precision array of dimension PROB(NGRP,NPLEN) containing the symmetrized escape, leakage and collision probability matrix.

Called by

DRAGON routine(s) : XL3TRK

12 THE MODULE FOR FLUX CALCULATION

12.1 Structure of **FLU**:

The main routine that controls this module is called FLU (see Section 2.2.10). It requires NENTRY=4 data structures. The first structure must be of type linked list or XSM file (IENTRY(*i*)=1 or 2) and will contain a FLUXUNK data structure. This data structure must be in creation or modification mode (JENTRY(*i*)=0 or 1). The second structure must be of type linked list or XSM file (IENTRY(*i*)=1 or 2) and will contain an ASMPIJ data structure. The third data structure will contain the multigroup cross sections required for the CP evaluation in the form of a read-only MACROLIB or MICROLIB data structure (linked list or XSM file). The fourth data structure must be of type IENTRY(*i*)=1 (linked list) and will contain a TRACKING data structure.

Structure of the flux module: FLU

```

FLU
|----- FLUGET
|         |----- FLUGPI
|         |----- FLURFL
|----- FLUDRV
|         |----- FLUASR
|         |----- FLUADN
|         |----- FLUGFL
|         |----- FLUSFL
|         |----- FLUQFC
|         |----- FLUQFE ->
|         |----- FLUINR ->

```

Structure of the outer iteration driver: FLUQFE

```

FLUQFE
|----- FLUGFL
|----- FLUSFL
|----- FLUBLN
|----- FLULBD
|----- FLUQFB
|----- FLUQFS
|----- FLUQFX
|----- B1HOM
|         |----- B1DIF
|         |         |----- B1BETA
|         |         |----- B1SOL

```

Structure of the inner iteration driver: FLUINR

```

FLUINR
|----- FMODUL
|----- SMODUL
|----- FLUACV
|         |----- SMODUL
|----- FLUBAL
|----- FLUDB2
|         |----- FMODUL
|         |----- FLUALB
|----- FLUFUI

```

12.2 General Routines Description

12.2.1 FLUACV

Purpose To compute the over-relaxation factor using a variational principle and to return the new flux approximation.

Syntax CALL FLUACV(SMODUL, IPSYS, IPMACR, IPTRK, IPBTF, IPRINT, ITPIJ, KDIR, NGROUP, NBMIX, NREGIO, NUNKNO, ILEAK, MATCOD, VOLUME, KEYFLX, FUNKNO, SUNKNO, ISADJ, IGDEB, ILASTG, DB2, SIGT0, SIGS0, XSCAT, IJJ, NJJ, IPOS, WOVER, DELFL, GAMMA, RESTE)

Author(s) G. Marleau

Description of parameters

SMODUL	external function for residual evaluation. Here SMODUL can be TRFICS for CP based calculations or JPMS for response matrix based calculations using the J_{\pm} method.
IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IPBTF	integer scalar variable for accessing the binary tracking file to be analyzed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. Not used by this routine.
ITPIJ	integer scalar variable describing the type of CP available: <ul style="list-style-type: none"> • ITPIJ=0 scattering modified isotropic CP; • ITPIJ=1 standard isotropic CP; • ITPIJ=2 scattering modified isotropic and directional CP; • ITPIJ=3 standard isotropic and directional CP.
KDIR	integer scalar variable describing the direction for the CP matrix: <ul style="list-style-type: none"> • KDIR=0 for flux solution; • KDIR=1 for x directed solution with anisotropic scattering in B_1 model; • KDIR=2 for y directed solution with anisotropic scattering in B_1 model; • KDIR=3 for z directed solution with anisotropic scattering in B_1 model; • KDIR=4 for x directed solution with anisotropic scattering in B_0 model; • KDIR=5 for y directed solution with anisotropic scattering in B_0 model; • KDIR=6 for z directed solution with anisotropic scattering in B_0 model.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.

NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
ILEAK	integer scalar variable describing the leakage model to use: <ul style="list-style-type: none"> • ILEAK=0 in the case where no leakage model is considered; • ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor; • ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor; • ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term; • ILEAK=4 in the case where the leakage is approximate using the albedo approximation; • ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling; • ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search; • ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search; • ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.
MATCOD	integer array of dimension MATCOD(NREGION) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGION) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGION) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
ISADJ	integer scalar variable describing the type of flux calculation: <ul style="list-style-type: none"> • ISADJ=0 for direct flux solution; • ISADJ=1 for direct and pseudo-adjoint flux solution; • ISADJ=2 for direct and adjoint flux solution; • ISADJ=3 for direct, pseudo-adjoint and generalized pseudo-adjoint flux solution; • ISADJ=4 for direct, adjoint and generalized adjoint flux solution.
IGDEB	integer scalar variable describing the first group to process.
ILASTG	integer scalar variable describing the last group to process.
DB2	real array of dimension DB2(NGROUP) containing the dB^2 leakage parameter.

SIGT0	real array of dimension SIGT0(0:NBMIX) containing the transport corrected total cross section vector.
SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
XSCAT	real array of dimension XSCAT(0:NBMIX*NGROUP) containing the scattering cross section matrix.
IJJ	integer array of dimension IJJ(0:NBMIX) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(0:NBMIX) containing the number of diffusion group.
IPOS	integer array of dimension IPOS(0:NBMIX) containing the location of a mixture in the compressed scattering matrix.
WOVER	real scalar variable containing the variational acceleration factor.
DELFL	real array of dimension DELFL(NUNKNO,NGROUP) used for temporary storage.
GAMMA	real array of dimension GAMMA(NUNKNO) used for temporary storage.
RESTE	real array of dimension RESTE(NUNKNO,2) used for temporary storage.

Called by

DRAGON routine(s) : FLUINR

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, LCMSIX, XABORT

12.2.2 FLUADN

Purpose To re-normalize the generalized adjoint.

Syntax CALL FLUADN(IPFLUX, IPMACR, IPRINT, NGROUP, NBMIX, NREGIO, NUNKNO, NIFISS, FUNKNO, MATCOD, VOLUME, KEYFLX, IOUTER, SIGF0, FFDIR, QFDIR, FLUA)

Author(s) T. Courau

Description of parameters

IPFLUX	integer scalar variable for accessing the FLUXUNK data structure to be created.
IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. Not used by this routine.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.

NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
NIFISS	integer scalar variable describing the number of fissile isotopes.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
IOUTER	integer scalar variable describing the outer iteration number.
SIGF0	real array of dimension SIGF0(NBMIX,NIFISS) use for temporary storage.
FFDIR	real array of dimension FFDIR(NUNKNO,NGROUP) use for temporary storage.
QFDIR	real array of dimension QFDIR(NREGIO,NIFISS) use for temporary storage.
FLUA	real array of dimension FLUA(NUNKNO,NGROUP) use for temporary storage.

Called by

DRAGON routine(s) : FLUDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMSIX

12.2.3 FLUALB

Purpose To compute information required for a critical albedo search.

Syntax CALL FLUALB(IPSYS, NREGIO, MATCOD, VOLUME, KEYFLX, FUNKNO, SUNKNO, SIGS0, SIGT0, F1, F2, WORK)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
NREGIO	integer scalar variable describing the number of regions.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.

VOLUME	real array of dimension VOLUME(NREGION) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGION) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
SIGT0	real array of dimension SIGT0(0:NBMIX) containing the transport corrected total cross section vector.
F1	array of dimension F1(*) containing the first part of the neutron flux.
F2	array of dimension F2(*) containing the second part of the neutron flux.
WORK	array of dimension WORK(*) used for temporary storage.

Called by

DRAGON routine(s) : FLUDB2

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, XABORT

12.2.4 FLUASR

Purpose To complete the pseudo-adjoint source by including scattering terms.

Syntax CALL FLUASR(IPSYS, IPMACR, IPRINT, KDIR, NGROUP, NBMIX, NREGION, NUNKNO, ILEAK, MATCOD, KEYFLX, FUNKNO, SUNKNO, DB2, SIGS0, XSCAT, IJJ, NJJ, IPOS)

Author(s) T. Courau

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. Not used by this routine.
KDIR	integer scalar variable describing the direction for the CP matrix: <ul style="list-style-type: none"> • KDIR=0 for flux solution;

	<ul style="list-style-type: none"> • KDIR=1 for x directed solution with anisotropic scattering in B_1 model; • KDIR=2 for y directed solution with anisotropic scattering in B_1 model; • KDIR=3 for z directed solution with anisotropic scattering in B_1 model; • KDIR=4 for x directed solution with anisotropic scattering in B_0 model; • KDIR=5 for y directed solution with anisotropic scattering in B_0 model; • KDIR=6 for z directed solution with anisotropic scattering in B_0 model.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
ILEAK	integer scalar variable describing the leakage model to use: <ul style="list-style-type: none"> • ILEAK=0 in the case where no leakage model is considered; • ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor; • ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor; • ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term; • ILEAK=4 in the case where the leakage is approximate using the albedo approximation; • ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling; • ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search; • ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search; • ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
DB2	real array of dimension DB2(NGROUP) containing the dB^2 leakage parameter.

SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
XSCAT	real array of dimension XSCAT(0:NBMIX*NGROUP) containing the scattering cross section matrix.
IJJ	integer array of dimension IJJ(0:NBMIX) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(0:NBMIX) containing the number of diffusion group.
IPOS	integer array of dimension IPOS(0:NBMIX) containing the location of a mixture in the compressed scattering matrix.

Called by

DRAGON routine(s) : FLUDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMSIX

12.2.5 FLUBAL

Purpose To compute the flux rebalancing factors for non converged groups with up-scattering.

Syntax CALL FLUBAL(IPSYS, IPMACR, IPRINT, ITPIJ, KDIR, NGROUP, NBMIX, NREGIO, NUNKNO, LEAKSW, ILEAK, MATCOD, VOLUME, KEYFLX, FUNKNO, SUNKNO, ISADJ, IGDEB, ILASTG, DB2, SIGT0, SIGS0, XSCAT, IJJ, NJJ, IPOS, REBAL, PIS)

Author(s) G. Marleau

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. In the case where $IPRINT \geq 1$ the flux rebalancing factors are provided on the output file.
ITPIJ	integer scalar variable describing the type of CP available: <ul style="list-style-type: none"> • ITPIJ=0 scattering modified isotropic CP; • ITPIJ=1 standard isotropic CP; • ITPIJ=2 scattering modified isotropic and directional CP; • ITPIJ=3 standard isotropic and directional CP.
KDIR	integer scalar variable describing the direction for the CP matrix: <ul style="list-style-type: none"> • KDIR=0 for flux solution; • KDIR=1 for x directed solution with anisotropic scattering in B_1 model;

	<ul style="list-style-type: none"> • KDIR=2 for y directed solution with anisotropic scattering in B_1 model; • KDIR=3 for z directed solution with anisotropic scattering in B_1 model; • KDIR=4 for x directed solution with anisotropic scattering in B_0 model; • KDIR=5 for y directed solution with anisotropic scattering in B_0 model; • KDIR=6 for z directed solution with anisotropic scattering in B_0 model.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
LEAKSW	logical scalar variable describing the presence (. TRUE .) or the absence (. FALSE .) of leakage.
ILEAK	integer scalar variable describing the leakage model to use: <ul style="list-style-type: none"> • ILEAK=0 in the case where no leakage model is considered; • ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor; • ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor; • ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term; • ILEAK=4 in the case where the leakage is approximate using the albedo approximation; • ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling; • ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search; • ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search; • ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.

ISADJ	integer scalar variable describing the type of flux calculation: <ul style="list-style-type: none"> • ISADJ=0 for direct flux solution; • ISADJ=1 for direct and pseudo-adjoint flux solution; • ISADJ=2 for direct and adjoint flux solution; • ISADJ=3 for direct, pseudo-adjoint and generalized pseudo-adjoint flux solution; • ISADJ=4 for direct, adjoint and generalized adjoint flux solution.
IGDEB	integer scalar variable describing the first group to process.
ILASTG	integer scalar variable describing the last group to process.
DB2	real array of dimension DB2(NGROUP) containing the dB^2 leakage parameter.
SIGT0	real array of dimension SIGT0(0:NBMIX) containing the transport corrected total cross section vector.
SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
XSCAT	real array of dimension XSCAT(0:NBMIX*NGROUP) containing the scattering cross section matrix.
IJJ	integer array of dimension IJJ(0:NBMIX) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(0:NBMIX) containing the number of diffusion group.
IPOS	integer array of dimension IPOS(0:NBMIX) containing the location of a mixture in the compressed scattering matrix.
REBAL	real array of dimension REBAL(NGROUP,NGROUP+1) used for temporary storage.
PIS	real array of dimension PIS(NREGIO) used for temporary storage.

Called by

DRAGON routine(s) : FLUINR

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALSB, XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMLIB, LCMSIX, XABORT

12.2.6 FLUBLN

Purpose To compute the directional buckling from the critical neutron balance.

Syntax CALL FLUBLN(IPMACR, IPRINT, NGROUP, NBMIX, NREGIO, NUNKNO, MATCOD,
VOLUME, B2, FUNKNO, SIGT0, SIGS0, IJJ, NJJ, IPOS, XSCAT, IHETL,
REFKEF, BIL1)

Author(s) I. Petrovic, G. Marleau and R. Roy

Description of parameters

IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. In the case where $IPRINT \geq 10$ the computed directional buckling are provided on the output file.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SIGT0	real array of dimension SIGT0(0:NBMIX) containing the transport corrected total cross section vector.
SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
IJJ	integer array of dimension IJJ(0:NBMIX) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(0:NBMIX) containing the number of diffusion group.
IPOS	integer array of dimension IPOS(0:NBMIX) containing the location of a mixture in the compressed scattering matrix.
XSCAT	real array of dimension XSCAT(0:NBMIX*NGROUP) containing the scattering cross section matrix.
IHETL	integer scalar variable describing the type of buckling calculation: <ul style="list-style-type: none"> • IHETL= 1 for x direction search; • IHETL= 2 for y direction search; • IHETL= 3 for z direction search; • IHETL= 4 for radial search; • IHETL= 5 for global search.
REFKEF	double precision scalar variable containing the reference value for k_{eff} .

BIL1 double precision scalar variable containing the total neutron production.

Called by

DRAGON routine(s) : FLUQFE

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMSIX, XABORT

12.2.7 FLUDB2

Purpose To find the albedo to match the input dB^2 value and to find the corresponding flux.

Syntax CALL FLUDB2(FMODUL, IPSYS, IPTRK, IPBTF, IPRINT, NBMIX, NREGIO, NUNKNO, MATCOD, VOLUME, KEYFLX, ILEAK, FUNKNO, SUNKNO, ISADJ, TITLE, DB2, SIGT0, SIGS0, PNL)

Author(s) A. Hébert

Description of parameters

FMODUL	external function for flux evaluation evaluation. Here FMODUL can be TRFICF for CP based calculations or JPMF for response matrix based calculations using the J_{\pm} method.
IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IPBTF	integer scalar variable for accessing the binary tracking file to be analyzed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. In the case where $IPRINT \geq 5$ the sources and the flux rebalancing are provided on the output file.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
ILEAK	integer scalar variable describing the leakage model to use: <ul style="list-style-type: none"> • ILEAK=0 in the case where no leakage model is considered; • ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor;

	<ul style="list-style-type: none"> • ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor; • ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term; • ILEAK=4 in the case where the leakage is approximate using the albedo approximation; • ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling; • ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search; • ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search; • ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.
FUNKNO	real array of dimension FUNKNO(NUNKNO) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO) containing the sources (flux and possibly currents) for the problem.
ISADJ	integer scalar variable describing the type of flux calculation: <ul style="list-style-type: none"> • ISADJ=0 for direct flux solution; • ISADJ=1 for direct and pseudo-adjoint flux solution; • ISADJ=2 for direct and adjoint flux solution; • ISADJ=3 for direct, pseudo-adjoint and generalized pseudo-adjoint flux solution; • ISADJ=4 for direct, adjoint and generalized adjoint flux solution.
TITLE	character*72 scalar variable containing the title of the problem.
DB2	real array of dimension DB2(NGROUP) containing the dB^2 leakage parameter.
SIGT0	real array of dimension SIGT0(0:NBMIX) containing the transport corrected total cross section vector.
SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
PNL	real scalar variable containing the non-leakage factor.

Called by

DRAGON routine(s) : FLUINR

Calling

DRAGON routine(s) : FLUALB

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMLIB, SETARA, RLSARA, XABORT

12.2.8 FLUDRV

Purpose To solve the transport equation using the power iteration method with thermal group rebalancing and variational acceleration.

Syntax CALL FLUDRV(IPFLUX, IPSYS, IPMACR, IPTRK, IPBTF, ITPIJ, CXDOOR, COPTIO, IPRINT, LEAKSW, IYPEC, ISADJ, ILEAK, ICOPAR, EPSPAR, NGROUP, NBMIX, NREGIO, NUNKNO, NIFISS, MXNL, INITFL, B2, REFKEF, TITLE, NAMGPA, NAMGAS, FUNKNO, SUNKNO, MATCOD, VOLUME, KEYFLX)

Author(s) G. Marleau, A. Hébert, R. Roy, I. Petrovic and T. Courau

Description of parameters

IPFLUX	integer scalar variable for accessing the FLUXUNK data structure to be created.
IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IPBTF	integer scalar variable for accessing the binary tracking file to be analyzed.
ITPIJ	integer scalar variable describing the type of CP available: <ul style="list-style-type: none"> • ITPIJ=0 scattering modified isotropic CP; • ITPIJ=1 standard isotropic CP; • ITPIJ=2 scattering modified isotropic and directional CP; • ITPIJ=3 standard isotropic and directional CP.
CXDOOR	character*12 scalar variable containing the name of the flux solution module to be used.
COPTIO	character*4 scalar variable containing the type of leakage option to consider: <ul style="list-style-type: none"> • COPTIO=LKRD for imposed leakage; • COPTIO=B0 for B_0 leakage; • COPTIO=P0 for P_0 leakage; • COPTIO=B1 for B_1 leakage; • COPTIO=P1 for P_1 leakage; • COPTIO=B0TR for transport corrected B_0 leakage.
IPRINT	integer scalar variable describing the amount of information printed by this routine. For IPRINT>0 the calculation options are provided on the output file.
LEAKSW	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
IYPEC	integer scalar variable describing the type of flux evaluation: <ul style="list-style-type: none"> • IYPEC= 0 to skip the flux calculation; • IYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence; • IYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage;

- ITYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling;
- ITYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling;
- ITYPEC= 5 direct problem with leakage sources and convergence on buckling;
- ITYPEC= 6 direct problem fixed sources.

ISADJ integer scalar variable describing the type of flux calculation:

- ISADJ=0 for direct flux solution;
- ISADJ=1 for direct and pseudo-adjoint flux solution;
- ISADJ=2 for direct and adjoint flux solution;
- ISADJ=3 for direct, pseudo-adjoint and generalized pseudo-adjoint flux solution;
- ISADJ=4 for direct, adjoint and generalized adjoint flux solution.

ILEAK integer scalar variable describing the leakage model to use:

- ILEAK=0 in the case where no leakage model is considered;
- ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor;
- ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor;
- ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term;
- ILEAK=4 in the case where the leakage is approximate using the albedo approximation;
- ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling;
- ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
- ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search;
- ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
- ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search;
- ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.

ICOPAR integer array of dimension ICOPAR(6) describing the iteration parameters:

- ICOPAR(1) is the number of free iteration for variational acceleration;
- ICOPAR(2) is the number of accelerated iteration for variational acceleration;
- ICOPAR(3) is the flag for rebalancing;
- ICOPAR(4) is the maximum number of inner iterations;
- ICOPAR(5) is the maximum number of outer iterations;
- ICOPAR(6) is the contamination flag.

EPSPAR real array of dimension EPSPAR(NBEPs) containing the convergence parameters:

	<ul style="list-style-type: none"> • EPSPAR(1) is the convergence parameter for the unknowns in the inner iteration; • EPSPAR(2) is the convergence parameter for the eigenvalue in the outer iteration; • EPSPAR(3) is the convergence parameter for the unknowns in the outer iteration; • EPSPAR(4) is the convergence parameter for the generalized adjoint; • EPSPAR(5) is the contamination parameter for the generalized adjoint.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
NIFISS	integer scalar variable describing the number of fissile isotopes.
MXNL	integer scalar variable describing the maximum order of the scattering cross section.
INITFL	integer scalar variable describing the flux initialization option: <ul style="list-style-type: none"> • INITFL=0 default initialization; • INITFL=1 taken from FLUXUNK; • INITFL=2 taken from data structure.
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
REFKEF	double precision scalar variable containing the reference value for k_{eff} .
TITLE	character*72 scalar variable containing the title of the problem.
NAMGPA	character array of dimension NAMGPA(2)*12 containing the name of the generalized pseudo-adjoint.
NAMGAS	character*12 scalar variable containing the name of the generalized adjoint source.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.

Called by

DRAGON routine(s) : FLU

Calling

DRAGON routine(s) : FLUADN, FLUASR, FLUGFL, FLUINR, FLUQFC, FLUQFE, FLUSFL, JPMF, JPMS, TRFICF, TRFICS

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMput, LCMSIX, SETARA, RLSARA, XABORT

12.2.9 FLUFUI

Purpose To compute the dB^2 value corresponding to the actual leakage.

Syntax FLUFUI=FLUFUI(IPSYS, NBMIX, NREGIO, NUNKNO, MATCOD, VOLUME, KEYFLX, FUNKNO, SUNKNO, SIGT0, SIGS0)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO) containing the sources (flux and possibly currents) for the problem.
SIGT0	real array of dimension SIGT0(0:NBMIX) containing the transport corrected total cross section vector.
SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
FLUFUI	real scalar parameter containing the dB^2 leakage parameter.

Called by

DRAGON routine(s) : FLUINR

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, XABORT

12.2.10 FLUGET

Purpose To read and analyze data for flux solution module.

Syntax CALL FLUGET(IPFLUX, LEAKSW, NGROUP, NREGIO, NUNKNO, ITPIJ, IYPEC, ISADJ, ICOPAR, EPSPAR, COPTIO, ILEAK, IPRINT, INITFL, B2, REFKEF, KEYFLX, FUNKNO)

Author(s) G. Marleau

Description of parameters

- | | |
|--------|---|
| IPFLUX | integer scalar variable for accessing the FLUXUNK data structure to be created. |
| LEAKSW | logical scalar variable describing the presence (<i>.TRUE.</i>) or the absence (<i>.FALSE.</i>) of leakage. |
| NGROUP | integer scalar variable describing the number of energy groups. |
| NREGIO | integer scalar variable describing the number of regions. |
| NUNKNO | integer scalar variable describing the number of unknowns in the flux/current solution vector. |
| ITPIJ | integer scalar variable describing the type of CP available: <ul style="list-style-type: none"> • ITPIJ=0 scattering modified isotropic CP; • ITPIJ=1 standard isotropic CP; • ITPIJ=2 scattering modified isotropic and directional CP; • ITPIJ=3 standard isotropic and directional CP. |
| IYPEC | integer scalar variable describing the type of flux evaluation: <ul style="list-style-type: none"> • IYPEC= 0 to skip the flux calculation; • IYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence; • IYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage; • IYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling; • IYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling; • IYPEC= 5 direct problem with leakage sources and convergence on buckling; • IYPEC= 6 direct problem fixed sources. |
| ISADJ | integer scalar variable describing the type of flux calculation: <ul style="list-style-type: none"> • ISADJ=0 for direct flux solution; • ISADJ=1 for direct and pseudo-adjoint flux solution; |

- ISADJ=2 for direct and adjoint flux solution;
 - ISADJ=3 for direct, pseudo-adjoint and generalized pseudo-adjoint flux solution;
 - ISADJ=4 for direct, adjoint and generalized adjoint flux solution.
- ICOPAR** integer array of dimension ICOPAR(6) describing the iteration parameters:
- ICOPAR(1) is the number of free iteration for variational acceleration;
 - ICOPAR(2) is the number of accelerated iteration for variational acceleration;
 - ICOPAR(3) is the flag for rebalancing;
 - ICOPAR(4) is the maximum number of inner iterations;
 - ICOPAR(5) is the maximum number of outer iterations;
 - ICOPAR(6) is the contamination flag.
- EPSPAR** real array of dimension EPSPAR(NBEPs) containing the convergence parameters:
- EPSPAR(1) is the convergence parameter for the unknowns in the inner iteration;
 - EPSPAR(2) is the convergence parameter for the eigenvalue in the outer iteration;
 - EPSPAR(3) is the convergence parameter for the unknowns in the outer iteration;
 - EPSPAR(4) is the convergence parameter for the generalized adjoint;
 - EPSPAR(5) is the contamination parameter for the generalized adjoint.
- COPTIO** character*4 scalar variable containing the type of leakage option to consider:
- COPTIO=LKRD for imposed leakage;
 - COPTIO=B0 for B_0 leakage;
 - COPTIO=P0 for P_0 leakage;
 - COPTIO=B1 for B_1 leakage;
 - COPTIO=P1 for P_1 leakage;
 - COPTIO=B0TR for transport corrected B_0 leakage.
- ILEAK** integer scalar variable describing the leakage model to use:
- ILEAK=0 in the case where no leakage model is considered;
 - ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor;
 - ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor;
 - ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term;
 - ILEAK=4 in the case where the leakage is approximate using the albedo approximation;
 - ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling;
 - ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
 - ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search;
 - ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;

	<ul style="list-style-type: none"> • ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search; • ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.
IPRINT	integer scalar variable describing the amount of information printed by this routine. Not used here.
INITFL	integer scalar variable describing the flux initialization option: <ul style="list-style-type: none"> • INITFL=0 default initialization; • INITFL=1 taken from FLUXUNK; • INITFL=2 taken from data structure.
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
REFKEF	double precision scalar variable containing the reference value for k_{eff} .
KEYFLX	integer array of dimension KEYFLX(NREGION) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.

Called by

DRAGON routine(s) : FLU

Calling

DRAGON routine(s) : FLUGPI, FLURFL

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, LCMSIX, XABORT

12.2.11 FLUGFL

Purpose To read the flux from the FLUXUNK data structure.

Syntax CALL FLUGFL(IPFLUX, NGROUP, NUNKNO, FUNKNO)

Author(s) G. Marleau

Description of parameters

IPFLUX	integer scalar variable for accessing the FLUXUNK data structure to be created.
NGROUP	integer scalar variable describing the number of energy groups.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.

FUNKNO real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.

Called by

DRAGON routine(s) : FLUDRV, FLUQFE

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN

12.2.12 FLUGPI

Purpose To read data for flux solution module.

Syntax CALL FLUGPI(IPRINT, IYPEC, ISADJ, ICOPAR, EPSPAR, COPTIO, ILEAK, INITFL, INITLK, IRSDIR, BRSDIR, CARLST)

Author(s) G. Marleau

Description of parameters

IPRINT integer scalar variable describing the amount of information printed by this routine. Not used by this routine.

IYPEC integer scalar variable describing the type of flux evaluation:

- IYPEC= 0 to skip the flux calculation;
- IYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence;
- IYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage;
- IYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling;
- IYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling;
- IYPEC= 5 direct problem with leakage sources and convergence on buckling;
- IYPEC= 6 direct problem fixed sources.

ISADJ integer scalar variable describing the type of flux calculation:

- ISADJ=0 for direct flux solution;
- ISADJ=1 for direct and pseudo-adjoint flux solution;
- ISADJ=2 for direct and adjoint flux solution;
- ISADJ=3 for direct, pseudo-adjoint and generalized pseudo-adjoint flux solution;
- ISADJ=4 for direct, adjoint and generalized adjoint flux solution.

ICOPAR integer array of dimension ICOPAR(6) describing the iteration parameters:

- ICOPAR(1) is the number of free iteration for variational acceleration;

- ICOPAR(2) is the number of accelerated iteration for variational acceleration;
 - ICOPAR(3) is the flag for rebalancing;
 - ICOPAR(4) is the maximum number of inner iterations;
 - ICOPAR(5) is the maximum number of outer iterations;
 - ICOPAR(6) is the contamination flag.
- EPSPAR real array of dimension EPSPAR(NBEPS) containing the convergence parameters:
- EPSPAR(1) is the convergence parameter for the unknowns in the inner iteration;
 - EPSPAR(2) is the convergence parameter for the eigenvalue in the outer iteration;
 - EPSPAR(3) is the convergence parameter for the unknowns in the outer iteration;
 - EPSPAR(4) is the convergence parameter for the generalized adjoint;
 - EPSPAR(5) is the contamination parameter for the generalized adjoint.
- COPTIO character*4 scalar variable containing the type of leakage option to consider:
- COPTIO=LKRD for imposed leakage;
 - COPTIO=B0 for B_0 leakage;
 - COPTIO=P0 for P_0 leakage;
 - COPTIO=B1 for B_1 leakage;
 - COPTIO=P1 for P_1 leakage;
 - COPTIO=B0TR for transport corrected B_0 leakage.
- ILEAK integer scalar variable describing the leakage model to use:
- ILEAK=0 in the case where no leakage model is considered;
 - ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor;
 - ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor;
 - ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term;
 - ILEAK=4 in the case where the leakage is approximate using the albedo approximation;
 - ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling;
 - ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
 - ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search;
 - ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
 - ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search;
 - ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.
- INITFL integer scalar variable describing the flux initialization option:
- INITFL=0 default initialization;

- INITFL=1 taken from FLUXUNK;
- INITFL=2 taken from data structure.

INITLK integer scalar variable describing the leakage initialization option:

- INITLK=0 no initialization;
- INITLK=1 initialize d and compute B^2 ;
- INITLK=2 initialize d and B^2 .

IRSDIR integer array of dimension IRSDIR(NSDIR) describing the buckling direction read.

BRSDIR double precision array of dimension BRSDIR(NSDIR) the directional buckling direction read.

CARLST character*4 scalar variable containing the last string of character read on the input file.

Called by

DRAGON routine(s) : FLUGET

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : REDGET, XABORT

12.2.13 FLUINR

Purpose To compute group source and call flux solution module in fast and resonance groups. For thermal group this routine controls the iteration process and performs rebalancing and computes a variational over-relaxation parameter.

Syntax CALL FLUINR(FMODUL, SMODUL, IPSYS, IPMACR, IPTRK, IPBTF, IPRINT, ITPIJ, KDIR, NGROUP, NBMIX, NREGIO, NUNKNO, MAXINR, EPSTHR, IFRITR, IACITR, IREBAL, LEAKSW, ILEAK, TITLE, MATCOD, VOLUME, KEYFLX, FUNKNO, SUNKNO, MXNL, ISADJ, DB2, SIGT0, SIGS0, XSCAT, IJJ, NJJ, IPOS, IFGUPS, IGCONV, DELFL, SOURC, PNL)

Author(s) G. Marleau, A. Hébert, R. Roy, I. Petrovic and T. Courau

Description of parameters

FMODUL external function for flux evaluation evaluation. Here FMODUL can be TRFICF for CP based calculations or JPMF for response matrix based calculations using the J_{\pm} method.

SMODUL external function for residual evaluation. Here SMODUL can be TRFICS for CP based calculations or JPMS for response matrix based calculations using the J_{\pm} method.

IPSYS integer scalar variable for accessing the ASMPIJ data structure to be analyzed.

IPMACR integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.

IPTRK integer scalar variable for accessing the TRACKING data structure to be analyzed.

IPBTF integer scalar variable for accessing the binary tracking file to be analyzed.

IPRINT	integer scalar variable describing the amount of information printed by this routine. In the case where $IPRINT > 0$, the result of each inner iteration is transferred to the output file.
ITPIJ	integer scalar variable describing the type of CP available: <ul style="list-style-type: none"> • ITPIJ=0 scattering modified isotropic CP; • ITPIJ=1 standard isotropic CP; • ITPIJ=2 scattering modified isotropic and directional CP; • ITPIJ=3 standard isotropic and directional CP.
KDIR	integer scalar variable describing the direction for the CP matrix: <ul style="list-style-type: none"> • KDIR=0 for flux solution • KDIR=1 for x directed solution with anisotropic scattering in B_1 model; • KDIR=2 for y directed solution with anisotropic scattering in B_1 model; • KDIR=3 for z directed solution with anisotropic scattering in B_1 model; • KDIR=4 for x directed solution with anisotropic scattering in B_0 model; • KDIR=5 for y directed solution with anisotropic scattering in B_0 model; • KDIR=6 for z directed solution with anisotropic scattering in B_0 model.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MAXINR	integer scalar variable describing the maximum number of inner iteration.
EPSTHR	real scalar variable describing the convergence parameter for the unknowns in the inner iteration.
IFRITR	integer scalar variable describing the number of free iteration for variational acceleration.
IACITR	integer scalar variable describing the number of accelerated iteration for variational acceleration.
IREBAL	integer scalar variable describing the flag for rebalancing.
LEAKSW	logical scalar variable describing the presence (<code>.TRUE.</code>) or the absence (<code>.FALSE.</code>) of leakage.
ILEAK	integer scalar variable describing the leakage model to use: <ul style="list-style-type: none"> • ILEAK=0 in the case where no leakage model is considered; • ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor; • ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor; • ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term; • ILEAK=4 in the case where the leakage is approximate using the albedo approximation; • ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling; • ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;

	<ul style="list-style-type: none"> • ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search; • ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search; • ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.
TITLE	character*72 scalar variable containing the title of the problem.
MATCOD	integer array of dimension MATCOD(NREGION) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGION) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGION) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
MXNL	integer scalar variable describing the maximum order of the scattering cross section.
ISADJ	integer scalar variable describing the type of flux calculation: <ul style="list-style-type: none"> • ISADJ=0 for direct flux solution; • ISADJ=1 for direct and pseudo-adjoint flux solution; • ISADJ=2 for direct and adjoint flux solution; • ISADJ=3 for direct, pseudo-adjoint and generalized pseudo-adjoint flux solution; • ISADJ=4 for direct, adjoint and generalized adjoint flux solution.
DB2	real array of dimension DB2(NGROUP) containing the dB^2 leakage parameter.
SIGT0	real array of dimension SIGT0(0:NBMIX) containing the transport corrected total cross section vector.
SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
XSCAT	real array of dimension XSCAT(0:NBMIX*NGROUP) containing the scattering cross section matrix.
IJJ	integer array of dimension IJJ(0:NBMIX) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(0:NBMIX) containing the number of diffusion group.
IPOS	integer array of dimension IPOS(0:NBMIX) containing the location of a mixture in the compressed scattering matrix.
IFGUPS	integer array of dimension IFGUPS(MXNL) describing the first group with up-scattering.

IGCONV integer array of dimension IGCONV(NGROUP) used for temporary storage.
 DELFL real array of dimension DELFL(NUNKNO,NGROUP) used for temporary storage.
 SOURC real array of dimension SOURC(NUNKNO) used for temporary storage.
 PNL real array of dimension PNL(NGROUP) used for temporary storage.

Called by

DRAGON routine(s) : FLUDRV

Calling

DRAGON routine(s) : FLUACV, FLUBAL, FLUDB2, FLUFUI

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, LCMSIX, SETARA, RLSARA, XABORT

12.2.14 FLULBD

Purpose To compute the B_1 homogeneous Λ correction factor.

Syntax CALL FLULBD(IPRINT, NGROUP, B2, SIGTN, LAMBDA)

Author(s) I. Petrovic

Description of parameters

IPRINT integer scalar variable describing the amount of information printed by this routine. For the case where $IPRINT \geq 10$ the homogenized cross section and Λ are printed on the output file.

NGROUP integer scalar variable describing the number of energy groups.

B2 real array of dimension B2(4) containing the problem square buckling:

- B2(1) is the x directed buckling;
- B2(2) is the y directed buckling;
- B2(3) is the z directed buckling;
- B2(4) is the homogeneous buckling.

SIGTN real array of dimension SIGTN(NGROUP) containing the homogenized transport corrected total cross sections.

LAMBDA real array of dimension LAMBDA(NGROUP) containing Λ^g .

Called by

DRAGON routine(s) : FLUQFE

12.2.15 FLUQFB

Purpose To add the contribution of the leakage term to the total source.

Syntax CALL FLUQFB(IPSYS, IPRINT, NGROUP, NREGIO, NUNKNO, B2, FUNKNO, SUNKNO, PPP)

Author(s) I. Petrovic

Description of parameters

IPSYS integer scalar variable for accessing the ASMPIJ data structure to be analyzed.

IPRINT integer scalar variable describing the amount of information printed by this routine. For the case where $IPRINT \geq 100$ the current source is printed on the output file.

NGROUP integer scalar variable describing the number of energy groups.

NREGIO integer scalar variable describing the number of regions.

NUNKNO integer scalar variable describing the number of unknowns in the flux/current solution vector.

B2 real array of dimension B2(4) containing the problem square buckling:

- B2(1) is the x directed buckling;
- B2(2) is the y directed buckling;
- B2(3) is the z directed buckling;
- B2(4) is the homogeneous buckling.

FUNKNO real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.

SUNKNO real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.

PPP real array of dimension PPP(NREGIO,NREGIO,3) used for temporary storage.

Called by

DRAGON routine(s) : FLUQFE

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, LCMSIX, XABORT

12.2.16 FLUQFC

Purpose To add the contributions from currents to the sources.

Syntax CALL FLUQFC(IPSYS, IPMACR, ITPIJ, COPTIO, IPRINT, NGROUP, NBMIX, NREGIO, NUNKNO, MATCOD, FUNKNO, SUNKNO, CLBD, XSA, XSB, SIGTH)

Author(s) G. Marleau

Description of parameters

IPSYS integer scalar variable for accessing the ASMPIJ data structure to be analyzed.

IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
ITPIJ	integer scalar variable describing the type of CP available: <ul style="list-style-type: none"> • ITPIJ=0 scattering modified isotropic CP; • ITPIJ=1 standard isotropic CP; • ITPIJ=2 scattering modified isotropic and directional CP; • ITPIJ=3 standard isotropic and directional CP.
COPTIO	character*4 scalar variable containing the type of leakage option to consider: <ul style="list-style-type: none"> • COPTIO=LKRD for imposed leakage; • COPTIO=B0 for B_0 leakage; • COPTIO=P0 for P_0 leakage; • COPTIO=B1 for B_1 leakage; • COPTIO=P1 for P_1 leakage; • COPTIO=B0TR for transport corrected B_0 leakage.
IPRINT	integer scalar variable describing the amount of information printed by this routine. For IPRINT>100 the sources are provided on the output file.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
CLBD	real array of dimension CLBD(NGROUP) containing the group dependent Λ .
XSA	real array of dimension XSA(0:NBMIX) use for temporary storage.
XSB	real array of dimension XSB(0:NBMIX) use for temporary storage.
SIGTH	real array of dimension SIGTH(NGROUP) containing the transport corrected total homogenized cross section.

Called by

DRAGON routine(s) : FLUDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, LCMSIX, XABORT

12.2.17 FLUQFE

Purpose To evaluate the fission, and leakage sources and to process the outer iteration for eigenvalue convergence.

Syntax CALL FLUQFE(IPFLUX, IPSYS, IPMACR, IPRINT, LEAKSW, IYPEC, ISADJ, ILEAK, IOUTER, NGROUP, NBMIX, NREGIO, NUNKNO, NIFISS, MATCOD, VOLUME, KEYFLX, EPSEIG, EPSFLX, COPTIO, REFKEF, B2, EIGENK, LCONV, CFIXSR, FUNKNO, SUNKNO, DB2, SIGT0, SIGS0, XSCAT, IJJ, NJJ, IPOS, SIGTH, SIGF0, QTOTL, RELFOL, LOSCIL)

Author(s) G. Marleau, A. Hébert, I. Petrovic and T. Courau

Description of parameters

- | | |
|--------|---|
| IPFLUX | integer scalar variable for accessing the FLUXUNK data structure to be created. |
| IPSYS | integer scalar variable for accessing the ASMPIJ data structure to be analyzed. |
| IPMACR | integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed. |
| IPRINT | integer scalar variable describing the amount of information printed by this routine. For IPRINT>0 the outer iteration convergence information is provided on the output file. |
| LEAKSW | logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage. |
| IYPEC | integer scalar variable describing the type of flux evaluation: <ul style="list-style-type: none"> • IYPEC= 0 to skip the flux calculation; • IYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence; • IYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage; • IYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling; • IYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling; • IYPEC= 5 direct problem with leakage sources and convergence on buckling; • IYPEC= 6 direct problem fixed sources. |
| ISADJ | integer scalar variable describing the type of flux calculation: <ul style="list-style-type: none"> • ISADJ=0 for direct flux solution; • ISADJ=1 for direct and pseudo-adjoint flux solution; • ISADJ=2 for direct and adjoint flux solution; • ISADJ=3 for direct, pseudo-adjoint and generalized pseudo-adjoint flux solution; • ISADJ=4 for direct, adjoint and generalized adjoint flux solution. |
| ILEAK | integer scalar variable describing the leakage model to use: <ul style="list-style-type: none"> • ILEAK=0 in the case where no leakage model is considered; |

- ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor;
- ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor;
- ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term;
- ILEAK=4 in the case where the leakage is approximate using the albedo approximation;
- ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling;
- ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
- ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search;
- ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
- ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search;
- ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.

IOUTER	integer scalar variable describing the outer iteration number.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
NIFISS	integer scalar variable describing the number of fissile isotopes.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
EPSEIG	real scalar variable containing the convergence parameter for the eigenvalue in the outer iteration.
EPSFLX	real scalar variable containing the convergence parameter for the unknowns in the outer iteration.
COPTIO	character*4 scalar variable containing the type of leakage option to consider: <ul style="list-style-type: none"> • COPTIO=LKRD for imposed leakage; • COPTIO=B0 for B_0 leakage; • COPTIO=P0 for P_0 leakage; • COPTIO=B1 for B_1 leakage; • COPTIO=P1 for P_1 leakage; • COPTIO=B0TR for transport corrected B_0 leakage.

REFKEF	double precision scalar variable containing the reference value for k_{eff} .
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
EIGENK	real array of dimension EIGENK(2) containing the current value for k_{eff} and k_{∞} .
LCONV	logical scalar variable describing if the outer iteration is converged (.TRUE.) or not (.FALSE.).
CFIXSR	character*12 scalar variable containing the name of the generalized adjoint source.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
DB2	real array of dimension DB2(NGROUP) containing the dB^2 leakage parameter.
SIGT0	real array of dimension SIGT0(0:NBMIX) containing the transport corrected total cross section vector.
SIGS0	real array of dimension SIGS0(0:NBMIX) containing the within group transport corrected scattering cross section vector.
XSCAT	real array of dimension XSCAT(0:NBMIX*NGROUP) containing the scattering cross section matrix.
IJJ	integer array of dimension IJJ(0:NBMIX) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(0:NBMIX) containing the number of diffusion group.
IPOS	integer array of dimension IPOS(0:NBMIX) containing the location of a mixture in the compressed scattering matrix.
SIGTH	real array of dimension SIGTH(NGROUP) containing the transport corrected total homogenized cross section.
SIGF0	real array of dimension SIGF0(NBMIX,NIFISS) containing the fission cross section.
QTOTL	real array of dimension QTOTL(NREGIO,NIFISS) containing the total fission rate.
RELFOL	real scalar variable containing the relative convergence of the flux reached.
LOSCIL	logical scalar variable identifying the presence (.TRUE.) of oscillation in the outer iteration.

Called by

DRAGON routine(s) : FLUDRV

Calling

DRAGON routine(s) : B1HOM, FLUBLN, FLUGFL, FLULBD, FLUQFB, FLUQFS, FLUQFX, FLUSFL

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMput, LCMSIX, SETARA, RLSARA, XABORT

12.2.18 FLUQFS

Purpose To add the contributions from fission to the sources.

Syntax CALL FLUQFS(IPMACR, IPRINT, NGROUP, NBMIX, NREGIO, NUNKNO, NIFISS, MATCOD, KEYFLX, CCHI, FACTNO, QTOTL, SUNKNO, XSCHI)

Author(s) G. Marleau and T. Courau

Description of parameters

IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. For IPRINT > 0 the total source is provided on the output file.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
NIFISS	integer scalar variable describing the number of fissile isotopes.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
CCHI	character*12 scalar variable containing the fission spectrum record name.
FACTNO	double precision scalar variable containing the source normalization factor.
QTOTL	real array of dimension QTOTL(NREGIO,NIFISS) containing the total fission rate.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
XSCHI	real array of dimension XSCHI(NBMIX,NIFISS) containing the fission spectrum.

Called by

DRAGON routine(s) : FLUQFE

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMSIX

12.2.19 FLUQFX

Purpose To add the contribution from the fixed sources to the total source.

Syntax CALL FLUQFX(IPMACR, IPRINT, NGROUP, NBMIX, NREGIO, NUNKNO, MATCOD,
KEYFLX, CFIXSR, SUNKNO, XSA)

Author(s) G. Marleau

Description of parameters

IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPRINT	integer scalar variable describing the amount of information printed by this routine. For IPRINT>0 the total source is provided on the output file.
NGROUP	integer scalar variable describing the number of energy groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
CFIXSR	character*12 scalar variable containing the fixed source record name.
SUNKNO	real array of dimension SUNKNO(NUNKNO,NGROUP) containing the sources (flux and possibly currents) for the problem.
XSCHI	real array of dimension XSCHI(NBMIX,NIFISS) containing the fission spectrum.
XSA	real array of dimension XSA(0:NBMIX) used for temporary storage.

Called by

DRAGON routine(s) : FLUQFE

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, XABORT

12.2.20 FLURFL

Purpose To read flux for initialization on input.

Syntax CALL FLURFL(NGROUP, NREGIO, NUNKNO, KEYFLX, FUNKNO)

Author(s) G. Marleau

Description of parameters

NGROUP	integer scalar variable describing the number of energy groups.
NREGION	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
KEYFLX	integer array of dimension KEYFLX(NREGION) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.

Called by

DRAGON routine(s) : FLUGET

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : REDGET, XABORT

12.2.21 FLUSFL

Purpose To save flux on FLUXUNK data structure.

Syntax CALL FLUSFL(IPFLUX, NGROUP, NUNKNO, FUNKNO)

Author(s) G. Marleau

Description of parameters

IPFLUX	integer scalar variable for accessing the FLUXUNK data structure to be created.
NGROUP	integer scalar variable describing the number of energy groups.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
FUNKNO	real array of dimension FUNKNO(NUNKNO,NGROUP) containing the unknowns (flux and possibly currents) that will be solved for.

Called by

DRAGON routine(s) : FLUDRV, FLUQFE

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMPUT

12.2.22 B1BETA

Purpose To compute the β function for a P_1 or B_1 calculation.

Syntax B1BETA=B1BETA(IAPROX,B2,SIG,DD)

Author(s) A. Hébert

Description of input parameters

IAPROX integer variable describing the type of approximation used:

- IAPROX=0 for imposed leakage;
- IAPROX=1 for P_0 or P_1 approximation;
- IAPROX=2 for B_0 or B_1 approximation.

B2 double precision variable containing the homogeneous buckling B^2 .

SIG double precision variable containing the homogenized total cross section.

DD double precision variable containing the leakage coefficient d (only used when IAPROX=0).

Description of output parameters

B1BETA double precision variable containing the value of β computed.

Called by

DRAGON routine(s) : B1DIF

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

12.2.23 B1DIF

Purpose To solve the B_N equations and to perform a buckling search if required.

Syntax CALL B1DIF (OPTION, TYPE , NGRO , ST , SFNU , XHI ,
IJJ0 , IJJ1 , NJJ0 , NJJ1 , SCAT0 , SCAT1 ,
REFKEF,IMPX , D , B2 , ALAM1 , CAET , A2 ,
PHI , ASTOC , BSTOC , CSTOC , SA , IND)

Author(s) A. Hébert

Description of parameters

OPTION character*4 scalar variable containing the type of leakage option to consider:

- OPTION=LKRD for imposed leakage;
- OPTION=B0 for B_0 leakage;
- OPTION=P0 for P_0 leakage;

	<ul style="list-style-type: none"> • OPTION=B1 for B_1 leakage; • OPTION=P1 for P_1 leakage; • OPTION=B0TR for transport corrected B_0 leakage.
TYPE	character*4 scalar variable describing the type of calculation: <ul style="list-style-type: none"> • TYPE=DIFF for a B_0 calculation; • TYPE=K for a B_1 calculation with k_{eff} search; • TYPE=B for a B_1 calculation with buckling search; • TYPE=L for a B_1 calculation with buckling search and leakage sources.
NGRO	integer scalar variable describing the number of energy groups.
ST	real array of dimension ST(NGRO) containing the total cross section.
SFNU	real array of dimension SFNU(NGRO) containing the product of ν and the fission cross section.
XHI	real array of dimension XHI(NGRO) containing the neutron fission spectrum.
IJJ0	integer array of dimension IJJ0(NBM) containing the position of the first diffusion group for isotropic scattering.
IJJ1	integer array of dimension IJJ1(NBM) containing the position of the first diffusion group for linearly anisotropic scattering.
NJJ0	integer array of dimension NJJ0(NBM) containing the number of diffusion groups for isotropic scattering.
NJJ1	integer array of dimension NJJ1(NBM) containing the number of diffusion groups for linearly anisotropic scattering.
SCAT0	real array of dimension SCAT0(NBM*NGRO) containing the isotropic scattering cross section matrix.
SCAT1	real array of dimension SCAT1(NBM*NGRO) containing the linearly anisotropic scattering cross section matrix.
REFKEF	double precision scalar variable containing the reference value for k_{eff} .
IMPX	integer scalar variable describing the amount of information printed by this routine.
D	array of dimension D(NGRO) containing the diffusion coefficients.
B2	double precision variable containing the homogeneous buckling B^2 .
ALAM1	double precision scalar variable containing the current value of k_{eff} .
CAET	double precision variable containing k_{∞} .
A2	double precision variable containing the migration area.
PHI	double precision array of dimension PHI(2*NGRO) containing the fundamental flux solution.
ASTOC	double precision array of dimension ASTOC(2*NGRO*(NGRO+1)) used for temporary storage.
BSTOC	double precision array of dimension BSTOC(NGRO,2*NGRO) used for temporary storage.
CSTOC	double precision array of dimension CSTOC(2*NGRO) used for temporary storage.

SA double precision array of dimension SA(2*NGRO) used for temporary storage.

IND integer array of dimension IND(NGRO) used for temporary storage.

Called by

DRAGON routine(s) : B1HOM

Calling

DRAGON routine(s) : B1BETA, B1SOL

UTILIB routine(s) : ALEIGD

GANLIB routine(s) : XABORT

12.2.24 B1HOM

Purpose To homogenize the unit cell and solve the B_N equations.

Syntax CALL B1HOM (IPMACR, NUNKNO, OPTION, TYPE , NGRO , IPAS ,
NBM , NFISSI, VOL , MAT , KEYFLX, FLUX ,
REFKEF,IMPX , D , ALAM1 , ST , PHI , XSCAT ,
IJJ , NJJ , IPOS , INORM , B2)

Author(s) A. Hébert

Description of parameters

IPMACR integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.

NUNKNO integer scalar variable describing the number of unknowns in the flux/current solution vector.

OPTION character*4 scalar variable containing the type of leakage option to consider:

- OPTION=LKRD for imposed leakage;
- OPTION=B0 for B_0 leakage;
- OPTION=P0 for P_0 leakage;
- OPTION=B1 for B_1 leakage;
- OPTION=P1 for P_1 leakage;
- OPTION=B0TR for transport corrected B_0 leakage.

TYPE character*4 scalar variable describing the type of calculation:

- TYPE=DIFF for a B_0 calculation;
- TYPE=K for a B_1 calculation with k_{eff} search;
- TYPE=B for a B_1 calculation with buckling search;
- TYPE=L for a B_1 calculation with buckling search and leakage sources.

NGRO integer scalar variable describing the number of energy groups.

IPAS integer scalar variable describing the number of regions.

NBM integer scalar variable describing the number of mixtures.

NFISSI	integer scalar variable describing the number of fissile isotopes.
VOL	real array of dimension VOL(IPAS) containing the volume associated with each region in the problem.
MAT	integer array of dimension MAT(IPAS) containing the mixture associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(IPAS) containing the region number associated with each zone in the geometry.
FLUX	real array of dimension FLUX(NUNKNO,NGRO) containing the unknowns (flux and possibly currents) that will be solved for.
REFKEF	double precision scalar variable containing the reference value for k_{eff} .
IMPX	integer scalar variable describing the amount of information printed by this routine. Not used here.
D	real array of dimension D(NGRO) containing the diffusion coefficients.
ALAM1	double precision scalar variable containing the current value of k_{eff} .
ST	real array of dimension ST(NGRO) containing the homogenized total cross section.
PHI	double precision array of dimension PHI(2*NGRO) used as temporary storage.
XSCAT	real array of dimension XSCAT(0:NBM*NGRO) containing the scattering cross section matrix.
IJJ	integer array of dimension IJJ(0:NBM) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(0:NBM) containing the number of diffusion group.
IPOS	integer array of dimension IPOS(0:NBM) containing the location of a mixture in the compressed scattering matrix.
INORM	integer scalar variable describing the flux normalization option: <ul style="list-style-type: none"> • INORM=-1 for a heterogeneous B_1 normalization; • INORM=2 for an homogeneous B_1 normalization.
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.

Called by

DRAGON routine(s) : FLUQFE

Calling

DRAGON routine(s) : B1DIF , B1HXS1, B1HXS2, B1HXS3

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA

12.2.25 B1HXS1, B1HXS2, B1HXS3

Purpose To homogenize the lattice cell properties for a homogeneous B_0 or B_1 leakage model.

Syntax CALL B1HXS1(MAXPTS, IPMACR, IPAS, NGRO, NBM, IAN, NFISSI, VOL, MAT, KEYFLX, FLUX, IJJ0, IJJ1, NJJ0, NJJ1, IDEL, IJJ , NJJ)

CALL B1HXS2(MAXPTS, IPMACR, IPAS, NGRO, NBM, IAN, NFISSI, VOL, MAT, KEYFLX, FLUX, IJJ0, IJJ1, NJJ0, NJJ1, IDEL, XSCAT, IJJ, NJJ, IPOS, GAR, GAF, A14, FLXIN, SA, ST, SFNU, XHI, SCAT0, SCAT1, SIGF0, CUR, NGROIN, INORM, B2, B2HOM)

CALL B1HXS3(MAXPTS, IPMACR, IPAS, NGRO, NBM, IAN, NFISSI, VOL, MAT, KEYFLX, FLUX, IJJ0, IJJ1, NJJ0, NJJ1, IDEL, XSCAT, IJJ, NJJ, IPOS, GAR, GAF, A14, FLXIN, SA, ST, SFNU, XHI, SCAT0, SCAT1, SIGF0, CUR, NGROIN, INORM, B2, B2HOM)

Author(s) A. Hébert

Description of parameters

MAXPTS	integer scalar variable describing the number of unknowns in the flux/current solution vector.
IPMACR	integer scalar variable for accessing a MACROLIB or MICROLIB data structure to be analyzed.
IPAS	integer scalar variable describing the number of regions.
NGRO	integer scalar variable describing the number of energy groups.
NBM	integer scalar variable describing the number of mixtures.
IAN	integer scalar variable describing the type of homogenization: <ul style="list-style-type: none"> • IAN=-1 for transport corrected P_0; • IAN=0 for P_0; • IAN=1 for P_1.
NFISSI	integer scalar variable describing the number of fissile isotopes.
VOL	real array of dimension VOL(IPAS) containing the volume associated with each region in the problem.
MAT	integer array of dimension MAT(IPAS) containing the mixture associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(IPAS) containing the region number associated with each zone in the geometry.
FLUX	real array of dimension FLUX(NUNKNO,*) containing the unknowns (flux and possibly currents) that will be solved for.
IJJ0	integer array of dimension IJJ0(NBM) containing the position of the first diffusion group for isotropic scattering.
IJJ1	integer array of dimension IJJ1(NBM) containing the position of the first diffusion group for linearly anisotropic scattering.

NJJ0	integer array of dimension NJJ0(NBM) containing the number of diffusion groups for isotropic scattering.
NJJ1	integer array of dimension NJJ1(NBM) containing the number of diffusion groups for linearly anisotropic scattering.
IDEL	integer array of dimension IDEL(2) describing the dimensions of the isotropic and linearly anisotropic scattering matrices.
IJJ	integer array of dimension IJJ(0:NBM) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(0:NBM) containing the number of diffusion group.
XSCAT	real array of dimension XSCAT(0:NBM*NGRO) containing the scattering cross section matrix.
GAR	real array of dimension GAR(0:NBM) used for temporary storage.
GAF	real array of dimension GAF(0:NBM) used for temporary storage.
A14	double precision array of dimension A14(2*NFISSI*NBM) used for temporary storage.
FLXIN	double precision array of dimension FLXIN(NGRO) containing the integrated fluxes.
SA	real array of dimension SA(NGRO) containing the absorption cross section.
ST	real array of dimension ST(NGRO) containing the total cross section.
SFNU	real array of dimension SFNU(NGRO) containing the product of ν and the fission cross section.
XHI	real array of dimension XHI(NGRO) containing the neutron fission spectrum.
SCAT0	real array of dimension SCAT0(NBM*NGRO) containing the isotropic scattering cross section matrix.
SCAT1	real array of dimension SCAT1(NBM*NGRO) containing the linearly anisotropic scattering cross section matrix.
SIGF0	real array of dimension SIGF0(NBM,NFISSI) containing the fission cross section cross section matrix.
CUR	double precision array of dimension CUR(*) used for temporary storage.
NGROIN	integer scalar variable containing the number of energy groups without up-scattering.
INORM	integer scalar variable describing the flux normalization option: <ul style="list-style-type: none"> • INORM=-1 for a heterogeneous B_1 normalization; • INORM=2 for an homogeneous B_1 normalization.
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
B2HOM	double precision variable containing the homogeneous value of B^2 .

Called by

DRAGON routine(s) : B1HOM

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMSIX, XABORT

12.2.26 B1SOL

Purpose To solve the system of linear equations that appear in the B_1 method.

Syntax CALL B1SOL (NGRO , B , IER)

Author(s) A. Hébert

Description of parameters

NGRO integer scalar variable describing the number of groups.

B real array of dimension B(NGRO,NGRO+1) containing the augmented coefficient matrix.

IER integer scalar variable to indicate failure (IER>0) or success (IER=0) of the solution algorithm.

Called by

DRAGON routine(s) : B1DIF

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALSBD

GANLIB routine(s) :

12.3 External Routines

12.3.1 TRFICF

Purpose Standard flux solution routine for the CP method.

Syntax CALL TRFICF(IPSYS , IPTRK , IPBTF , IPRNTF, IDIR , NREGIO,
NUNKNO, MATCOD, VOLUME, KEYFLX, FUNKNO,
SUNKNO,TITRE)

Author(s) G. Marleau

Description of parameters

IPSYS integer scalar variable for accessing the ASMPIJ data structure to be analyzed.

IPTRK integer scalar variable for accessing the TRACKING data structure to be analyzed.

IPBTF	integer scalar variable for accessing the binary tracking file to be analyzed.
IPRNTF	integer scalar variable describing the amount of information printed by this routine. For IPRNTF > 4 the flux/current solution are provided on the output file.
IDIR	integer scalar variable describing the type of solution: <ul style="list-style-type: none"> • IDIR=0 for flux solution; • IDIR=1 for x directed current solution; • IDIR=2 for y directed current solution; • IDIR=3 for z directed current solution.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO) containing the sources (flux and possibly currents) for the problem.
TITRE	character*72 scalar variable containing the title of the problem.

Called by

DRAGON routine(s) : FLUDRV, TRFICS

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMLen, LCMNXT, SETARA, RLSARA,
XABORT

12.3.2 TRFICS

Purpose Standard residual evaluation routine for the CP method.

Syntax CALL TRFICS(IPSYS , IPTRK , IPBTF , IPRNTF , IDIR , NREGIO,
NUNKNO, MATCOD, VOLUME, KEYFLX, FUNKNO,
SUNKNO,TITRE)

Author(s) G. Marleau

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IPBTF	integer scalar variable for accessing the binary tracking file to be analyzed.
IPRNTF	integer scalar variable describing the amount of information printed by this routine. For IPRNTF > 4 the flux/current residuals are provided on the output file.
IDIR	integer scalar variable describing the type of solution: <ul style="list-style-type: none"> • IDIR=0 for flux solution; • IDIR=1 for x directed current solution; • IDIR=2 for y directed current solution; • IDIR=3 for z directed current solution.
NREGIO	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region in the problem.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO) containing the residual (flux and possibly currents) for the problem.
TITRE	character*72 scalar variable containing the title of the problem.

Called by

DRAGON routine(s) : FLUDRV

Calling

DRAGON routine(s) : TRFICF

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA

12.3.3 JPMF

Purpose Standard flux solution routine for the J_{\pm} method.

Syntax CALL JPMF (IPSYS , IPTRK , IFTRAK, IMPX , IDIR , NMERGE,
 NUNKNO, MAT , VOL , KEYFLX, FUNKNO,
 SUNKNO,TITR)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
IMPX	integer scalar variable describing the amount of information printed by this routine. For IMPX > 4 the flux/current solution are provided on the output file.
IDIR	integer scalar variable describing the type of solution: <ul style="list-style-type: none"> • IDIR=0 for flux solution; • IDIR=1 for x directed current solution; • IDIR=2 for y directed current solution; • IDIR=3 for z directed current solution.
NMERGE	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MAT	integer array of dimension MAT(NMERGE) containing the mixture associated with each region in the problem.
VOL	real array of dimension VOL(NMERGE) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NMERGE) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO) containing the sources (flux and possibly currents) for the problem.
TITR	character*72 scalar variable containing the title of the problem.

Called by

DRAGON routine(s) : FLUDRV

Calling

DRAGON routine(s) : JPMFLX

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMLen, LCMNXT, SETARA, RLSARA, XABORT

12.3.4 JPMS

Purpose Standard residual evaluation routine for the J_{\pm} method.

Syntax CALL JPMS (IPSYS , IPTRK , IFTRAK, IMPX , IDIR , NMERGE,
NUNKNO, MAT , VOL , KEYFLX, FUNKNO,
SUNKNO,TITR)

Author(s) A. Hébert

Description of parameters

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be analyzed.
IPTRK	integer scalar variable for accessing the TRACKING data structure to be analyzed.
IFTRAK	integer scalar variable for accessing the binary tracking file to be analyzed.
IMPX	integer scalar variable describing the amount of information printed by this routine. For $IMPX > 4$ the flux/current residuals are provided on the output file.
IDIR	integer scalar variable describing the type of solution: <ul style="list-style-type: none"> • IDIR=0 for flux solution; • IDIR=1 for x directed current solution; • IDIR=2 for y directed current solution; • IDIR=3 for z directed current solution.
NMERGE	integer scalar variable describing the number of regions.
NUNKNO	integer scalar variable describing the number of unknowns in the flux/current solution vector.
MAT	integer array of dimension MAT(NMERGE) containing the mixture associated with each region in the problem.
VOL	real array of dimension VOL(NMERGE) containing the volume associated with each region in the problem.
KEYFLX	integer array of dimension KEYFLX(NMERGE) containing the region number associated with each zone in the geometry.
FUNKNO	real array of dimension FUNKNO(NUNKNO) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NUNKNO) containing the residuals (flux and possibly currents) for the problem.
TITR	character*72 scalar variable containing the title of the problem.

Called by

DRAGON routine(s) : FLUDRV

Calling

DRAGON routine(s) : JPMRES

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMIOF, LCMLen, LCMNXT, SETARA, RLSARA, XABORT

12.3.5 JPMFLX

Purpose To solve the J_{\pm} flux current equations without CP reconstruction.

Syntax CALL JPMFLX(NMBLK , IFR , ALB , NMERGE, IJAT , INUM ,
MIX , DVX , MU1 , IMA , WSSB , NGEN ,
IGEN , ISURF , CHORD , SIGS , PII , PIS ,
FUNKNO, SUNKNO, IGAT , IGAU , GAR)

Author(s) A. Hébert

Description of parameters

NMBLK	integer scalar variable describing the total number of blocks in the problem.
IFR	integer array of dimension IFR(IJAS) containing the index number for the incoming currents.
ALB	real array of dimension ALB(IJAS) containing the boundary conditions.
NMERGE	integer scalar variable describing the number of merged blocks.
IJAT	integer scalar variable describing the number of outgoing currents.
INUM	integer array of dimension INUM(NMBLK) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(IJAR) containing the index-number of out-currents.
DVX	real array of dimension DVX(IJAR) containing the weight associated with each out-current.
MU1	integer array of dimension MU1(IJAT) containing the position of each diagonal element in matrix $(I - W_{SS}A)$.
IMA	integer array of dimension IMA(IJAT) containing the position of the first non-zero column element in matrix $(I - W_{SS}A)$.
WSSB	real array of dimension WSSB(IMA(IJAT)) containing the matrix $(I - W_{SS}A)$ after factorization.
NGEN	integer scalar variable describing the total number of generating blocks.
IGEN	integer array of dimension IGEN(NMERGE) containing the index number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(NGEN) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(NPIJ) containing the mean chord length associated with each surface.
SIGS	real array of dimension SIGS(NGEN) containing the within-group scattering cross sections of the generating blocks.
PII	real array of dimension PII(NGEN) containing the volume to volume reduced collision probabilities.

PIS	real array of dimension PIS(NPIS) containing the volume to surface reduced leakage probabilities.
FUNKNO	real array of dimension FUNKNO(NMERGE+IJAT) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NMERGE+IJAT) containing the sources (flux and possibly currents) for the problem.
IGAT	integer array of dimension IGAT(NMERGE) used for temporary storage.
IGAU	integer array of dimension IGAU(NGEN) used for temporary storage.
GAR	real array of dimension GAR(IJAT) used for temporary storage.

Called by

DRAGON routine(s) : JPMF

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLUS

GANLIB routine(s) :

12.3.6 JPMRES

Purpose To evaluate the J_{\pm} flux current residual without CP reconstruction.

Syntax CALL JPMRES(NMBLK , IFR , ALB , NMERGE, IJAT , INUM ,
MIX , DVX , MU1 , IMA , WSSB , NGEN ,
IGEN , ISURF , CHORD , SIGS , PII , PIS ,
FUNKNO, SUNKNO, IGAT , IGAU , GAR)

Author(s) A. Hébert

Description of parameters

NMBLK	integer scalar variable describing the total number of blocks in the problem.
IFR	integer array of dimension IFR(IJAS) containing the index number for the incoming currents.
ALB	real array of dimension ALB(IJAS) containing the boundary conditions.
NMERGE	integer scalar variable describing the number of merged blocks.
IJAT	integer scalar variable describing the number of outgoing currents.
INUM	integer array of dimension INUM(NMBLK) containing the index-number of the merged block associated to each block.
MIX	integer array of dimension MIX(IJAR) containing the index-number of out-currents.
DVX	real array of dimension DVX(IJAR) containing the weight associated with each out-current.
MU1	integer array of dimension MU1(IJAT) containing the position of each diagonal element in matrix $(I - W_{SS}A)$.

IMA	integer array of dimension IMA(IJAT) containing the position of the first non-zero column element in matrix $(I - W_{SS}A)$.
WSSB	real array of dimension WSSB(IMA(IJAT)) containing the matrix $(I - W_{SS}A)$ after factorization.
NGEN	integer scalar variable describing the total number of generating blocks.
IGEN	integer array of dimension IGEN(NMERGE) containing the index number of the generating block associated with each merged block.
ISURF	integer array of dimension ISURF(NGEN) containing the number of surfaces associated with each generating block.
CHORD	real array of dimension CHORD(NPIJ) containing the mean chord length associated with each surface.
SIGS	real array of dimension SIGS(NGEN) containing the within-group scattering cross sections of the generating blocks.
PII	real array of dimension PII(NGEN) containing the volume to volume reduced collision probabilities.
PIS	real array of dimension PIS(NPIS) containing the volume to surface reduced leakage probabilities.
FUNKNO	real array of dimension FUNKNO(NMERGE+IJAT) containing the unknowns (flux and possibly currents) that will be solved for.
SUNKNO	real array of dimension SUNKNO(NMERGE+IJAT) containing the residuals (flux and possibly currents) for the problem.
IGAT	integer array of dimension IGAT(NMERGE) used for temporary storage.
IGAU	integer array of dimension IGAU(NGEN) used for temporary storage.
GAR	real array of dimension GAR(IJAT) used for temporary storage.

Called by

DRAGON routine(s) : JPMS

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLUM

GANLIB routine(s) :

NR	integer scalar variable containing the number of regions.
FLUX	real array of dimension FLUX(NF,NR,NG,3) containing the flux.
AKEEP	double precision array of dimension AKEEP(3) containing the eigenvalue for the last three iterations.
IG0	integer scalar variable containing the first group to process.
MU	real scalar variable containing the variational acceleration factor.

Called by

DRAGON routine(s) : MOC2DR

13.2.2 MOC2BL

Purpose To rebalance the inner iterations.

Syntax CALL MOC2BL(NG, IG0, NA, PHI, XCSOU, XCTRC, XCDIA, XCCAT, DB2, REBAL, FLUN, IPRT)

Author(s) R. Roy

Description of parameters

NG	integer scalar variable containing the number of groups.
IG0	integer scalar variable containing the first group to process.
NA	integer scalar variable containing the number of Legendre order for scattering.
PHI	double precision array of dimension PHI(NG) containing the region integrated flux.
XCSOU	double precision array of dimension XCSOU(NG) containing the region integrated sources.
XCTRC	double precision array of dimension XCTRC(NG) containing the region integrated transport corrected total cross sections.
XCDIA	double precision array of dimension XCDIA(NG) containing the region integrated within group scattering cross sections.
XCCAT	double precision array of dimension XCCAT(NG,0:NA,NG) containing the region integrated scattering cross sections matrix.
DB2	double precision array of dimension DB2(NG) containing the region integrated leakage cross sections.
REBAL	double precision array of dimension REBAL(NG,NG+1) containing the rebalancing matrix.
FLUN	double precision array of dimension FLUN(NG) containing the group rebalancing factor.
IPRT	integer scalar variable containing the print flag.

Called by

DRAGON routine(s) : MOC2DR

Calling

DRAGON routine(s) : MOCSOL

UTILIB routine(s) :

GANLIB routine(s) : XABORT

13.2.3 MOC2BN

Purpose To perform the buckling search.

Syntax CALL MOC2BN(NGRP, NANIS, NBN, PHI, XCTOT, XCTRC, XCDIA, XCCAT, XCNUF, XCCHI, XCABS, DIFF, BETA, REBAL, FLUN, REFKEF, EBMX, B2, IPRT)

Author(s) R. Roy

Description of parameters

NGRP	integer scalar variable containing the number of groups.
NANIS	integer scalar variable containing the number of Legendre order for scattering.
NBN	integer scalar variable containing the number of Legendre order for leakage.
PHI	double precision array of dimension PHI(NGRP) containing the region integrated flux.
XCTOT	double precision array of dimension XCTOT(NGRP) containing the region integrated total cross sections.
XCTRC	double precision array of dimension XCTRC(NGRP) containing the region integrated transport corrected total cross sections.
XCDIA	double precision array of dimension XCDIA(NGRP) containing the region integrated within group scattering cross sections.
XCCAT	double precision array of dimension XCCAT(NGRP,0:NANIS,NGRP) containing the region integrated scattering cross sections matrix.
XCNUF	double precision array of dimension XCNUF(NGRP) containing the region integrated fission cross sections.
XCCHI	double precision array of dimension XCCHI(NGRP) containing the region integrated fission production cross sections.
XCABS	double precision array of dimension XCABS(NGRP) containing the region integrated absorption cross sections.
DIFF	double precision array of dimension DIFF(NGRP) containing the region integrated diffusion cross sections.
BETA	double precision array of dimension BETA(NGRP) used for temporary storage.
REBAL	double precision array of dimension REBAL(NGRP,NGRP+1) containing the rebalancing matrix.
FLUN	double precision array of dimension FLUN(NGRP) containing the flux normalization factor.
REFKEF	double precision scalar variable containing the reference eigenvalue.
EBMX	real scalar variable containing the convergence criteria for the eigenvalue.

B2 double precision scalar variable containing B_2 .

IPRT integer scalar variable the print flag.

Called by

DRAGON routine(s) : MOC2MH

Calling

DRAGON routine(s) : MOCSOL

UTILIB routine(s) :

GANLIB routine(s) : XABORT

13.2.4 MOC2DR

Purpose To control the 2-D solution to the method of characteristics.

Syntax CALL MOC2DR(IPFLUX, IFTRAK, NGRP, NREG, NSOUT, NANIS, NMAT, NGSS, MXSEG, NTRK, NPHI, NFUNL, NMOD, KEYANI, MATALB, VOL, VOLINV, WGSS, XGSS, YGSS, PHANG, SEGLEN, NRSEG, EXPT, EXP2, CYCLE, FLM, FLP, CYP, CYM, ALPHA, DFLUX, DWEIG, FMEAN, SIGANG, NALB, ALBEDO, XSTOT, XSTRC, XTINV, XSDIA, XSCAT, NIFIS, XSNUF, XSCHI, ITRB, FLUX, FLUXO, DIFFB1, ISGMR, RHARM, LEAKSW, LREBAL, NINTMX, AIEPSF, NEXTMX, AEEPSF, IPRT, IYPEC, ILEAK, NL, NBN, RKEFF, RB2, TRHAR, REBAL, CPTL, CPTA, PHI, FLUN, PNL, XCSOU, XCTOT, XCTRC, XCDIA, XCCAT, XCNUF, XCCHI, XCABS, DIFF, DB2, BETA, LEXIN, NOVOID, REFKEF)

Author(s) R. Roy

Description of parameters

IPFLUX integer scalar variable containing the pointer to the FLUXUNK data structure.

IFTRAK integer scalar variable containing the unit associated with the binary tracking file.

NGRP integer scalar variable containing the number of groups.

NREG integer scalar variable containing the number of regions.

NSOUT integer scalar variable containing the number of outer surfaces.

NANIS integer scalar variable containing the number of Legendre order for scattering.

NMAT integer scalar variable containing the number of mixtures.

NGSS integer scalar variable containing the number of angular integration points.

MXSEG integer scalar variable containing the maximum length of an integration line.

NTRK integer scalar variable containing the number of integration lines.

NPHI integer scalar variable containing the number of angles in direction ϕ .

NFUNL	integer scalar variable containing the number of Legendre order for the flux.
NMOD	integer scalar variable containing the number of spherical harmonics modes.
KEYANI	integer array of dimension KEYANI((NL+1)*(NL+1)) containing the coupling vector for the flux and scattering real spherical harmonics.
MATALB	integer array of dimension MATALB(-NSOUT:NREG) containing the albedo number and mixture associated with surfaces and regions.
VOL	real array of dimension VOL(NREG) containing the region volume.
VOLINV	real array of dimension VOLINV(NREG) containing the inverse of the region volume.
WGSS	real array of dimension WGSS(MXGAUS) containing the integration weight.
XGSS	real array of dimension XGSS(MXGAUS) containing the cosine of the integration points.
YGSS	real array of dimension YGSS(MXGAUS) containing the secant of the integration points.
PHIANG	real array of dimension PHIANG(NPHI) that is not used.
SEGLN	real array of dimension SEGLN(MXSEG) containing the tracking segment length.
NRSEG	integer array of dimension NRSEG(MXSEG) containing the tracking segment type.
EXPT	real array of dimension EXPT(NGSS,MXSEG) used for temporary storage.
EXP2	real array of dimension EXP2(NGSS,MXSEG) used for temporary storage.
CYCLE	real array of dimension CYCLE(NGSS) that is not used.
FLM	real array of dimension FLM(NGSS,MXSEG) used for temporary storage.
FLP	real array of dimension FLP(NGSS,MXSEG) used for temporary storage.
CYP	real array of dimension CYP(NGSS,MXSEG) used for temporary storage.
CYM	real array of dimension CYM(NGSS,MXSEG) used for temporary storage.
ALPHA	real array of dimension ALPHA(NGSS) that is not used.
DFLUX	real array of dimension DFLUX(NGSS) that is not used.
DWEIG	real array of dimension DWEIG(NGSS) that is not used.
FMEAN	real array of dimension FMEAN(NGSS) that is not used.
SIGANG	real array of dimension SIGANG(NGSS,-NALB:NMAT,NGRP) used for temporary storage.
NALB	integer scalar variable containing the number of albedo.
ALBEDO	real array of dimension ALBEDO(NALB) containing the albedos.
XSTOT	real array of dimension XSTOT(0:NMAT,NGRP) containing the total cross section.
XSTRC	real array of dimension XSTRC(0:NMAT,NGRP) containing the transport correction.
XTINV	real array of dimension XTINV(0:NMAT,NGRP) containing the inverse of the total cross section.
XSDIA	real array of dimension XSDIA(0:NMAT,NGRP) containing the within group scattering.

XSCAT	real array of dimension XSCAT(NGRP,0:NMAT,0:NANIS,NGRP) containing the scattering matrix.
NIFIS	integer scalar variable containing the number of fissile isotopes.
XSNUF	real array of dimension XSNUF(0:NMAT,NIFIS,NGRP) containing $\nu\Sigma_f$.
XSCHI	real array of dimension XSCHI(0:NMAT,NIFIS,NGRP) containing the fission spectrum.
ITRB	integer scalar variable that is not used.
FLUX	real array of dimension FLUX(NFUNL,NREG,NGRP,8) containing the current flux.
FLUXO	real array of dimension FLUXO(NREG,NFUNL,NGRP) containing the old flux.
DIFFB1	real array of dimension DIFFB1(NGRP) containing the diffusion coefficients.
ISGNR	integer array of dimension ISGNR(NFUNL,NMOD) containing the spherical harmonics sign.
RHARM	real array of dimension RHARM(NGSS,*) that is not used.
LEAKSW	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
LREBAL	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage for rebalancing.
NINTMX	integer scalar variable containing the maximum number of inner iterations.
AIEPSF	real scalar variable containing the convergence criterion for the inner iteration.
NEXTMX	integer scalar variable containing the maximum number of outer iterations.
AEEPSF	real scalar variable containing the convergence criterion for the outer iteration.
IPRT	integer scalar variable containing the print flag.
ITYPEC	integer scalar variable containing the type of flux evaluation: <ul style="list-style-type: none"> • ITYPEC= 0 to skip the flux calculation; • ITYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence; • ITYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage; • ITYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling; • ITYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling; • ITYPEC= 5 direct problem with leakage sources and convergence on buckling; • ITYPEC= 6 direct problem fixed sources.
ILEAK	integer scalar variable containing the leakage model to use: <ul style="list-style-type: none"> • ILEAK=0 in the case where no leakage model is considered; • ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor; • ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor;

- ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term;
- ILEAK=4 in the case where the leakage is approximate using the albedo approximation;
- ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling;
- ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
- ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search;
- ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search;
- ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search;
- ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.

NL	integer scalar variable containing the number of Legendre order for the flux.
NBN	integer scalar variable containing the number of Legendre order for leakage.
RKEFF	real scalar variable containing the eigenvalue.
RB2	real scalar variable containing the buckling.
TRHAR	real array of dimension TRHAR(NFUNL,NGSS,*) that is not used.
REBAL	double precision array of dimension REBAL(NGRP,NGRP+1) containing the rebalancing matrix.
CPTL	integer scalar variable used for temporary storage.
CPTA	integer scalar variable used for temporary storage.
PHI	double precision array of dimension PHI(NGRP) containing the region integrated flux.
FLUN	double precision array of dimension FLUN(NGRP) containing the flux normalization factor.
PNL	double precision array of dimension PNL(NGRP) containing the non-leakage probability.
XCSOU	double precision array of dimension XCSOU(NGRP) containing the region integrated sources.
XCTOT	double precision array of dimension XCTOT(NGRP) containing the region integrated total cross sections.
XCTRC	double precision array of dimension XCTRC(NGRP) containing the region integrated transport corrected total cross sections.
XCDIA	double precision array of dimension XCDIA(NGRP) containing the region integrated within group scattering cross sections.
XCCAT	double precision array of dimension XCCAT(NGRG,0:NANIS,NGRP) containing the region integrated scattering cross sections matrix.
XCNUF	double precision array of dimension XCNUF(NGRP) containing the region integrated fission cross sections.
XCCHI	double precision array of dimension XCCHI(NGRP) containing the region integrated fission production cross sections.

XCABS	double precision array of dimension XCABS(NGRP) containing the region integrated absorption cross sections.
DIFF	double precision array of dimension DIFF(NGRP) containing the region integrated diffusion cross sections.
DB2	double precision array of dimension DB2(NGRP) containing the region integrated leakage cross sections.
BETA	double precision array of dimension BETA(NGRP) used for temporary storage.
LEXIN	logical scalar variable containing the flag for approximate exponential.
NOVOID	logical scalar variable containing the flag (.TRUE.) to indicate the presence of void regions.
REFKEF	double precision scalar variable containing the reference eigenvalue.

Called by

DRAGON routine(s) : MOCDRV

Calling

DRAGON routine(s) : MOC2AC, MOC2BL, MOC2HM, MOC2I0, MOC2I1, MOC2KF, MOC2MH, MOC3I0, MOC3I1, MOCRWD

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, XABORT

13.2.5 MOC2HM

Purpose To compute the region homogenized cross sections.

Syntax CALL MOC2HM(NGRP, NREG, NANIS, NMAT, NFUNL, NIFIS, KEYANI, MATCOD, VOL, FLUX, XSTOT, XSTRC, XSDIA, XSCAT, XSNUF, XSCHI, PHI, XCTOT, XCTRC, XCDIA, XCCAT, XCNUF, XCCHI, XCABS, IPRT)

Author(s) R. Roy

Description of parameters

NGRP	integer scalar variable containing the number of groups.
NREG	integer scalar variable containing the number of regions.
NANIS	integer scalar variable containing the number of Legendre order for scattering.
NMAT	integer scalar variable containing the number of mixtures.
NFUNL	integer scalar variable containing the number of Legendre order for the flux.
NIFIS	integer scalar variable containing the number of fissile isotopes.
KEYANI	integer array of dimension KEYANI((NL+1)*(NL+1)) containing the coupling vector for the flux and scattering real spherical harmonics.
MATCOD	integer array of dimension MATCOD(NREG) containing the mixture associated with each region.

VOL	real array of dimension VOL(NREG) containing the region volume.
FLUX	real array of dimension FLUX(NFUNL,NREG,NGRP) containing the current flux.
XSTOT	real array of dimension XSTOT(0:NMAT,NGRP) containing the total cross section.
XSTRC	real array of dimension XSTRC(0:NMAT,NGRP) containing the transport correction.
XSDIA	real array of dimension XSDIA(0:NMAT,NGRP) containing the within group scattering.
XSCAT	real array of dimension XSCAT(NGRP,0:NMAT,0:NANIS,NGRP) containing the scattering matrix.
XSNUF	real array of dimension XSNUF(0:NMAT,NIFIS,NGRP) containing $\nu\Sigma_f$.
XSCHI	real array of dimension XSCHI(0:NMAT,NIFIS,NGRP) containing the fission spectrum.
PHI	double precision array of dimension PHI(NGRP) containing the region integrated flux.
XCTOT	double precision array of dimension XCTOT(NGRP) containing the region integrated total cross sections.
XCTRC	double precision array of dimension XCTRC(NGRP) containing the region integrated transport corrected total cross sections.
XCDIA	double precision array of dimension XCDIA(NGRP) containing the region integrated within group scattering cross sections.
XCCAT	double precision array of dimension XCCAT(NGRG,0:NANIS,NGRP) containing the region integrated scattering cross sections matrix.
XCNUF	double precision array of dimension XCNUF(NGRP) containing the region integrated fission cross sections.
XCCHI	double precision array of dimension XCCHI(NGRP) containing the region integrated fission production cross sections.
XCABS	double precision array of dimension XCABS(NGRP) containing the region integrated absorption cross sections.
IPRT	integer scalar variable containing the print flag.

Called by

DRAGON routine(s) : MOC2DR

13.2.6 MOC2I0

Purpose To integrate along a characteristic using approximate exponential tables for cases with void.

Syntax CALL MOC2I0(IFTRAK, NG, MT, NR, NE, NS, MXS, NT, MATALB, WG, YG, SEGLEN, NRSEG, EXPT, EXP2, FLM, FLP, CYM, CYP, NA, SIGANG, SR, FLUX, IG0)

Author(s) R. Roy

Description of parameters

IFTRAK	integer scalar variable containing the unit associated with the binary tracking file.
NG	integer scalar variable containing the number of groups.
MT	integer scalar variable containing the number of mixtures.
NR	integer scalar variable containing the number of regions.
NE	integer scalar variable containing the number of integration points.
NS	integer scalar variable containing the number of outer surfaces.
MXS	integer scalar variable containing the maximum number of segments in an integration line.
NT	integer scalar variable containing the number of tracks.
MATALB	integer array of dimension MATALB(-NS:NR) containing the albedo/mixture index associated with each surface and region.
WG	real array of dimension WG(MXE) containing the integration weight.
YG	real array of dimension YG(MXE) containing the secant of the integration points.
SEGLN	real array of dimension SEGLN(MXS) containing the tracking segment length.
NRSEG	integer array of dimension NRSEG(MXS) containing the tracking segment type.
EXPT	real array of dimension EXPT(NE,MXS) used for temporary storage.
EXP2	real array of dimension EXP2(NE,MXS) used for temporary storage.
FLM	real array of dimension FLM(NGSS,MXSEG) used for temporary storage.
FLP	real array of dimension FLP(NGSS,MXSEG) used for temporary storage.
CYM	real array of dimension CYM(NGSS,MXSEG) used for temporary storage.
CYP	real array of dimension CYP(NGSS,MXSEG) used for temporary storage.
NA	integer scalar variable containing the number of albedo.
SIGANG	real array of dimension SIGANG(NE,-NA:MT,NG) containing the surface and region attenuation factor.
SR	real array of dimension SR(NF,NR,NG) used for temporary storage.
FLUX	real array of dimension FLUX(NF,NR,NG) containing the output fluxes.
IG0	integer scalar variable containing the first group to analyze.

Called by

DRAGON routine(s) : MOC2DR

13.2.7 MOC2I1

Purpose To integrate along a characteristic using approximate exponential tables for cases without void.

Syntax CALL MOC2I1(IFTRAK, NG, MT, NR, NE, NS, MXS, NT, MATALB, WG, SEGLN, NRSEG, EXPT, EXP2, FLM, FLP, CYM, CYP, NA, SIGANG, SR, FLUX, IG0)

Author(s) R. Roy

Description of parameters

IFTRAK	integer scalar variable containing the unit associated with the binary tracking file.
NG	integer scalar variable containing the number of groups.
MT	integer scalar variable containing the number of mixtures.
NR	integer scalar variable containing the number of regions.
NE	integer scalar variable containing the number of integration points.
NS	integer scalar variable containing the number of outer surfaces.
MXS	integer scalar variable containing the maximum number of segments in an integration line.
NT	integer scalar variable containing the number of tracks.
MATALB	integer array of dimension MATALB(-NS:NR) containing the albedo/mixture index associated with each surface and region.
WG	real array of dimension WG(MXE) containing the integration weight.
SEGLN	real array of dimension SEGLN(MXS) containing the tracking segment length.
NRSEG	integer array of dimension NRSEG(MXS) containing the tracking segment type.
EXPT	real array of dimension EXPT(NE,MXS) used for temporary storage.
EXP2	real array of dimension EXP2(NE,MXS) used for temporary storage.
FLM	real array of dimension FLM(NGSS,MXSEG) used for temporary storage.
FLP	real array of dimension FLP(NGSS,MXSEG) used for temporary storage.
CYM	real array of dimension CYM(NGSS,MXSEG) used for temporary storage.
CYP	real array of dimension CYP(NGSS,MXSEG) used for temporary storage.
NA	integer scalar variable containing the number of albedo.
SIGANG	real array of dimension SIGANG(NE,-NA:MT,NG) containing the surface and region attenuation factor.
SR	real array of dimension SR(NF,NR,NG) used for temporary storage.
FLUX	real array of dimension FLUX(NF,NR,NG) containing the output fluxes.
IG0	integer scalar variable containing the first group to analyze.

Called by

DRAGON routine(s) : MOC2DR

13.2.8 MOC2KF

Purpose To compare neutron production and loss and compute the flux normalization factor.

Syntax CALL MOC2KF(NGRP, LEAKSW, OLDBIL, PHI, XCABS, XCNUF, XCCHI, DB2, AKEFF, AFLNOR, IPRT)

Author(s) R. Roy

Description of parameters

NGRP	integer scalar variable containing the number of groups.
LEAKSW	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
OLDBIL	double precision scalar variable containing the previous total neutron production.
PHI	double precision array of dimension PHI(NGRP) containing the region integrated flux.
XCABS	double precision array of dimension XCABS(NGRP) containing the region integrated absorption cross sections.
XCNUF	double precision array of dimension XCNUF(NGRP) containing the region integrated fission cross sections.
XCCHI	double precision array of dimension XCCHI(NGRP) containing the region integrated fission production cross sections.
DB2	double precision array of dimension DB2(NG) containing the region integrated leakage cross sections.
AKEFF	double precision scalar variable containing k_{eff} .
AFLNOR	double precision scalar variable containing the flux normalization factor for eigenvalue problem.
IPRT	integer scalar variable containing the print flag.

Called by

DRAGON routine(s) : MOC2DR

13.2.9 MOC2MH

Purpose To perform the eigenvalue search.

Syntax CALL MOC2MH(IYPEC, NBN, NGRP, NANIS, PHI, XCTOT, XCTRC, XCDIA, XCCAT, XCNUF, XCCHI, XCABS, DIFF, BETA, REBAL, FLUN, REFKEF, AKFRB, B2VAL, OOL, EBMX, IPRT)

Author(s) R. Roy

Description of parameters

IYPEC	integer scalar variable containing the the type of flux evaluation: <ul style="list-style-type: none"> • IYPEC= 0 to skip the flux calculation; • IYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence; • IYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage;
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- IYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling;
- IYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling;
- IYPEC= 5 direct problem with leakage sources and convergence on buckling;
- IYPEC= 6 direct problem fixed sources.

NBN	integer scalar variable containing the number of Legendre order for leakage.
NGRP	integer scalar variable containing the number of groups.
NANIS	integer scalar variable containing the number of Legendre order for scattering.
PHI	double precision array of dimension PHI(NGRP) containing the region integrated flux.
XCTOT	double precision array of dimension XCTOT(NGRP) containing the region integrated total cross sections.
XCTRC	double precision array of dimension XCTRC(NGRP) containing the region integrated transport corrected total cross sections.
XCDIA	double precision array of dimension XCDIA(NGRP) containing the region integrated within group scattering cross sections.
XCCAT	double precision array of dimension XCCAT(NGRP,0:NANIS,NGRP) containing the region integrated scattering cross sections matrix.
XCNUF	double precision array of dimension XCNUF(NGRP) containing the region integrated fission cross sections.
XCCHI	double precision array of dimension XCCHI(NGRP) containing the region integrated fission production cross sections.
XCABS	double precision array of dimension XCABS(NGRP) containing the region integrated absorption cross sections.
DIFF	double precision array of dimension DIFF(NGRP) containing the region integrated diffusion cross sections.
BETA	double precision array of dimension BETA(NGRP) used for temporary storage.
REBAL	double precision array of dimension REBAL(NGRP,NGRP+1) containing the rebalancing matrix.
FLUN	double precision array of dimension FLUN(NGRP) containing the flux normalization factor.
REFKEF	double precision scalar variable containing the reference eigenvalue.
AKFRB	double precision scalar variable containing k_{eff} .
B2VAL	double precision scalar variable containing B_2 .
OOL	double precision scalar variable containing the total leakage terms.
EBMX	real scalar variable containing the convergence criteria for the eigenvalue.
IPRT	integer scalar variable the print flag.

Called by

DRAGON routine(s) : MOC2DR

Calling

DRAGON routine(s) : MOC2BN

UTILIB routine(s) : ALSBD

GANLIB routine(s) : XABORT

13.2.10 MOC2WR

Purpose To save on the FLUXUNK structure the flux/current solution.

Syntax CALL MOC2WR(IPFLUX, IYPEC, RKEFF, RB2, NFUNL, NREG, NGRP, FLUXO, DIFF)

Author(s) R. Roy

Description of parameters

IPFLUX integer scalar variable containing the pointer to the FLUXUNK data structure.

IYPEC integer scalar variable containing the the type of flux evaluation:

- IYPEC= 0 to skip the flux calculation;
- IYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence;
- IYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage;
- IYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling;
- IYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling;
- IYPEC= 5 direct problem with leakage sources and convergence on buckling;
- IYPEC= 6 direct problem fixed sources.

RKEFF real scalar variable containing the eigenvalue.

RB2 real scalar variable containing the buckling.

NFUNL integer scalar variable containing the number of Legendre order for the flux.

NREG integer scalar variable containing the number of regions.

NGRP integer scalar variable containing the number of groups.

FLUXO real array of dimension FLUXO(NREG,NFUNL,NGRP) containing the flux and current vector.

DIFF real array of dimension DIFF(NGRP) containing the diffusion coefficients.

Called by

DRAGON routine(s) : MOCDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMPUT

13.2.11 MOC3I0

Purpose To integrate along a characteristic using exact exponential for cases with void.

Syntax CALL MOC3I0(IFTRAK, NG, MT, NR, NE, NS, MXS, NT, MATALB, WG, YG, SEGLEN, NRSEG, EXPT, EXP2, FLM, FLP, CYM, CYP, NA, SIGANG, SR, FLUX, IG0)

Author(s) R. Roy

Description of parameters

IFTRAK	integer scalar variable containing the unit associated with the binary tracking file
NG	integer scalar variable containing the number of groups.
MT	integer scalar variable containing the number of mixtures.
NR	integer scalar variable containing the number of regions.
NE	integer scalar variable containing the number of integration points.
NS	integer scalar variable containing the number of outer surfaces.
MXS	integer scalar variable containing the maximum number of segments in an integration line.
NT	integer scalar variable containing the number of tracks.
MATALB	integer array of dimension MATALB(-NS:NR) containing the albedo/mixture index associated with each surface and region.
WG	real array of dimension WG(MXE) containing the integration weight.
YG	real array of dimension YG(MXE) containing the secant of the integration points.
SEGLEN	real array of dimension SEGLEN(MXS) containing the tracking segment length.
NRSEG	integer array of dimension NRSEG(MXS) containing the tracking segment type.
EXPT	real array of dimension EXPT(NE,MXS) used for temporary storage.
EXP2	real array of dimension EXP2(NE,MXS) used for temporary storage.
FLM	real array of dimension FLM(NGSS,MXSEG) used for temporary storage.
FLP	real array of dimension FLP(NGSS,MXSEG) used for temporary storage.
CYM	real array of dimension CYM(NGSS,MXSEG) used for temporary storage.
CYP	real array of dimension CYP(NGSS,MXSEG) used for temporary storage.
NA	integer scalar variable containing the number of albedo.
SIGANG	real array of dimension SIGANG(NE,-NA:MT,NG) containing the surface and region attenuation factor.

SR real array of dimension SR(NF,NR,NG) used for temporary storage.

FLUX real array of dimension FLUX(NF,NR,NG) containing the output fluxes.

IG0 integer scalar variable containing the first group to analyze.

Called by

DRAGON routine(s) : MOC2DR

13.2.12 MOC3I1

Purpose To integrate along a characteristic using exact exponential for cases without void.

Syntax CALL MOC3I1(IFTRAK, NG, MT, NR, NE, NS, MXS, NT, MATALB, WG, SEGLN, NRSEG,
EXPT, EXP2, FLM, FLP, CYM, CYP, NA, SIGANG, SR, FLUX, IG0)

Author(s) R. Roy

Description of parameters

IFTRAK integer scalar variable containing the unit associated with the binary tracking file

NG integer scalar variable containing the number of groups.

MT integer scalar variable containing the number of mixtures.

NR integer scalar variable containing the number of regions.

NE integer scalar variable containing the number of integration points.

NS integer scalar variable containing the number of outer surfaces.

MXS integer scalar variable containing the maximum number of segments in an integration line.

NT integer scalar variable containing the number of tracks.

MATALB integer array of dimension MATALB(-NS:NR) containing the albedo/mixture index associated with each surface and region.

WG real array of dimension WG(MXE) containing the integration weight.

SEGLN real array of dimension SEGLN(MXS) containing the tracking segment length.

NRSEG integer array of dimension NRSEG(MXS) containing the tracking segment type.

EXPT real array of dimension EXPT(NE,MXS) used for temporary storage.

EXP2 real array of dimension EXP2(NE,MXS) used for temporary storage.

FLM real array of dimension FLM(NGSS,MXSEG) used for temporary storage.

FLP real array of dimension FLP(NGSS,MXSEG) used for temporary storage.

CYM real array of dimension CYM(NGSS,MXSEG) used for temporary storage.

CYP real array of dimension CYP(NGSS,MXSEG) used for temporary storage.

NA integer scalar variable containing the number of albedo.

SIGANG	real array of dimension SIGANG(NE,-NA:MT,NG) containing the surface and region attenuation factor.
SR	real array of dimension SR(NF,NR,NG) used for temporary storage.
FLUX	real array of dimension FLUX(NF,NR,NG) containing the output fluxes.
IG0	integer scalar variable containing the first group to analyze.

Called by

DRAGON routine(s) : MOC2DR

13.2.13 MOCDRV

Purpose To control the solution to the transport equation using the method of characteristics.

Syntax CALL MOCDRV(IPFLUX, IPTRK, IPMACR, IFTRAK, NGRP, NMAT, NIFIS, NANIS, NL, NBN, NUN, FLUXO, DIFFB1, NINTMX, AIEPS, NEXTMX, AEEPS, IFRITR, IACITR, IYPEC, ILEAK, NREGIO, MATCOD, VOL, VOLINV, XSOLD, XSSIGT, XTINV, XSSIGW, XSCHI, XSNUF, XSTK, NJJ, IJJ, IPOS, XSCAT, VSCAT, NALB, ALBEDO, LEAKSW, ILK, ITRANC, ITRB, TITRE, LCACA, LEXIN, REFKEF, IPRT, CDIRFL)

Author(s) R. Roy

Description of parameters

IPFLUX	integer scalar variable containing the pointer to the FLUXUNK data structure.
IPTRK	integer scalar variable containing the pointer to the TRACKING data structure.
IPMACR	integer scalar variable containing the pointer to the MACROLIB or MICROLIB data structure.
IFTRAK	integer scalar variable containing the file unit number associated to the tracking file.
NGRP	integer scalar variable containing the number of groups treated.
NMAT	integer scalar variable containing the number of mixtures considered.
NIFIS	integer scalar variable containing the number of fissile isotopes.
NANIS	integer scalar variable containing the number of Legendre order for scattering.
NL	integer scalar variable containing the number of Legendre order for the flux.
NBN	integer scalar variable containing the number of Legendre order for leakage.
NUN	integer scalar variable containing the number of unknown.
FLUXO	real array of dimension FLUXO(NUN,NGRP) containing the initial flux/current vector.
DIFFB1	real array of dimension DIFFB1(NGRP) containing the homogeneous B_1 diffusion coefficients.
NINTMX	integer scalar variable containing the maximum number of inner iterations.
AIEPS	real scalar variable containing the convergence criterion for the inner iteration.

NEXTMX	integer scalar variable containing the maximum number of outer iterations.
AEEPS	real scalar variable containing the convergence criterion for the outer iteration.
IFRITR	integer scalar variable containing the number of free iterations.
IACITR	integer scalar variable containing the number of accelerated iterations.
ITYPEC	integer scalar variable containing the the type of flux evaluation: <ul style="list-style-type: none"> • ITYPEC= 0 to skip the flux calculation; • ITYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence; • ITYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage; • ITYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling; • ITYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling; • ITYPEC= 5 direct problem with leakage sources and convergence on buckling; • ITYPEC= 6 direct problem fixed sources.
ILEAK	integer scalar variable containing the leakage model to use: <ul style="list-style-type: none"> • ILEAK=0 in the case where no leakage model is considered; • ILEAK=1 in the case where the scattering modified CP matrix is multiplied by a non-leakage factor; • ILEAK=2 in the case where the reduced CP matrix is multiplied by a non-leakage factor; • ILEAK=3 in the case where the leakage correction is represented by a negative scattering cross section term; • ILEAK=4 in the case where the leakage is approximate using the albedo approximation; • ILEAK=5 in the case where a B_1 heterogeneous leakage method is considered with imposed buckling; • ILEAK=6 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=7 in the case where a B_1 heterogeneous leakage method is considered with y buckling search; • ILEAK=8 in the case where a B_1 heterogeneous leakage method is considered with x buckling search; • ILEAK=9 in the case where a B_1 heterogeneous leakage method is considered with radial buckling search; • ILEAK=10 in the case where a B_1 heterogeneous leakage method is considered with global buckling search.
NREGIO	integer scalar variable containing the number of regions.
MATCOD	integer array of dimension MATCOD(*) containing the mixture associated with each region in the problem.
VOL	real array of dimension VOL(*) containing the volume associated with each region in the problem.

VOLINV	real array of dimension VOLINV(*) containing the inverse of the volume associated with each region in the problem.
XSOLD	real array of dimension XSOLD(0:NMAT,NGRP) containing the old set of total cross sections.
XSSIGT	real array of dimension XSSIGT(0:NMAT,NGRP) containing the reference set of total cross sections.
XTINV	real array of dimension XTINV(0:NMAT,NGRP) containing the inverse of XSSIGT.
XSSIGW	real array of dimension XSSIGW(0:NMAT,NGRP) containing the within group scattering.
XSCHI	real array of dimension XSCHI(0:NMAT,NIFIS,NGRP) containing the fission spectrum.
XSNUF	real array of dimension XSNUF(0:NMAT,NIFIS,NGRP) containing $\nu\Sigma_f$.
XSTK	real array of dimension XSTK(NMAT,NIFIS) used for temporary storage of cross sections.
NJJ	integer array of dimension NJJ(*) containing the number of group with scattering to a specific group.
IJJ	integer array of dimension IJJ(*) containing the highest group with scattering to a specific group.
IPOS	integer array of dimension IPOS(*) containing the location in the compressed scattering vector associated with a specific mixture.
XSCAT	real array of dimension XSCAT(NGRP,0:NMAT,0:NANIS,NGRP) containing the scattering matrix.
VSCAT	real array of dimension VSCAT(*) containing the used for temporary storage of the compressed scattering matrix.
NALB	integer scalar variable containing the number of albedo.
ALBEDO	real array of dimension ALBEDO(NALB) containing the albedos.
LEAKSW	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
ILK	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage for rebalancing.
ITRANC	integer scalar variable containing the type of transport correction.
ITRB	integer scalar variable that is not used.
TITRE	character*72 scalar variable containing the title.
LCACA	integer scalar variable containing the type of angular quadrature.
LEXIN	logical scalar variable containing the flag for approximate exponential.
REFKEF	double precision scalar variable containing the reference eigenvalue.
IPRT	integer scalar variable containing the print flag.
CDIRFL	character*12 scalar variable containing the name of the flux directory.

Called by

DRAGON routine(s) : MOC

Calling

DRAGON routine(s) : MOC2DR, MOC2WR, MOCIK3

UTILIB routine(s) : ALCACT, ALGPT

GANLIB routine(s) : LCMGET, LCMLen, LCMLIB, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

13.2.14 MOCGFL

Purpose To extract from the FLUXUNK structure the flux and currents.

Syntax CALL MOCGFL(IPFLUX, IYPEC, NGROUP, NUNKNO, FLUX)

Author(s) R. Roy

Description of parameters

IPFLUX integer scalar variable containing the pointer to the FLUXUNK data structure.

IYPEC integer scalar variable containing the type of flux calculation where:

- IYPEC= 0 to skip the flux calculation;
- IYPEC= 1 to compute the direct problem solution with fission sources and k_{eff} convergence;
- IYPEC= 2 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed leakage;
- IYPEC= 3 to compute the direct problem solution with fission sources and k_{eff} convergence and imposed buckling;
- IYPEC= 4 to compute the direct problem solution with fission sources with imposed k_{eff} and convergence on buckling;
- IYPEC= 5 direct problem with leakage sources and convergence on buckling;
- IYPEC= 6 direct problem fixed sources.

NGROUP integer scalar variable containing the number of groups.

NUNKNO integer scalar variable containing the number of unknowns (number of regions and number of currents).

FLUX real array of dimension FLUX(NUNKNO,NGROUP) containing the multigroup flux/current.

Called by

DRAGON routine(s) : MOC

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMPUT

13.2.15 MOCIK3

Purpose To generate the vector for the real spherical harmonics vectors.

Syntax CALL MOCIK3(NDIM, NL, ISIGNR, KEYANI)

Author(s) R. Roy

Description of parameters

NDIM integer scalar variable containing the dimension of the problem.

NL integer scalar variable containing the number of Legendre order for the flux.

ISIGNR integer array of dimension ISIGNR($8*(NL+1)*(NL+1)$) containing the sign for the real spherical harmonics.

KEYANI integer array of dimension KEYANI($((NL+1)*(NL+1))$) containing the coupling vector for the flux and scattering real spherical harmonics.

Called by

DRAGON routine(s) : MOCDRV

13.2.16 MOCRWD

Purpose To read the information part of the tracking file.

Syntax CALL MOCRWD(IFTRAK)

Author(s) R. Roy

Description of parameters

IFTRAK integer scalar variable containing the unit associated with the binary tracking file.

Called by

DRAGON routine(s) : MOC2DR

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

13.2.17 MOCSOL

Purpose To solve a system of linear equations using Gaussian elimination with partial pivoting.

Syntax CALL MOCSOL(N, IS, B, IER, MAX)

Author(s) R. Roy based on ALSBD by A. Hébert

Description of parameters

N integer scalar variable containing the order of the coefficient matrix.

IS integer scalar variable containing the number of source vectors.

B double precision array of dimension B(MAX,*) containing the augmented system matrix.

IER integer scalar variable containing the error flag.

MAX integer scalar variable containing the first dimension of the augmented system matrix.

Called by

DRAGON routine(s) : MOC2BL, MOC2BN

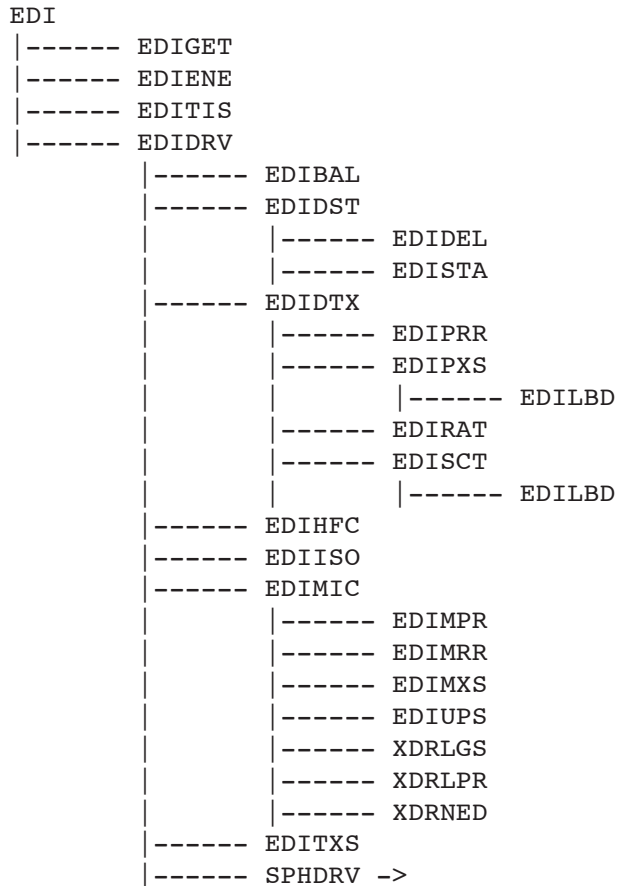
14 THE MODULE FOR EDITING

14.1 Structure of EDI :

The main routine that controls this module is called EDI (see Section 2.2.12). It requires up to NENTRY=7 data structures. The first structure must be of type linked list or XSM file (IENTRY(*i*)=1 or 2) and will contain an EDITING data structure in creation or modification mode (JENTRY(*i*)=0 or 1). The second structure must be of type linked list or XSM file (IENTRY(*i*)=1 or 2) and will contain a FLUXUNK data structure. The third structure must be of type linked list or XSM file a read-only MACROLIB or MICROLIB data structure (linked list or XSM file). The fourth data structure must be of type IENTRY(*i*)=1 (linked list) and will contain a TRACKING data structure. In the case where the SPH homogenization option is to be activated, three additional data structures can be provided which contain respectively the reference and homogenization geometries (GEOMETRY data structure) and the reference ASMPIJ data structure which contains the reference collision probabilities.

The EDI : module can be represented by the following tree:

Structure of module: EDI



The routines XDRLGS, XDRLPR and XDRNED are defined in Section 21.2.

14.2 General Routines Description

14.2.1 EDIBAL

Purpose To compute the four factors.

Syntax CALL EDIBAL(IPEDIT, IPRINT, NGCOND, NMERGE, NTAUXT, IFFAC, EIGENK, B2, ILEAK, RATECM, SCATTD, ITYPER, DRATE, DLEAK)

Author(s) G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be created.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the neutron balance will also be produced on the output file.
NGCOND	integer scalar variable describing the number of condensed groups.
NMERGE	integer scalar variable describing the number of merged regions.
NTAUXT	integer scalar variable containing the number of reaction rate types to process.
IFFAC	integer scalar variable describing the four factor calculation option: <ul style="list-style-type: none"> • IFFAC=0 means no four factor calculation • IFFAC=1 means that the four factor calculation is to be performed.
EIGENK	real scalar variable containing the problem k_{eff} eigenvalue.
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
ILEAK	integer scalar variable describing the presence of leakage.
RATECM	double precision array of dimension RATECM(0:NMERGE,NGCOND,NTAUXT) containing the reaction rates for various type of reaction. Here for homogenized region i and condensed group g we use: <ul style="list-style-type: none"> • RATECM($i,g,1$) is for integrated flux; • RATECM($i,g,2$) is for total reaction rates; • RATECM($i,g,3$) is for absorption reaction rates; • RATECM($i,g,4$) is for fissions reaction rates; • RATECM($i,g,5$) is for production rates; • RATECM($i,g,6$) is for leakage rates; • RATECM($i,g,7$) is for total out of group scattering rates;

- RATECM($i,g,8$) is for within group scattering reaction rates;
- RATECM($i,g,9$) is for χ ;
- RATECM($i,g,10$) is for transport correction reaction rates;
- RATECM($i,g,11$) is for x directed leakage rates;
- RATECM($i,g,12$) is for y directed leakage rates;
- RATECM($i,g,13$) is for z directed leakage rates;
- RATECM($i,g,13+I$) is for fission production rates for isotope I ;
- RATECM($i,g,13+NIFISS+I$) is for chi for isotope I ;
- RATECM($i,g,13+2*NIFISS+I$) is for fission production rates for isotope I ;
- RATECM($i,g,13+3*NIFISS+l$) is for out of group scattering for isotropic order l ;
- RATECM($i,g,13+3*NIFISS+NL+J$) is for edit rates of type J
- RATECM($i,g,NTAUXT$) is for $1/v$ reaction rates.

SCATTD	double precision array of dimension SCATTD(NMERGE,NGCOND,NGCOND) containing the scattering rates. Here SCATTD(i,g,h) is for the scattering from group h to group g for merged region i .
ITYPER	integer array of dimension ITYPER(NMERGE) describing the region type.
DRATE	double precision array of dimension DRATE(2,2,NGCOND+1) containing the double precision group rates.
DLEAK	double precision array of dimension DLEAK(2,NGCOND+1)) containing the double precision group leakages.

Called by

DRAGON routine(s) : EDIDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMPUT

14.2.2 EDIDEL

Purpose To compute the incremental cross sections.

Syntax CALL EDIDEL(IPRINT, NGCOND, NMERGE, IGR, SCATTD, INGSCT, IFGSCT, IPOSCT, XSCAT, DELSCT)

Author(s) G. Marleau

Description of input parameters

IPRINT integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the incremental cross sections will also be produced on the output file.

NGCOND	integer scalar variable describing the number of condensed groups.
NMERGE	integer scalar variable describing the number of merged regions.
IGR	integer scalar variable describing the current group being analyzed.
SCATTD	double precision array of dimension SCATTD(NMERGE,NGCOND,NGCOND) containing the scattering rates. Here SCATTD(i,g,h) is for the scattering from group h to group g for merged region i .
INGSCT	integer array of dimension INGSCT(NMERGE) containing the number of group for which scattering to group IGR takes places.
IFGSCT	integer array of dimension IFGSCT(NMERGE) containing the highest group for which scattering to group IGR takes places.
IPOSCT	integer array of dimension IPOSCT(NMERGE) containing the first position in the compressed scattering matrix associated with each mixture.
XSCAT	real array of dimension XSCAT(NMERGE*NGCOND) containing the compressed scattering matrix.
DELSCT	real array of dimension DELSCT(NGCOND) containing the incremental cross sections associated with scattering.

Called by

DRAGON routine(s) : EDIDST

14.2.3 EDIDRV

Purpose To compute the optional equivalence SPH factors, the integrated flux and reaction rates and to perform edition statistical analysis and four factor calculation.

Syntax CALL EDIDRV(IPEDIT, IPFLUX, IPLIB, IPSYS, IPGEO1, IPGEO2, MAXPTS, MAXISO, CDOOR, NGROUP, NBMIX, NREGIO, LEAKSW, NWGTH, NIFISS, NEDMAC, CTITRE, NL, ITRANC, NGCOND, NMERGE, IFFAC, ILUPS, NSAVES, NSTATS, CURNAM, OLDNAM, NSPH, KSPH, CNDOOR, NBMICR, NACTI, IPRINT, NTENER, IXEDI, ISOTXS, MATCOD, VOLUME, KEYFLX, IGCOND, IMERGE, ISOCAR, IACTI, FLUXES, ENERGY, ENERV, ISONAM)

Author(s) G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be created.
IPFLUX	integer scalar variable for accessing the FLUXUNK data structure to be read.
IPLIB	integer scalar variable for accessing the MICROLIB data structure to be read.
IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be read.
IPGEO1	integer scalar variable for accessing the reference GEOMETRY data structure to be read.
IPGEO2	integer scalar variable for accessing the homogenization GEOMETRY data structure to be read.

MAXPTS	integer scalar variable describing the maximum number of macro-regions in edition.
MAXISO	integer scalar variable describing the maximum number of isotopes.
CDOOR	character*12 scalar variable describing the flux calculation provided.
NGROUP	integer scalar variable describing the number of groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
LEAKSW	logical scalar variable describing the presence (.TRUE.) or the absence (.FALSE.) of leakage.
NWGTH	integer scalar variable describing the processing of linearly anisotropic scattering matrix: <ul style="list-style-type: none"> • NMGTH=0 use flux to merge/condense the linearly anisotropic scattering matrix; • NMGTH=1 use current to merge/condense the linearly anisotropic scattering matrix; • NMGTH=2 use buckling-weighted coherent method to merge/condense the linearly anisotropic scattering matrix; • NMGTH=3 use buckling-weighted coherent method and directional diagonal correction to merge/condense the linearly anisotropic scattering matrix;
NIFISS	integer scalar variable describing the maximum number of fissile isotopes.
NEDMAC	integer scalar variable describing the maximum number of edit cross sections.
CTITRE	character*72 scalar variable describing the title of the problem.
NL	integer scalar variable describing the maximum isotropy level for the scattering cross section.
ITRANC	integer scalar variable describing the type of transport correction: <ul style="list-style-type: none"> • ITRANC=0 means that the transport correction is not taken into account; • ITRANC=1 means that the transport correction is computed; • ITRANC=2 means that the transport correction is taken from the MACROLIB or MICROLIB data structure.
NGCOND	integer scalar variable describing the number of condensed groups.
NMERGE	integer scalar variable describing the number of merged regions.
IFFAC	integer scalar variable describing the four factor calculation option: <ul style="list-style-type: none"> • IFFAC=0 means no four factor calculation; • IFFAC=1 means that the four factor calculation is to be performed.
ILUPS	integer scalar variable describing how up-scattering is to be treated: <ul style="list-style-type: none"> • ILUPS=0 no special treatment; • ILUPS=1 remove up-scattering contribution.
NSAVES	integer scalar variable describing the cross section analysis options: <ul style="list-style-type: none"> • NSAVES=0 no homogenized cross section computation; • NSAVES=1 compute homogenized cross section but do not save; • NSAVES=2 compute homogenized cross section and save;

	<ul style="list-style-type: none"> • NSAVES=3 compute homogenized cross section and save incremental.
NSTATS	integer scalar variable describing the type of statistics to be considered: <ul style="list-style-type: none"> • NSTATS=0 no statistics; • NSTATS=1 statistics on fluxes; • NSTATS=2 statistics on reaction rates; • NSTATS=3 statistics on fluxes and reaction rates; • NSTATS=-1 incremental cross sections.
CURNAM	character*12 scalar variable describing the name of the directory where the results will be saved.
OLDNAM	character*12 scalar variable describing the name of the directory where the reference results for statistical analysis are stored.
NSPH	integer scalar variable describing the SPH homogenization option: <ul style="list-style-type: none"> • NSPH=0 no correction (default); • NSPH=1 the SPH factors are read from the EDITING data structure; • NSPH=2 homogeneous macro-calculation; • NSPH=3 any type of PIJ macro-calculation; • NSPH=4 any type of diffusion macro-calculation.
KSPH	integer scalar variable describing the SPH normalization option: <ul style="list-style-type: none"> • KSPH=1 average flux normalization; • KSPH=2 Selengut normalization; • KSPH=3 Selengut normalization with surface leakage.
CNDOOR	character*12 scalar variable describing the type of SPH macro-calculation.
NBMICR	integer scalar variable describing the type of processing for isotopic cross section: <ul style="list-style-type: none"> • NBMICR<-1 generate full cross section library including depletion chain and independent fission spectrum for selected isotopes; • NBMICR=-1 generate full cross section library including depletion chain and independent fission spectrum for all isotopes; • NBMICR=0 do not generate microscopic cross section library; • NBMICR=1 process all isotope cross section library; • NBMICR>1 process cross section library for selected isotopes.
NACTI	integer scalar variable describing the number of activation mixtures.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, additional output will also be produced on the output file.
NTENER	integer scalar variable describing the presence (NTENER=0) or absence of the energy vector.
IXEDI	integer scalar variable describing the first ISOTXS record number.
ISOTXS	integer array of dimension ISOTXS(2) describing the contents of the ISOTXS file.

MATCOD	integer array of dimension MATCOD(NREGION) containing the mixture associated with each region.
VOLUME	real array of dimension VOLUME(NREGION) containing the volume associated with each region.
KEYFLX	integer array of dimension KEYFLX(NREGION) containing the unknown associated with each region.
IGCOND	integer array of dimension IGCOND(NGROUP) containing the condensed group limits.
IMERGE	integer array of dimension IMERGE(NREGION) containing the homogenization indices.
ISOCAR	integer array of dimension ISOCAR(2,MXISO) containing the name of the isotopes to process.
IACIT	integer array of dimension IACIT(NBMIX) containing the mixture numbers for which activation analysis will take place.
FLUXES	real array of dimension FLUXES(NREGION*NGROUP) containing the multigroup regional flux.
ENERGY	real array of dimension ENERGY(2*NGCOND+1) containing the condensed energy group limits and lethargy width.
ENERV	real array of dimension ENERV(NGROUP) containing a $1/v$ cross section.
ISONAM	integer array of dimension ISOCAR(3,MXISO) containing the name of the isotopes to process.

Called by

DRAGON routine(s) : EDI

Calling

DRAGON routine(s) : EDIBAL, EDIDST, EDIDTX, EDIHFC, EDIISO, EDIMIC, EDITXS, SPHDRV

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMGET, LCMLN, LCMPUT, LCMSIX, SETARA, RLSARA

14.2.4 EDIDST

Purpose To produce reaction rates and flux statistics.

Syntax CALL EDIDST(IPEDIT, IPRINT, NSTATS, NGCOND, NMERGE, NL, NIFISS, NEDMAC, NTAUXT, NTENER, ENERGY, OLDNAM, MXVAL, MXERR, VOLMER, RATECM, SCATTD, FLXOLD, OLDRAT, VALER, INGSCT, IFGSCT, IPOSCT)

Author(s) G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be created.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the statistical differences between two test cases will also produced on the output file.
NSTATS	integer scalar variable describing the type of statistics to be considered:

	<ul style="list-style-type: none"> • NSTATS=0 no statistics; • NSTATS=1 statistics on fluxes; • NSTATS=2 statistics on reaction rates; • NSTATS=3 statistics on fluxes and reaction rates; • NSTATS=-1 incremental cross sections.
NGCOND	integer scalar variable describing the number of condensed groups.
NMERGE	integer scalar variable describing the number of merged regions.
NL	integer scalar variable describing the maximum isotropy level for the scattering cross section.
NFISS	integer scalar variable describing the maximum number of fissile isotopes.
NEDMAC	integer scalar variable describing the maximum number of edit cross sections.
NTAUXT	integer scalar variable containing the number of reaction rate types to process.
NTENER	integer scalar variable describing the presence (NTENER=0) or absence of the energy vector.
ENERGY	real array of dimension ENERGY(2*NGCOND+1) containing the condensed energy group limits and lethargy width.
OLDNAM	character*12 scalar variable describing the name of the directory where the reference results for statistical analysis are stored.
MXVAL	integer scalar variable describing the maximum dimension of OLDRAT.
MXERR	integer scalar variable describing the maximum dimension of VALERR.
VOLMER	double precision array of dimension VOLMER(NMERGE) containing the merged volumes.
RATECM	double precision array of dimension RATECM(0:NMERGE,NGCOND,NTAUXT) containing the reaction rates for various type of reaction. Here for homogenized region i and condensed group g we use: <ul style="list-style-type: none"> • RATECM($i,g,1$) is for integrated flux; • RATECM($i,g,2$) is for total reaction rates; • RATECM($i,g,3$) is for absorption reaction rates; • RATECM($i,g,4$) is for fissions reaction rates; • RATECM($i,g,5$) is for production rates; • RATECM($i,g,6$) is for leakage rates; • RATECM($i,g,7$) is for total out of group scattering rates; • RATECM($i,g,8$) is for within group scattering reaction rates; • RATECM($i,g,9$) is for χ; • RATECM($i,g,10$) is for transport correction reaction rates; • RATECM($i,g,11$) is for x directed leakage rates; • RATECM($i,g,12$) is for y directed leakage rates; • RATECM($i,g,13$) is for z directed leakage rates; • RATECM($i,g,13+I$) is for fission production rates for isotope I; • RATECM($i,g,13+NFISS+I$) is for chi for isotope I;

- RATECM($i,g,13+2*NIFISS+I$) is for fission production rates for isotope I ;
- RATECM($i,g,13+3*NIFISS+l$) is for out of group scattering for isotropic order l ;
- RATECM($i,g,13+3*NIFISS+NL+J$) is for edit rates of type J ;
- RATECM($i,g,NTAUXT$) is for $1/v$ reaction rates.

SCATTD	double precision array of dimension SCATTD(NMERGE,NGCOND,NGCOND,NL) containing the scattering rates. Here SCATTD(i,g,h,l) is for the scattering from group h to group g for merged region i and Legendre order l .
FLXOLD	real array of dimension FLXOLD(NMERGE) containing the old flux.
OLDRAT	real array of dimension OLDRAT(MXVAL) containing the old reaction rates.
VALER	real array of dimension VALER(MXERR) for temporary storage.
INGSCT	integer array of dimension INGSCT(NMERGE) containing the number of group for which scattering to group IGR takes places.
IFGSCT	integer array of dimension IFGSCT(NMERGE) containing the highest group for which scattering to group IGR takes places.
IPOSCT	integer array of dimension IPOSCT(NMERGE) containing the first position in the compressed scattering matrix associated with each mixture.

Called by

DRAGON routine(s) : EDIDRV

Calling

DRAGON routine(s) : EDIDEL, EDISTA

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMLIB, LCMSIX

14.2.5 EDIDTX

Purpose To evaluate and print reaction rates.

Syntax CALL EDIDTX(IPEDIT, IPFLUX, IPMACR, IPRINT, NGROUP, NGCOND, NBMIX, NREGIO, NMERGE, NL, NIFISS, NEDMAC, NTAUXT, ILEAKS, NWGTH, ILUPS, MATCOD, VOLUME, KEYFLX, IGCOND, IMERGE, FLUXES, EIGENK, NTENER, ENERGY, ENERV, NSAVES, CURNAM, B2, NBMICR, HVECT, NCOMB, TIMEF, ITRANC, SPH, VOLMER, RATECM, FLXINT, SCATTD, DXSTRD, DISFCT, NAMEAD, FFUEL, IFUELR, FACT, MATMC, NAMFI, MIXFI, MIXFF, AVGVEL, DIRC, FFNFT, EFISS)

Author(s) G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be created.
IPFLUX	integer scalar variable for accessing the FLUXUNK data structure to be read.

IPMACR	integer scalar variable for accessing the MACROLIB or MICROLIB data structure to be read.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the reaction rates will also be produced on the output file.
NGROUP	integer scalar variable describing the number of groups.
NGCOND	integer scalar variable describing the number of condensed groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGIO	integer scalar variable describing the number of regions.
NMERGE	integer scalar variable describing the number of merged regions.
NL	integer scalar variable describing the maximum isotropy level for the scattering cross section.
ITRANC	integer scalar variable describing the type of transport correction: <ul style="list-style-type: none"> • ITRANC=0 means that the transport correction is not taken into account; • ITRANC=1 means that the transport correction is computed; • ITRANC=2 means that the transport correction is taken from the MACROLIB or MICROLIB data structure.
NIFISS	integer scalar variable describing the maximum number of fissile isotopes.
NEDMAC	integer scalar variable describing the maximum number of edit cross sections.
NTAUXT	integer scalar variable containing the number of reaction rate types to process.
ILEAKS	integer scalar variable describing the leakage option.
NWGTH	integer scalar variable describing the processing of linearly anisotropic scattering matrix: <ul style="list-style-type: none"> • NMGTH=0 use flux to merge/condense the linearly anisotropic scattering matrix; • NMGTH=1 use current to merge/condense the linearly anisotropic scattering matrix; • NMGTH=2 use buckling-weighted coherent method to merge/condense the linearly anisotropic scattering matrix; • NMGTH=3 use buckling-weighted coherent method and directional diagonal correction to merge/condense the linearly anisotropic scattering matrix.
ILUPS	integer scalar variable describing how up-scattering is to be treated: <ul style="list-style-type: none"> • ILUPS=0 no special treatment; • ILUPS=1 remove up-scattering contribution.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the unknown associated with each region.
IGCOND	integer array of dimension IGCOND(NGROUP) containing the condensed group limits.
IMERGE	integer array of dimension IMERGE(NREGIO) containing the homogenization indices.

FLUXES	real array of dimension FLUXES(NREGIO*NGROUP) containing the multigroup regional flux.
EIGENK	real scalar variable containing the problem k_{eff} eigenvalue.
NTENER	integer scalar variable describing the presence (NTENER=0) or absence of the energy vector.
ENERGY	real array of dimension ENERGY(2*NGCOND+1) containing the condensed energy group limits and lethargy width.
ENERV	real array of dimension ENERV(NGROUP) containing a $1/v$ cross section.
NSAVES	integer scalar variable describing the cross section analysis options: <ul style="list-style-type: none"> • NSAVES=0 no homogenized cross section computation; • NSAVES=1 compute homogenized cross section but do not save; • NSAVES=2 compute homogenized cross section and save; • NSAVES=3 compute homogenized cross section and save incremental.
CURNAM	character*12 scalar variable describing the name of the directory where the results will be saved.
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
NBMICR	integer scalar variable describing the type of processing for isotopic cross section: <ul style="list-style-type: none"> • NBMICR<-1 generate full cross section library including depletion chain and independent fission spectrum for selected isotopes; • NBMICR=-1 generate full cross section library including depletion chain and independent fission spectrum for all isotopes; • NBMICR=0 do not generate microscopic cross section library; • NBMICR=1 process all isotope cross section library; • NBMICR>1 process cross section library for selected isotopes.
HVECT	character array of dimension HVECT(NEDMAC)*6 containing the name of the editing cross sections.
NCOMB	integer scalar variable describing the number of regions containing fuel.
TIMEF	real array of dimension TIMEF(3) containing the time (days), burnup (KWD/Kg) and irradiation (n/kb).
ITRANC	integer scalar variable describing the type of transport correction: <ul style="list-style-type: none"> • ITRANC=0 means that the transport correction is not taken into account; • ITRANC=1 means that the transport correction is computed; • ITRANC=2 means that the transport correction is taken from the MACROLIB or MICROLIB data structure.
SPH	real array of dimension SPH(NMERGE,NGCOND) containing the SPH homogenization factors.
VOLMER	double precision array of dimension VOLMER(NMERGE) containing the merged volumes.

RATECM	double precision array of dimension RATECM(0:NMERGE,NGCOND,NTAUXT) containing the reaction rates for various type of reaction. Here for homogenized region i and condensed group g we use: <ul style="list-style-type: none"> • RATECM($i,g,1$) is for integrated flux; • RATECM($i,g,2$) is for total reaction rates; • RATECM($i,g,3$) is for absorption reaction rates; • RATECM($i,g,4$) is for fissions reaction rates; • RATECM($i,g,5$) is for production rates; • RATECM($i,g,6$) is for leakage rates; • RATECM($i,g,7$) is for total out of group scattering rates; • RATECM($i,g,8$) is for within group scattering reaction rates; • RATECM($i,g,9$) is for χ; • RATECM($i,g,10$) is for transport correction reaction rates; • RATECM($i,g,11$) is for x directed leakage rates; • RATECM($i,g,12$) is for y directed leakage rates; • RATECM($i,g,13$) is for z directed leakage rates; • RATECM($i,g,13+I$) is for fission production rates for isotope I; • RATECM($i,g,13+NIFISS+I$) is for chi for isotope I; • RATECM($i,g,13+2*NIFISS+I$) is for fission production rates for isotope I; • RATECM($i,g,13+3*NIFISS+l$) is for out of group scattering for isotropic order l; • RATECM($i,g,13+3*NIFISS+NL+J$) is for edit rates of type J; • RATECM($i,g,NTAUXT$) is for $1/v$ reaction rates.
FLXINT	real array of dimension FLXINT(NREGION,NGROUP,4) containing the integrated flux.
SCATTD	double precision array of dimension SCATTD(NMERGE,NGCOND,NGCOND,NL) containing the scattering rates. Here SCATTD(i,g,h,l) is for the scattering from group h to group g for merged region i and Legendre order l .
DXSTRD	double precision array of dimension DXSTRD(4,NGCOND,NMERGE) containing the equivalent transport diffusion coefficients.
DISFCT	real array of dimension DISFCT(NGCOND) containing the flux disadvantage factors.
NAMEAD	integer array of dimension NAMEAD(2,NEDMAC) containing the extra editing names.
FFUEL	real array of dimension FFUEL(NREGION,NIFISS) containing the neutron production in fuel.
IFUELR	integer array of dimension IFUELR(NREGION) containing the fuel region location.
FACT	real array of dimension FACT(NMERGE) containing the normalization factors.
MATMC	integer array of dimension MATMC(NMERGE) containing the material per merged region.
NAMFI	integer array of dimension NAMFI(2,NIFISS) containing the name of fissile isotope.
MIXFI	integer array of dimension MIXFI(NBMIX,NIFISS) containing the mixture of fissile isotope.
MIXFF	integer array of dimension MIXFF(NMERGE,NIFISS) containing the region of fissile isotope.

AVGVEL	real array of dimension AVGVEL(NMERGE,NGCOND) containing the neutron average velocity.
DIRC	double precision array of dimension DIRC(0:NMERGE,NGCOND,3) containing the directional correction factors.
FFNFT	real array of dimension FFNFT(NREGIO,NIFISS) containing the fission rate in fuel.
EFISS	double precision array of dimension EFISS(0:NMERGE,0:NIFISS+1) containing the energy produced per fission.

Called by

DRAGON routine(s) : EDIDRV

Calling

DRAGON routine(s) : EDIPRR, EDIPXS, EDIRAT, EDISCT

UTILIB routine(s) : XDRDBL, XDRSET

GANLIB routine(s) : LCMGET, LCMLN, LCMSIX, SETARA, RLSARA, XABORT

14.2.6 EDIENE

Purpose To evaluate energy limits for condensation.

Syntax CALL EDIENE(NGROUP, NGCR, NGCOND, NTENER, IGCR, EGCR, IGCOND, ENERGY, ENERV)

Author(s) G. Marleau

Description of input parameters

NGROUP	integer scalar variable describing the number of groups.
NGCR	integer scalar variable describing the number of condensed groups read.
NGCOND	integer scalar variable describing the number of condensed groups.
NTENER	integer scalar variable describing the presence (NTENER=0) or absence of the energy vector.
IGCR	integer array of dimension IGCR(NGROUP+1) containing the condensed group limits.
EGCR	real array of dimension EGCR(NGROUP+1) containing the condensed energy limits.
IGCOND	integer array of dimension IGCOND(NGROUP) containing the condensed group limits.
ENERGY	real array of dimension ENERGY(2*NGCOND+1) containing the condensed energy group limits and lethargy width.
ENERV	real array of dimension ENERV(NGROUP) containing a $1/v$ cross section.

Called by

DRAGON routine(s) : EDI

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

14.2.7 EDIGET

Purpose To read edition options parameters.

Syntax CALL EDIGET(NGROUP, NGCOND, NREGIO, NBMIX, NMERGE, IFFAC, ILUPS, NSAVES, NSTATS, CURNAM, OLDNAM, NSPH, KSPH, CNDOOR, MACGEO, NWGTH, MXISO, NBMICR, NACTI, IPRINT, MAXPTS, ICALL, ISOTXS, IGCR, EGCR, IMERGE, MATCOD, ISOCAR, IACTI, MIXMER)

Author(s) G. Marleau

Description of input parameters

NGROUP	integer scalar variable describing the number of groups.
NGCOND	integer scalar variable describing the number of condensed groups.
NREGIO	integer scalar variable describing the number of regions.
NBMIX	integer scalar variable describing the number of mixtures.
NMERGE	integer scalar variable describing the number of merged regions.
IFFAC	integer scalar variable describing the four factor calculation option: <ul style="list-style-type: none"> • IFFAC=0 means no four factor calculation; • IFFAC=1 means that the four factor calculation is to be performed.
ILUPS	integer scalar variable describing how up-scattering is to be treated: <ul style="list-style-type: none"> • ILUPS=0 no special treatment; • ILUPS=1 remove up-scattering contribution.
NSAVES	integer scalar variable describing the cross section analysis options: <ul style="list-style-type: none"> • NSAVES=0 no homogenized cross section computation; • NSAVES=1 compute homogenized cross section but do not save; • NSAVES=2 compute homogenized cross section and save; • NSAVES=3 compute homogenized cross section and save incremental.
NSTATS	integer scalar variable describing the type of statistics to be considered: <ul style="list-style-type: none"> • NSTATS=0 no statistics; • NSTATS=1 statistics on fluxes; • NSTATS=2 statistics on reaction rates; • NSTATS=3 statistics on fluxes and reaction rates; • NSTATS=-1 incremental cross sections.

CURNAM	character*12 scalar variable describing the name of the directory where the results will be saved.
OLDNAM	character*12 scalar variable describing the name of the directory where the reference results for statistical analysis are stored.
NSPH	integer scalar variable describing the SPH homogenization option: <ul style="list-style-type: none"> • NSPH=0 no correction; • NSPH=1 the SPH factors are read from the EDITING data structure; • NSPH=2 homogeneous macro-calculation; • NSPH=3 any type of PIJ macro-calculation; • NSPH=4 any type of diffusion macro-calculation.
KSPH	integer scalar variable describing the SPH normalization option: <ul style="list-style-type: none"> • KSPH=1 average flux normalization; • KSPH=2 Selengut normalization; • KSPH=3 Selengut normalization with surface leakage.
CNDOOR	character*12 scalar variable describing the type of SPH macro-calculation.
MACGEO	character*12 scalar variable describing the name of the SPH macro-geometry considered.
NWGTH	integer scalar variable describing the processing of linearly anisotropic scattering matrix: <ul style="list-style-type: none"> • NMGTH=0 use flux to merge/condense the linearly anisotropic scattering matrix; • NMGTH=1 use current to merge/condense the linearly anisotropic scattering matrix; • NMGTH=2 use buckling-weighted coherent method to merge/condense the linearly anisotropic scattering matrix; • NMGTH=3 use buckling-weighted coherent method and directional diagonal correction to merge/condense the linearly anisotropic scattering matrix.
MXISO	integer scalar variable describing the maximum number of isotopes available.
NBMICR	integer scalar variable describing the type of processing for isotopic cross section: <ul style="list-style-type: none"> • NBMICR<-1 generate full cross section library including depletion chain and independent fission spectrum for selected isotopes; • NBMICR=-1 generate full cross section library including depletion chain and independent fission spectrum for all isotopes; • NBMICR=0 do not generate microscopic cross section library; • NBMICR=1 process all isotope cross section library; • NBMICR>1 process cross section library for selected isotopes.
NACTI	integer scalar variable describing the number of activation mixtures.
IPRINT	integer scalar variable describing the amount of information printed by this routine.
MAXPTS	integer scalar variable describing the maximum number of macro-regions in edition.
ICALL	integer scalar variable describing the maximum directory index reached in EDITING data structure.
ISOTXS	integer array of dimension ISOTXS(2) describing the contents of the ISOTXS file.

IGCR	integer array of dimension IGCR(NGROUP+1) containing the condensed group limits.
EGCR	real array of dimension EGCR(NGROUP+1) containing the condensed energy limits.
IMERGE	integer array of dimension IMERGE(NREGION) containing the homogenization indices.
MATCOD	integer array of dimension MATCOD(NREGION) containing the mixture associated with each region.
ISOCAR	integer array of dimension ISOCAR(2,MXISO) containing the name of the isotopes to process.
IACI	integer array of dimension IACI(NBMIX) containing the mixture numbers for which activation analysis will take place.
MIXMER	integer array of dimension MIXMER(0:NBMIX) containing the homogenized mixture indices.

Called by

DRAGON routine(s) : EDI

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : REDGET, XABORT

14.2.8 EDIHFC

Purpose To evaluate the H-factors.

Syntax CALL EDIHFC(IPEDIT, IPLIB, NGROUP, NGCOND, NREGION, NMERGE, NBISO, MAXR, NDEPL, MATCOD, ISONAM, CURNAM, IGCOND, IMERGE, INADPL, ISONRF, MIX, FLXINT, FLXMER, DEN, IDR, RER, SIGF, FACTH, DHFCT, EJOULE, DFISS, DEPRO)

Author(s) G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be created.
IPLIB	integer scalar variable for accessing the MICROLIB data structure to be read.
NGROUP	integer scalar variable describing the number of groups.
NGCOND	integer scalar variable describing the number of condensed groups.
NREGION	integer scalar variable describing the number of regions.
NMERGE	integer scalar variable describing the number of merged regions.
NBISO	integer scalar variable describing the number of isotopes.
MAXR	integer scalar variable describing the maximum number of depleting reaction.
NDEPL	integer scalar variable describing the number of depleting isotopes

MATCOD	integer array of dimension MATCOD(NREGION) containing the mixture associated with each region.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the isotope names.
CURNAM	character*12 scalar variable describing the name of the directory where the results will be saved.
IGCOND	integer array of dimension IGCOND(NGROUP) containing the condensed group limits.
IMERGE	integer array of dimension IMERGE(NREGION) containing the homogenization indices.
INADPL	integer array of dimension INADPL(2,NDEPL) containing the depleting isotope names.
ISONRF	integer array of dimension ISONRF(3,NBISO) containing the isotope reference names.
MIX	integer array of dimension MIX(NBISO) containing the mixture number associated with each isotope.
FLXINT	real array of dimension FLXINT(NREGION,NGROUP) containing the integrated flux.
FLXMER	double precision array of dimension FLXMER(0:NMERGE,NGCOND) containing the homogenized and condensed flux.
DEN	real array of dimension DEN(NBISO) containing the isotopic density.
IDR	integer array of dimension IDR(MAXR,NDEPL) containing the depletion reaction.
RER	real array of dimension RER(MAXR,NDEPL) containing the depletion rates.
SIGF	real array of dimension SIGF(NGROUP) containing the fission cross section.
FACHT	real array of dimension FACHT(NMERGE) containing the H-factors in a condensed group.
DHFCT	double precision array of dimension DHFCT(NMERGE,NGCOND) containing the H-factors in all groups.
EJOULE	real array of dimension EJOULE(NBISO) containing the energy in MJ for 10^{24} fissions.
DFISS	double precision array of dimension DFISS(NMERGE) containing the fission rate per homogenized region.
DEPRO	double precision array of dimension DEPRO(NMERGE) containing the energy production rate per homogenized region.

Called by

DRAGON routine(s) : EDIDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRDBL, XDRSDB, XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX

14.2.9 EDIISO

Purpose To select the isotopes for homogenization and condensation of microscopic or activation cross section.

Syntax CALL EDIISO(IPEDIT, NSSTP, NACTI, NREGIO, NMERGE, NBISO, NBMIX, NBMICR, NBNMIC, NBNISO, ISOCAR, ISONAM, MATCOD, IMERGE, VOLUME, IACTI, ISONRF, MIXISO, AWRISO, DENISO, TMPISO, EJISO, VOLMER, INDISO, INDMIC, ISNNAM, ISNNRF, MIXISN, AWRISN, DENISN, TMPISN, VOLISN, EJISN, DNUM, DTMP, DVOL, DNUMMX, ISOCOD)

Author(s) A. Hébert and G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be created.
NSSTP	integer scalar variable that controls the storage of homogenized cross sections. Storage is activated if NSSTP=2, 3 and 4.
NACTI	integer scalar variable providing the number of activation mixtures.
NREGIO	integer scalar variable describing the number of regions.
NMERGE	integer scalar variable describing the number of merged regions.
NBISO	integer scalar variable describing the number of isotopes.
NBMIX	integer scalar variable describing the number of mixtures.
NBMICR	integer scalar variable describing the type of processing for isotopic cross section: <ul style="list-style-type: none"> • NBMICR<-1 generate full cross section library including depletion chain and independent fission spectrum for selected isotopes; • NBMICR=-1 generate full cross section library including depletion chain and independent fission spectrum for all isotopes; • NBMICR=0 do not generate microscopic cross section library; • NBMICR=1 process all isotope cross section library; • NBMICR>1 process cross section library for selected isotopes.
NBNMIC	integer scalar variable describing the number of microscopic isotopes to be saved.
NBNISO	integer scalar variable describing the new reference isotopes names.
ISOCAR	integer array of dimension ISOCAR(2,MXISO) containing the name of the isotopes to process.
ISONAM	integer array of dimension ISOCAR(3,MXISO) containing the name of the isotopes to process.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture associated with each region.
IMERGE	integer array of dimension IMERGE(NREGIO) containing the homogenization indices.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume associated with each region.
IACTI	integer array of dimension IACTI(NBMIX) containing the mixture numbers for which activation analysis will take place.
ISONRF	integer array of dimension ISONRF(3,NBISO) containing the isotope reference names.
MIXISO	integer array of dimension MIXISO(NBISO) containing the mixture number associated with each isotope.

AWRISO	real array of dimension AWRISO(NBISO) containing the isotope atomic weight.
DENISO	real array of dimension DENISO(NBISO) containing the isotopic density.
TMPISO	real array of dimension TMPISO(NBISO) containing the isotope temperature.
EJISO	real array of dimension EJISO(NBISO) containing the energy produced for 10^{24} fission in MJ for isotopes.
VOLMER	double precision array of dimension VOLMER(NMERGE) containing the merged volumes.
INDISO	integer array of dimension INDISO(NBISO,2) describing if an isotope is to be processed or not.
INDMIC	integer array of dimension INDMIC(NMERGE+1,NBISO) describing is a microscopic cross section is to be generated or not.
ISNNAM	integer array of dimension ISNNAM(3,NMERGE*NBISO) describing the names of the new isotopes.
ISNNRF	integer array of dimension ISNNRF(3,NMERGE*NBISO) describing the new isotope reference names.
MIXISN	integer array of dimension MIXISN(NMERGE*NBISO) describing the mixture associated with the new isotopes.
AWRISN	real array of dimension AWRISN(NMERGE*NBISO) describing the atomic weight of the new isotopes.
DENISN	real array of dimension DENISN(NMERGE*NBISO) describing the density of the new isotopes.
TMPISN	real array of dimension TMPISN(NMERGE*NBISO) describing the temperature of the new isotopes.
VOLISN	real array of dimension VOLISN(NMERGE*NBISO) describing the volume occupied by the new isotopes.
EJISN	real array of dimension EJISN(NMERGE*NBISO) containing the energy produced for 10^{24} fission in MJ for the new isotopes.
DNUM	double precision array of dimension DNUM(NMERGE,NBISO) containing the number of isotope in a merged region.
DTMP	double precision array of dimension DTMP(NMERGE,NBISO) containing the temperature of the nuclide in a merged region.
DVOL	double precision array of dimension DVOL(NMERGE,NBISO) containing the temperature of the nuclide in a merged region.
DNUMMX	double precision array of dimension DNUMMX(NMERGE) containing the number of isotope in a mixture.
ISOCOD	integer array of dimension ISOCOD(NREGIO,NBISO) describing the position of the new isotopes with respect to the original regions.

Called by

DRAGON routine(s) : EDIDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRDBL, XDRSET

GANLIB routine(s) : LCMPUT, RLSARA, SETARA

14.2.10 EDILBD

Purpose To calculate the Λ correction term for the B_1 leakage contribution.

Syntax CALL EDILBD(NGROUP, DLBDG, B2)

Author(s) G. Marleau

Description of input parameters

NGROUP integer scalar variable describing the number of groups.

DLBDG double precision array of dimension DLBDG(NGROUP) containing the total cross section.

B2 real array of dimension B2(4) containing the problem square buckling:

- B2(1) is the x directed buckling;
- B2(2) is the y directed buckling;
- B2(3) is the z directed buckling;
- B2(4) is the homogeneous buckling.

Called by

DRAGON routine(s) : EDIPXS, EDISCT

14.2.11 EDIMIC

Purpose To homogenize and condense the microscopic cross section.

Syntax CALL EDIMIC(IPEDIT, IPLIB, IPRINT, NGROUP, NGCOND, NREGIO, NMERGE, NL, NBISO, NBMIX, NED, ILEAKS, ILUPS, NSSTP, NTAUXT, B2, TIMEF, NBNMIC, HVECT, ISOCAR, ISONAM, IGCOND, IMERGE, FLXINT, DENISO, VOLMER, RATECM, INDISO, INDMIC, DNUM, DFLXDN, DFLDNC, DNUMMX, ISOCOD, DXSTRD, SPH)

Author(s) A. Hébert and G. Marleau

Description of input parameters

IPEDIT integer scalar variable for accessing the EDITING data structure to be created.

IPLIB integer scalar variable for accessing the MICROLIB data structure to be read.

IPRINT integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the microscopic cross sections will also be produced on the output file.

NGROUP	integer scalar variable describing the number of groups.
NGCOND	integer scalar variable describing the number of condensed groups.
NREGIO	integer scalar variable describing the number of regions.
NMERGE	integer scalar variable describing the number of merged regions.
NL	integer scalar variable describing the maximum isotropy level for the scattering cross section.
NBISO	integer scalar variable describing the number of isotopes.
NBMIX	integer scalar variable describing the number of mixtures.
NED	integer scalar variable describing the maximum number of edit cross sections.
ILEAKS	integer scalar variable describing the leakage option.
ILUPS	integer scalar variable describing how up-scattering is to be treated: <ul style="list-style-type: none"> • ILUPS=0 no special treatment; • ILUPS=1 remove up-scattering contribution.
NSSTP	integer scalar variable that controls the storage of homogenized cross sections. Storage is activated if NSSTP=2, 3 and 4.
NTAUXT	integer scalar variable containing the number of reaction rate types to process.
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
TIMEF	real array of dimension TIMEF(3) containing the time (days), burnup (KWD/Kg) and irradiation (n/kb).
NBNMIC	integer scalar variable describing the number of microscopic isotopes to be saved.
HVECT	character array of dimension HVECT(NEDMAC)*6 containing the name of the editing cross sections.
ISOCAR	integer array of dimension ISOCAR(2,MXISO) containing the name of the isotopes to process.
ISONAM	integer array of dimension ISOCAR(3,MXISO) containing the name of the isotopes to process.
IGCOND	integer array of dimension IGCOND(NGCOND) containing the condensed group limits.
IMERGE	integer array of dimension IMERGE(NREGIO) containing the homogenization indices.
FLXINT	real array of dimension FLXINT(NREGIO,NGROUP,4) containing the integrated flux.
DENISO	real array of dimension DENISO(NBISO) containing the isotopic density.
VOLMER	double precision array of dimension VOLMER(NMERGE) containing the merged volumes.
RATECM	double precision array of dimension RATECM(0:NMERGE,NGCOND,NTAUXT) containing the reaction rates for various type of reaction. Here for homogenized region i and condensed group g we use:

- RATECM($i,g,1$) is for integrated flux;
- RATECM($i,g,2$) is for total reaction rates;
- RATECM($i,g,3$) is for absorption reaction rates;
- RATECM($i,g,4$) is for fissions reaction rates;
- RATECM($i,g,5$) is for production rates;
- RATECM($i,g,6$) is for leakage rates;
- RATECM($i,g,7$) is for total out of group scattering rates;
- RATECM($i,g,8$) is for within group scattering reaction rates;
- RATECM($i,g,9$) is for χ ;
- RATECM($i,g,10$) is for transport correction reaction rates;
- RATECM($i,g,11$) is for x directed leakage rates;
- RATECM($i,g,12$) is for y directed leakage rates;
- RATECM($i,g,13$) is for z directed leakage rates;
- RATECM($i,g,13+I$) is for fission production rates for isotope I ;
- RATECM($i,g,13+NIFISS+I$) is for chi for isotope I ;
- RATECM($i,g,13+2*NIFISS+I$) is for fission production rates for isotope I ;
- RATECM($i,g,13+3*NIFISS+l$) is for out of group scattering for isotropic order l ;
- RATECM($i,g,13+3*NIFISS+NL+J$) is for edit rates of type J ;
- RATECM($i,g,NTAUXT$) is for $1/v$ reaction rates.

INDISO	integer array of dimension INDISO(NBISO,2) describing if an isotope is to be processed or not.
INDMIC	integer array of dimension INDMIC(NMERGE+1,NBNMIC) describing is a microscopic cross section is to be generated or not.
DNUM	double precision array of dimension DNUM(NMERGE,NBNMIC) containing the number of isotope in a merged region.
DFLXDN	double precision array of dimension DFLXDN(NGROUP,4) containing the total isotopic reaction rate for the original groups.
DFLDNC	double precision array of dimension DFLDNC(NGCOND,3) containing the total isotopic reaction rate for the condensed groups.
DNUMMX	double precision array of dimension DNUMMX(NMERGE) containing the number of isotope in a mixture.
ISOCOD	integer array of dimension ISOCOD(NREGIO,NBISO) describing the position of the new isotopes with respect to the original regions.
DXSTRD	double precision array of dimension DXSTRD(4,NGCOND,NMERGE) containing the equivalent transport correction.
SPH	real array of dimension SPH(NMERGE,NGCOND) containing the SPH homogenization factors.

Called by

DRAGON routine(s) : EDIDRV

Calling

DRAGON routine(s) : EDIMPR, EDIMRR, EDIMXS, EDIUPS, XDRLGS, XDRLPR, XDRNED

UTILIB routine(s) : XDRDBL

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX, SETARA, RLSARA

14.2.12 EDIMPR

Purpose To find the cross section from linear expansion.

Syntax CALL EDIMPR(NGROUP, NPROC, MINLEG, MAXLEG, INDPRO, PERT, XSREC, XSSCT)

Author(s) G. Marleau

Description of input parameters

NGROUP	integer scalar variable describing the number of groups.
NPROC	integer scalar variable describing the number of cross section types to process.
MINLEG	integer scalar variable describing the minimum Legendre order for scattering to process.
MAXLEG	integer scalar variable describing the maximum Legendre order for scattering to process.
INDPRO	integer array of dimension INDPRO(NPROC) containing a pointer for cross section to process. Processing takes place if $INDPRO(i) > 0$.
PERT	real scalar variable containing the term for perturbation.
XSREC	real array of dimension XSREC(NGROUP,NPROC,2) containing the vector cross section records.
XSSCT	real array of dimension XSSCT(NGROUP,NGROUP,MAXLEG-MINLEG+1,2) containing the scattering cross section records.

Called by

DRAGON routine(s) : EDIMIC

14.2.13 EDIMRR

Purpose To evaluate isotopic reaction rates from microscopic cross section.

Syntax CALL EDIMRR(NGROUP, NGCOND, NPROC, MINLEG, MAXLEG, NMERGE, IMR, ILEAKS, IGCOND, INDPRO, ITYPRO, XSREC, XSSCT, DFLXDN, DRATE, DRST)

Author(s) G. Marleau

Description of input parameters

NGROUP	integer scalar variable describing the number of groups.
NGCOND	integer scalar variable describing the number of condensed groups.
NPROC	integer scalar variable describing the number of cross section types to process.
MINLEG	integer scalar variable describing the minimum Legendre order for scattering to process.

MAXLEG	integer scalar variable describing the maximum Legendre order for scattering to process.
NMERGE	integer scalar variable describing the number of merged regions.
IMR	integer scalar variable describing the current homogenized region.
ILEAKS	integer scalar variable describing the leakage option.
IGCOND	integer array of dimension IGCOND(NGROUP) containing the condensed group limits.
INDPRO	integer array of dimension INDPRO(NPROC) containing a pointer for cross section to process. Processing takes place if $INDPRO(i) > 0$.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing a pointer for cross section processed. Processing has taken place if $ITYPRO(i) > 0$.
XSREC	real array of dimension XSREC(NGROUP,NPROC) containing the vector cross section records.
XSSCT	real array of dimension XSSCT(NGROUP,NGROUP,MAXLEG-MINLEG+1) containing the scattering cross section records.
DFLXDN	double precision array of dimension DFLXDN(NGROUP,4) containing the fluxes.
DRATE	double precision array of dimension DRATE(NGCOND,NPROC,NMERGE) containing the general reaction rates.
DRSCT	double precision array of dimension DRSCT(NGCOND,NGCOND,MAXLEG-MINLEG+1, NMERGE) containing the scattering rates.

Called by

DRAGON routine(s) : EDIMIC

14.2.14 EDIMXS

Purpose To evaluate microscopic cross section from isotopic reaction rates.

Syntax CALL EDIMXS(NGCOND, NPROC, MINLEG, MAXLEG, NMERGE, IMR, ILEAKS, INDPRO, DFLDNC, DRATE, DRSCT, PERT, XSREC, XSSCT, DXSTRD)

Author(s) G. Marleau

Description of input parameters

NGCOND	integer scalar variable describing the number of condensed groups.
NPROC	integer scalar variable describing the number of cross section types to process.
MINLEG	integer scalar variable describing the minimum Legendre order for scattering to process.
MAXLEG	integer scalar variable describing the maximum Legendre order for scattering to process.
NMERGE	integer scalar variable describing the number of merged regions.
IMR	integer scalar variable describing the current homogenized region.
ILEAKS	integer scalar variable describing the leakage option.

INDPRO	integer array of dimension INDPRO(NPROC) containing a pointer for cross section to process. Processing takes place if INDPRO(<i>i</i>)>0.
DFLDNC	double precision array of dimension DFLDNC(NGCOND,3) containing the total isotopic reaction rate for the condensed groups.
DRATE	double precision array of dimension DRATE(NGCOND,NPROC,NMERGE) containing the general reaction rates.
DRSCT	double precision array of dimension DRSCT(NGCOND,NGCOND,MAXLEG-MINLEG+1, NMERGE) containing the scattering rates.
PERT	real scalar variable containing the term for perturbation.
XSREC	real array of dimension XSREC(NGROUP,NPROC,2) containing the vector cross section records.
XSSCT	real array of dimension XSSCT(NGROUP,NGROUP,MAXLEG-MINLEG+1,2) containing the scattering cross section records.
DXSTRD	double precision array of dimension DXSTRD(4,NGCOND,NMERGE) containing the equivalent transport correction.

Called by

DRAGON routine(s) : EDIMIC

14.2.15 EDIPRR

Purpose To print reaction rates.

Syntax CALL EDIPRR(IPRINT, NGCOND, NMERGE, NL, NIFISS, NEDMAC, NTAUXT, ILEAKS, NTENER, B2, ENERGY, SPH, VOLMER, RATECM, SCATTD)

Author(s) G. Marleau

Description of input parameters

IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the macroscopic reaction rates will also be produced on the output file.
NGCOND	integer scalar variable describing the number of condensed groups.
NMERGE	integer scalar variable describing the number of merged regions.
NL	integer scalar variable describing the maximum isotropy level for the scattering cross section.
NIFISS	integer scalar variable describing the maximum number of fissile isotopes.
NEDMAC	integer scalar variable describing the maximum number of edit cross sections.
NTAUXT	integer scalar variable containing the number of reaction rate types to process.
ILEAKS	integer scalar variable describing the leakage option.
NTENER	integer scalar variable describing the presence (NTENER=0) or absence of the energy vector.
B2	real array of dimension B2(4) containing the problem square buckling:

	<ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
ENERGY	real array of dimension ENERGY(NGCOND+1) containing the condensed energy group limits.
SPH	real array of dimension SPH(NMERGE,NGCOND) containing the SPH homogenization factors.
VOLMER	double precision array of dimension VOLMER(NMERGE) containing the merged volumes.
RATECM	<p>double precision array of dimension RATECM(0:NMERGE,NGCOND,NTAUXT) containing the reaction rates for various type of reaction. Here for homogenized region i and condensed group g we use:</p> <ul style="list-style-type: none"> • RATECM($i,g,1$) is for integrated flux; • RATECM($i,g,2$) is for total reaction rates; • RATECM($i,g,3$) is for absorption reaction rates; • RATECM($i,g,4$) is for fissions reaction rates; • RATECM($i,g,5$) is for production rates; • RATECM($i,g,6$) is for leakage rates; • RATECM($i,g,7$) is for total out of group scattering rates; • RATECM($i,g,8$) is for within group scattering reaction rates; • RATECM($i,g,9$) is for χ; • RATECM($i,g,10$) is for transport correction reaction rates; • RATECM($i,g,11$) is for x directed leakage rates; • RATECM($i,g,12$) is for y directed leakage rates; • RATECM($i,g,13$) is for z directed leakage rates; • RATECM($i,g,13+I$) is for fission production rates for isotope I; • RATECM($i,g,13+NIFISS+I$) is for chi for isotope I; • RATECM($i,g,13+2*NIFISS+I$) is for fission production rates for isotope I; • RATECM($i,g,13+3*NIFISS+l$) is for out of group scattering for isotropic order l; • RATECM($i,g,13+3*NIFISS+NL+J$) is for edit rates of type J; • RATECM($i,g,NTAUXT$) is for $1/v$ reaction rates.
SCATTD	double precision array of dimension SCATTD(NMERGE,NGCOND,NGCOND,NL) containing the scattering rates. Here SCATTD(i,g,h,l) is for the scattering from group h to group g for merged region i and Legendre order l .

Called by

DRAGON routine(s) : EDIDTX

14.2.16 EDIPXS

Purpose To evaluate and print the cross sections.

Syntax CALL EDIPXS(IPEDIT, IPRINT, NSAVES, NGCOND, NMERGE, NL, NIFISS, NEDMAC, NTAUXT, ILEAKS, NWGTH, NTENER, NBMICR, ITRANC, EIGENK, B2, ENERGY, VOLMER, RATECM, SCATTD, EFISS, DISFCT, NAMEAD, MATMC, FACT, TIMEF, SPH, HVECT, NAMFI, MIXFI, MIXFF, DIRC, NNTOTF, SCATC, DIFF, IJJ, NJJ, IPOS, IFGUPS, XSFIS, DLBDG)

Author(s) G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be created.
IPRINT	integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the macroscopic cross sections will also be produced on the output file.
NSAVES	integer scalar variable describing the cross section analysis options: <ul style="list-style-type: none"> • NSAVES=0 no homogenized cross section computation; • NSAVES=1 compute homogenized cross section but do not save; • NSAVES=2 compute homogenized cross section and save; • NSAVES=3 compute homogenized cross section and save incremental.
NGCOND	integer scalar variable describing the number of condensed groups.
NMERGE	integer scalar variable describing the number of merged regions.
NL	integer scalar variable describing the maximum isotropy level for the scattering cross section.
NIFISS	integer scalar variable describing the maximum number of fissile isotopes.
NEDMAC	integer scalar variable describing the maximum number of edit cross sections.
NTAUST	integer scalar variable containing the number of reaction rate types to process.
ILEAKS	integer scalar variable describing the leakage option.
NWGTH	integer scalar variable describing the processing of linearly anisotropic scattering matrix: <ul style="list-style-type: none"> • NMGTH=0 use flux to merge/condense the linearly anisotropic scattering matrix; • NMGTH=1 use current to merge/condense the linearly anisotropic scattering matrix; • NMGTH=2 use buckling-weighted coherent method to merge/condense the linearly anisotropic scattering matrix; • NMGTH=3 use buckling-weighted coherent method and directional diagonal correction to merge/condense the linearly anisotropic scattering matrix.
NTENER	integer scalar variable describing the presence (NTENER=0) or absence of the energy vector.
NBMICR	integer scalar variable describing the type of processing for isotopic cross section: <ul style="list-style-type: none"> • NBMICR<-1 generate full cross section library including depletion chain and independent fission spectrum for selected isotopes; • NBMICR=-1 generate full cross section library including depletion chain and independent fission spectrum for all isotopes; • NBMICR=0 do not generate microscopic cross section library; • NBMICR=1 process all isotope cross section library;

	<ul style="list-style-type: none"> • NBMICR>1 process cross section library for selected isotopes.
ITRANC	<p>integer scalar variable describing the type of transport correction:</p> <ul style="list-style-type: none"> • ITRANC=0 means that the transport correction is not taken into account; • ITRANC=1 means that the transport correction is computed; • ITRANC=2 means that the transport correction is taken from the MACROLIB or MICROLIB data structure.
EIGENK	real scalar variable containing the problem k_{eff} eigenvalue.
B2	<p>real array of dimension B2(4) containing the problem square buckling:</p> <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
ENERGY	real array of dimension ENERGY(2*NGCOND+1) containing the condensed energy group limits and lethargy width.
VOLMER	double precision array of dimension VOLMER(NMERGE) containing the merged volumes.
RATECM	<p>double precision array of dimension RATECM(0:NMERGE,NGCOND,NTAUXT) containing the reaction rates for various type of reaction. Here for homogenized region i and condensed group g we use:</p> <ul style="list-style-type: none"> • RATECM($i,g,1$) is for integrated flux; • RATECM($i,g,2$) is for total reaction rates; • RATECM($i,g,3$) is for absorption reaction rates; • RATECM($i,g,4$) is for fissions reaction rates; • RATECM($i,g,5$) is for production rates; • RATECM($i,g,6$) is for leakage rates; • RATECM($i,g,7$) is for total out of group scattering rates; • RATECM($i,g,8$) is for within group scattering reaction rates; • RATECM($i,g,9$) is for χ; • RATECM($i,g,10$) is for transport correction reaction rates; • RATECM($i,g,11$) is for x directed leakage rates; • RATECM($i,g,12$) is for y directed leakage rates; • RATECM($i,g,13$) is for z directed leakage rates; • RATECM($i,g,13+I$) is for fission production rates for isotope I; • RATECM($i,g,13+NFISS+I$) is for chi for isotope I; • RATECM($i,g,13+2*NFISS+I$) is for fission production rates for isotope I; • RATECM($i,g,13+3*NFISS+l$) is for out of group scattering for isotropic order l; • RATECM($i,g,13+3*NFISS+NL+J$) is for edit rates of type J; • RATECM($i,g,NTAUXT$) is for $1/v$ reaction rates.

SCATTD	double precision array of dimension SCATTD(NMERGE,NGCOND,NGCOND,NL) containing the scattering rates. Here SCATTD(i,g,h,l) is for the scattering from group h to group g for merged region i and Legendre order l .
EFISS	double precision array of dimension EFISS(0:NMERGE,0:NIFISS+1) containing the energy produced per fission.
DISFCT	real array of dimension DISFCT(NGCOND) containing the flux disadvantage factors.
NAMEAD	integer array of dimension NAMEAD(2,NEDMAC) containing the extra editing names.
MATMC	integer array of dimension MATMC(NMERGE) containing the material per merged region.
FACT	real array of dimension FACT(NMERGE) containing the flux normalization factor.
TIMEF	real array of dimension TIMEF(3) containing the time (days), burnup (KWD/Kg) and irradiation (n/kb).
SPH	real array of dimension SPH(NMERGE,NGCOND) containing the SPH homogenization factors.
HVECT	character array of dimension HVECT(NEDMAC)*6 containing the name of the editing cross sections.
NAMFI	integer array of dimension NAMFI(2,NIFISS) containing the name of fissile isotope.
MIXFI	integer array of dimension MIXFI(NBMIX,NIFISS) containing the mixture of fissile isotope.
MIXFF	integer array of dimension MIXFF(NMERGE,NIFISS) containing the region of fissile isotope.
DIRC	double precision array of dimension DIRC(0:NMERGE,NGCOND,3) containing the directional correction factors.
NNTOTF	integer scalar variable describing the presence (NNFTOT>0) or absence (NNFTOT=0) of fissile mixtures.
SCATC	real array of dimension SCATC(NMERGE*NGCOND) containing the compressed scattering matrix.
DIFF	real array of dimension DIFF(NGCOND) containing the diffusion coefficients.
IJJ	integer array of dimension IJJ(NMERGE) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(NMERGE) containing the number of diffusion group.
IPOS	integer array of dimension IPOS(NMERGE) containing the location of a mixture in the compressed scattering matrix.
IFGUPS	integer array of dimension IFGUPS(NMERGE,NL) containing the identification of the first group with up-scattering.
XSFIS	real array of dimension XSFIS(NMERGE,NIFISS) containing the fission information.
DLBDG	double precision array of dimension DLBDG(NGCOND) containing the group dependent Λ .

Called by

DRAGON routine(s) : EDIDTX

Calling

DRAGON routine(s) : EDILBD

UTILIB routine(s) : XDRDBL, XDRSDB, XDRSET

GANLIB routine(s) : LCMPUT, LCMSIX

14.2.17 EDIRAT

Purpose To evaluate reaction rates from cross sections sections.

Syntax CALL EDIRAT(IOPERA, NREGION, NMERGE, IMERGE, MATCOD, FLXINT, SIGMAX,
RATES)

Author(s) G. Marleau

Description of input parameters

IOPERA integer scalar variable

NREGION integer scalar variable describing the number of regions.

NMERGE integer scalar variable describing the number of merged regions.

IMERGE integer array of dimension IMERGE(NREGION) containing the homogenization indices.

MATCOD integer array of dimension MATCOD(NREGION) containing the mixture associated with each region.

FLXINT real array of dimension FLXINT(NREGION) containing the integrated flux.

SIGMAX real array of dimension SIGMAX(0:NMERGE) containing merged regions cross sections.

RATES double precision array of dimension RATES(0:NMERGE) containing the merged regions reaction rates.

Called by

DRAGON routine(s) : EDIDTX

14.2.18 EDISCT

Purpose To evaluate scattering rates from cross sections.

Syntax CALL EDISCT(IPMACR, IPRINT, NGROUP, NGCOND, NBMIX, NREGION, NMERGE, NL,
NFISS, NTAUXT, ILEAKS, NWGTH, MATCOD, IGCOND, IMERGE, SPH,
RATECM, FLXINT, SCATTD, B2, DIRC, SIGMA, INGSCT, IFGSCT,
IPOSCT, XSCAT, DLBDG)

Author(s) G. Marleau

Description of input parameters

IPMACR integer scalar variable for accessing the MACROLIB or MICROLIB data structure to be read.

IPRINT integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the macroscopic scattering cross sections will also be produced on the output file.

NGROUP	integer scalar variable describing the number of groups.
NGCOND	integer scalar variable describing the number of condensed groups.
NBMIX	integer scalar variable describing the number of mixtures.
NREGION	integer scalar variable describing the number of regions.
NMERGE	integer scalar variable describing the number of merged regions.
NL	integer scalar variable describing the maximum isotropy level for the scattering cross section.
NFISS	integer scalar variable describing the maximum number of fissile isotopes.
NTAUXT	integer scalar variable containing the number of reaction rate types to process.
ILEAKS	integer scalar variable describing the leakage option.
NWGTH	integer scalar variable describing the processing of linearly anisotropic scattering matrix: <ul style="list-style-type: none"> • NMGTH=0 use flux to merge/condense the linearly anisotropic scattering matrix; • NMGTH=1 use current to merge/condense the linearly anisotropic scattering matrix; • NMGTH=2 use buckling-weighted coherent method to merge/condense the linearly anisotropic scattering matrix; • NMGTH=3 use buckling-weighted coherent method and directional diagonal correction to merge/condense the linearly anisotropic scattering matrix.
MATCOD	integer array of dimension MATCOD(NREGION) containing the mixture associated with each region.
IGCOND	integer array of dimension IGCOND(NGROUP) containing the condensed group limits.
IMERGE	integer array of dimension IMERGE(NREGION) containing the homogenization indices.
SPH	real array of dimension SPH(NMERGE,NGCOND) containing the SPH homogenization factors.
RATECM	double precision array of dimension RATECM(0:NMERGE,NGCOND,NTAUXT) containing the reaction rates for various type of reaction. Here for homogenized region i and condensed group g we use: <ul style="list-style-type: none"> • RATECM($i,g,1$) is for integrated flux; • RATECM($i,g,2$) is for total reaction rates; • RATECM($i,g,3$) is for absorption reaction rates; • RATECM($i,g,4$) is for fissions reaction rates; • RATECM($i,g,5$) is for production rates; • RATECM($i,g,6$) is for leakage rates; • RATECM($i,g,7$) is for total out of group scattering rates; • RATECM($i,g,8$) is for within group scattering reaction rates; • RATECM($i,g,9$) is for χ; • RATECM($i,g,10$) is for transport correction reaction rates; • RATECM($i,g,11$) is for x directed leakage rates; • RATECM($i,g,12$) is for y directed leakage rates; • RATECM($i,g,13$) is for z directed leakage rates;

	<ul style="list-style-type: none"> • RATECM($i,g,13+I$) is for fission production rates for isotope I; • RATECM($i,g,13+NIFISS+I$) is for chi for isotope I; • RATECM($i,g,13+2*NIFISS+I$) is for fission production rates for isotope I; • RATECM($i,g,13+3*NIFISS+l$) is for out of group scattering for isotropic order l; • RATECM($i,g,13+3*NIFISS+NL+J$) is for edit rates of type J ; • RATECM($i,g,NTAUXT$) is for $1/v$ reaction rates.
FLXINT	real array of dimension FLXINT(NREGIO,NGROUP,4) containing the integrated flux.
SCATTD	double precision array of dimension SCATTD(NMERGE,NGCOND,NGCOND,NL) containing the scattering rates. Here SCATTD(i,g,h,l) is for the scattering from group h to group g for merged region i and Legendre order l .
B2	real array of dimension B2(4) containing the problem square buckling: <ul style="list-style-type: none"> • B2(1) is the x directed buckling; • B2(2) is the y directed buckling; • B2(3) is the z directed buckling; • B2(4) is the homogeneous buckling.
DIRC	double precision array of dimension DIRC(0:NMERGE,NGCOND,3) containing the directional correction for the diffusion coefficients.
SIGMA	real array of dimension SIGMA(0:NBMIX) containing merged regions cross sections.
INGSCT	integer array of dimension INGSCT(NBMIX) containing the number of group for which scattering to group IGR takes places.
IFGSCT	integer array of dimension IFGSCT(NBMIX) containing the highest group for which scattering to group IGR takes places.
IPOSCT	integer array of dimension IPOSCT(NBMIX) containing the first position in the compressed scattering matrix associated with each mixture.
XSCAT	real array of dimension XSCAT(NBMIX*NGCOND) containing the compressed scattering matrix.
DLBDG	double precision array of dimension DLBDG(NGROUP) containing the total cross section.

Called by

DRAGON routine(s) : EDIDTX

Calling

DRAGON routine(s) : EDILBD

UTILIB routine(s) : XDRDBL

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX

14.2.19 EDISTA

Purpose To print the editing statistics.

Syntax CALL EDISTA(IPRINT, NMERGE, ITYPE, VOLMER, VOLREL, VOLTOT, FLXNEW, FLXOLD, RATNEW, RATOLD, VALERR)

Author(s) G. Marleau

Description of input parameters

IPRINT integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the statistics will also be produced on the output file.

NMERGE integer scalar variable describing the number of merged regions.

ITYPE integer scalar variable describing the type of statistics to print:

- ITYPE=1 for flux relative error;s
- ITYPE=2 for reaction rates relative errors;
- ITYPE=3 for delta sigma.

VOLMER double precision array of dimension VOLMER(NMERGE) containing the merged volumes.

VOLREL double precision scalar variable containing the ratio of the old to the new volumes.

VOLTOT real scalar variable containing the total volume.

FLXNEW double precision array of dimension FLXNEW(NMERGE) containing the new fluxes.

FLXOLD real array of dimension FLXOLD(NMERGE) containing the old fluxes.

RATNEW double precision array of dimension RATNEW(NMERGE) containing the new reaction rates.

RATOLD real array of dimension RATOLD(NMERGE) containing the new reaction rates.

VALERR real array of dimension VALERR(NMERGE) containing the relative error or incremental cross section.

Called by

DRAGON routine(s) : EDIDST

14.2.20 EDITIS

Purpose To test if an isotope for microscopic cross section editing is present.

Syntax CALL EDITIS(MAXISO, NBISO, NBMICR, ISONAM, ISOCAR)

Author(s) G. Marleau

Description of input parameters

MAXISO integer scalar variable describing the maximum number of isotopes.

NBISO integer scalar variable describing the number of isotopes.

NBMICR integer scalar variable describing the type of processing for isotopic cross section:

- NBMICR<-1 generate full cross section library including depletion chain and independent fission spectrum for selected isotopes;

- NBMICR=-1 generate full cross section library including depletion chain and independent fission spectrum for all isotopes;
- NBMICR=0 do not generate microscopic cross section library;
- NBMICR=1 process all isotope cross section library;
- NBMICR>1 process cross section library for selected isotopes.

ISONAM integer array of dimension ISONAM(3,NBISO) containing the isotope names.

ISOCAR integer array of dimension ISOCAR(2,MXISO) containing the name of the isotopes to process.

Called by

DRAGON routine(s) : EDI

14.2.21 EDITXS

Purpose To create ISOTXS files.

Syntax CALL EDITXS(IPEDIT, IWGOXS, IPRINT, NGCOND, NMERGE, NL, NBNISO, CTITLE, IMRG, NPROC, ENERGY, ISNNAM, ISNNRF, MIXISN, AWRISN, DENISN, TMPISN, VOLISN, EMJISN, AVGVEL, ITYPRO, LOCISO, IJJ, NJJ)

Author(s) G. Marleau

Description of input parameters

IPEDIT integer scalar variable for accessing the EDITING data structure to be created.

IWGOXS integer scalar variable containing the GOXS write unit.

IPRINT integer scalar variable describing the amount of information printed by this routine. A value of IPRINT=0 means that no information will be transferred to the output file. For IMPX>0, the contents of the ISOTXS file will also be produced on the output file.

NGCOND integer scalar variable describing the number of condensed groups.

NMERGE integer scalar variable describing the number of merged regions.

NL integer scalar variable describing the maximum isotropy level for the scattering cross section.

NBNISO integer scalar variable describing the new reference isotopes names.

CTITLE character*72 scalar variable describing the title of the problem.

IMRG integer scalar variable describing the mixture to consider.

NPROC integer scalar variable describing the number of cross section types to process.

ENERGY real array of dimension ENERGY(2*NGCOND+1) containing the condensed energy group limits and lethargy width.

ISNNAM integer array of dimension ISNNAM(3,NMERGE*NBNISO) describing the names of the new isotopes.

ISNNRF integer array of dimension ISNNRF(3,NMERGE*NBNISO) describing the new isotope reference names.

MIXISN	integer array of dimension MIXISN(NMERGE*NBNIISO) describing the mixture associated with the new isotopes.
AWRISN	real array of dimension AWRISN(NMERGE*NBNIISO) describing the atomic weight of the new isotopes.
DENISN	real array of dimension DENISN(NMERGE*NBNIISO) describing the density of the new isotopes.
TMPISN	real array of dimension TMPISN(NMERGE*NBNIISO) describing the temperature of the new isotopes.
VOLISN	real array of dimension VOLISN(NMERGE*NBNIISO) describing the volume occupied by the new isotopes.
EMJISN	real array of dimension EMJISN(NMERGE*NBNIISO) containing the energy produced for 10^{24} fission in MJ for the new isotopes.
AVGVEL	real array of dimension AVGVEL(NMERGE,NGCOND) contains the neutron average velocity.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing a pointer for cross section processed. Processing has taken place if $ITYPRO(i) > 0$.
LOCISO	integer array of dimension LOCISO(NBNIISO) containing the isotope localization vector.
IJJ	integer array of dimension IJJ(NMERGE) containing the position of the first diffusion group.
NJJ	integer array of dimension NJJ(NMERGE) containing the number of diffusion group.

Called by

DRAGON routine(s) : EDIDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : GXSDIM, XDRITE, XDRSET

GANLIB routine(s) : LCMGET, LCMLN, LCMSIX, SETARA, RLSARA

14.2.22 EDIUPS

Purpose To remove the up-scattering contribution from the scattering matrix.

Syntax CALL EDIUPS(NGCOND, NL, NMERGE, IMR, DRST)

Author(s) G. Marleau

Description of input parameters

NGCOND	integer scalar variable describing the number of condensed groups.
NL	integer scalar variable describing the maximum isotropy level for the scattering cross section.
NMERGE	integer scalar variable describing the number of merged regions.
IMR	integer scalar variable describing the mixture to consider.
DRST	double precision array of dimension DRST(NGCOND,NGCOND,NL,NMERGE) containing the scattering rates.

Called by

DRAGON routine(s) : EDIMIC

14.3 The SPH Homogenization Routines

The SPH homogenization procedure has the following structure

Structure of the SPH driver: STRSPH

```

SPHDRV
|----- BIVACT  ->
|----- EXCELT  ->
|----- JPMT    ->
|----- SYBILT  ->
|----- SPHGEO
|           |----- READEU
|           |----- XCGDIM
|           |----- XCGGEO  ->
|----- SPHEQU
|           |----- SPHREF
|           |----- SPHDIF
|           |           |----- BIVF2D
|           |           |----- BIVF2H
|           |           |----- BIVFSH
|           |           |----- BIVFSO
|           |           |----- BIVG2D
|           |           |----- BIVG2H
|           |           |----- BIVGSH
|           |           |----- BIVGSO
|           |----- SPHTRA
|           |           |----- EXCELP  ->
|           |           |----- JPMP    ->
|           |           |----- SYBILP  ->

```

Here the routines EXCELT, EXCELP, JPMT, JPMP, SYBILT, and SYBILP are defined respectively in sections Section 4, Section 10.3, Section 6, Section 10.5, Section 5 and Section 10.4. The routines for the BIVAC diffusion option (BIV*) are defined in Section 14.4. Finally the routines READEU, XCGDIM and XCGGEO are described in Section 6.3.3, Section 4.3.2 and Section 4.3.3 respectively.

14.3.1 SPHDIF

Purpose To perform a diffusion calculation over the macro-geometry in a single condensed group.

Syntax CALL SPHDIF(IPTRK2, KSPH, IPRINT, NREG, NUN, NMERGE, MAT, VOL, KEY,
MERG, ILK, CTITRE, COURIN, SIGMA, DIFF0, NGCOND, FLXMER,
SUNMER, FUNKNO, FLXTOT, IGR, IEX, SOURCE)

Author(s) A. Hébert

Description of input parameters

IPTRK2 integer scalar variable for accessing the TRACKING data structure to be read.

KSPH integer scalar variable containing the SPH normalization option where:

1. average flux normalization;

2. selengut normalization;
3. selengut normalization with surface leakage.

IPRINT	integer scalar variable containing the print flag.
NREG	integer scalar variable containing the number of macro-regions.
NUN	integer scalar variable containing the number of unknowns in the macro-calculation.
NMERGE	integer scalar variable containing the number of merged regions.
MAT	integer array of dimension MAT(*) containing the mixture index per macro-region.
VOL	real array of dimension VOL(*) containing the volume of macro-regions.
KEY	integer array of dimension KEY(*) containing the position of the flux components associated with each volume.
MERG	integer array of dimension MERG(*) containing the index of merged macro-regions.
ILK	logical scalar variable containing the leakage switch.
CTITRE	character*72 scalar variable containing the title.
COURIN	real scalar variable containing the incoming current per unit surface.
SIGMA	real array of dimension SIGMA(*) containing the removal macroscopic x-sections.
DIFF0	real array of dimension DIFF0(*) containing the diffusion coefficients.
NGCOND	integer scalar variable containing the number of groups condensed.
FLXMER	real array of dimension FLXMER(NMERGE,*) containing the flux estimate per mixture.
SUNMER	real array of dimension SUNMER(NMERGE,*) containing the incoming source.
IGR	integer scalar variable containing the energy group index.
IEX	integer scalar variable containing the iteration index.

Description of output parameters

FUNKNO	real array of dimension FUNKNO(NUN,*) containing the neutron flux.
FLXTOT	real scalar variable containing the averaged flux.

Description of work parameters

SOURCE	real array of dimension SOURCE(*) used for temporary storage.
--------	---

Called by

DRAGON routine(s) : SPHEQU

Calling

DRAGON routine(s) : BIVF2D, BIVF2H, BIVFSH, BIVFSO, BIVG2D, BIVG2H, BIVGSH, BIVGSO

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, SETARA, RLSARA

14.3.2 SPHDRV

Purpose To drive the SPH factor calculation.

Syntax CALL SPHDRV(IPEDIT, IPGEO1, IPGEO2, IPFLUX, IPMACR, IPSYS, MAXPTS, CDOOR, NDOOR, IPRINT, ITRANC, NGROUP, NGCOND, NBMIX, NREGIO, NMERGE, NIFISS, ILK, MATCOD, VOLUME, KEYFLX, IGCOND, IMERGE, FLUXES, NSPH, KSPH, CURNAM, CTITRE, SPH)

Author(s) A. Hébert

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be read.
IPGEO1	integer scalar variable for accessing the reference GEOMETRY data structure to be read.
IPGEO2	integer scalar variable for accessing the homogenization GEOMETRY data structure to be read.
IPFLUX	integer scalar variable for accessing the FLUXUNK data structure to be read.
IPMACR	integer scalar variable for accessing the MACROLIB data structure to be read.
IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be read.
MAXPTS	integer scalar variable containing the maximum number of macro-regions.
CDOOR	character*12 scalar variable containing the tracking module previously used in ASM:.
NDOOR	character*12 scalar variable containing the tracking module used for the macro-calculation.
IPRINT	integer scalar variable containing the print flag.
ITRANC	integer scalar variable containing the type of transport correction.
NGROUP	integer scalar variable containing the number of groups.
NGCOND	integer scalar variable containing the number of groups condensed.
NBMIX	integer scalar variable containing the number of mixtures.
NREGIO	integer scalar variable containing the number of regions.
NMERGE	integer scalar variable containing the number of regions merged.
NIFISS	integer scalar variable containing the number of fissile isotopes.
ILK	logical scalar variable containing the flag for neutron leakage through external boundary.
MATCOD	integer array of dimension MATCOD(NREGIO) containing the mixture index per region.
VOLUME	real array of dimension VOLUME(NREGIO) containing the volume of regions.
KEYFLX	integer array of dimension KEYFLX(NREGIO) containing the position of average fluxes.
IGCOND	integer array of dimension IGCOND(NGROUP) containing the limit condensed groups.
IMERGE	integer array of dimension IMERGE(NREGIO) containing the position of merged region.
FLUXES	real array of dimension FLUXES(NREGIO,NGROUP) containing the fluxes.

- NSPH** integer scalar variable containing the SPH calculation option where:
1. the SPH factors are read from the EDITING data structure;
 2. homogeneous macro-calculation;
 3. any type of PIJ macro-calculation;
 4. any type of diffusion macro-calculation.
- KSPH** integer scalar variable containing the SPH normalization option where:
1. average flux normalization;
 2. selengut normalization;
 3. selengut normalization with surface leakage.
- CURNAM** character*12 scalar variable containing the name of the directory where the SPH factors are stored.
- CTITRE** character*72 scalar variable containing the title.

Description of output parameters

SPH real array of dimension SPH(NMERGE,NGCOND) containing the SPH homogenization factors.

Called by

DRAGON routine(s) : EDIDRV

Calling

DRAGON routine(s) : BIVACT, EXCELT, JPMT, SPHEQU, SPHGEO, SYBILT

UTILIB routine(s) : XDRSET

GANLIB routine(s) : KDROPN, KDRCLS, LCMCL, LCMGET, LCMLN, LCMNXT, LCMOP, LCMPT, LCMSEX, REDGET, SETARA, RLSARA, XABORT

14.3.3 SPHEQU

Purpose To calculate the SPH factors for the homogenization of any geometry using a transport-transport or transport-diffusion equivalence.

Syntax CALL SPHEQU(IPTRK2, IFTRAK, IPFLUX, IPMACR, IPSYS, MAXMAT, NDOOR, NSPH, KSPH, IPRINT, ITRANC, NGROUP, NGCOND, NBMIX, NREGIO, NMERGE, NIFISS, MATCOD, VOLUME, KEYFLX, IGCOND, IMERGE, FLUXES, NREG2, NUN2, ILK, CTITRE, SPH, MAT2, VOL2, KEY2, MERG2, SIGMA, SIGMS, COURIN, VOLMER, SIGT, SIGW, DIFF, FLXMER, SUNMER, FUNKNO, FACTOR, SOURCE, CURH)

Author(s) A. Hébert

Description of parameters

- IPTRK2** integer scalar variable for accessing the TRACKING data structure to be read.
- IFTRAK** integer scalar variable for accessing the sequential binary TRACKING file to be read.
- IPFLUX** integer scalar variable for accessing the FLUXUNK data structure to be read.

IPMACR	integer scalar variable for accessing the MACROLIB data structure to be read.
IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be read.
MAXMAT	integer scalar variable containing the maximum number of mixtures.
NDOOR	character*12 scalar variable containing the name of the tracking module to be used.
NSPH	integer scalar variable containing the SPH calculation option where: <ul style="list-style-type: none"> 1. the SPH factors are read from the EDITING data; structure. 2. homogeneous macro-calculation; 3. any type of pij macro-calculation; 4. any type of diffusion macro-calculation.
KSPH	integer scalar variable containing the SPH normalization option where: <ul style="list-style-type: none"> 1. average flux normalization; 2. selengut normalization; 3. selengut normalization with surface leakage.
IPRINT	integer scalar variable containing the print flag.
ITRANC	integer scalar variable containing the type of transport correction.
NGROUP	integer scalar variable containing the number of groups.
NGCOND	integer scalar variable containing the number of groups condensed.
NBMIX	integer scalar variable containing the number of mixtures.
NREGIO	integer scalar variable containing the number of regions.
NMERGE	integer scalar variable containing the number of regions merged.
NIFISS	integer scalar variable containing the number of fissile isotopes.
MATCOD	integer array of dimension MATCOD(*) containing the mixture index per region.
VOLUME	real array of dimension VOLUME(*) containing the volume of regions.
KEYFLX	integer array of dimension KEYFLX(*) containing the position of average fluxes.
IGCOND	integer array of dimension IGCOND(*) containing the limit condensed groups.
IMERGE	integer array of dimension IMERGE(*) containing the position of merged region.
FLUXES	real array of dimension FLUXES(NREGIO,*) containing the fluxes.
NREG2	integer scalar variable containing the number of macro-regions (in the macro calculation).
NUN2	integer scalar variable containing the number of unknowns in a one-group macro-calculation.
ILK	logical scalar variable containing the leakage switch.
CTITRE	character*72 scalar variable containing the title.
SPH	real array of dimension SPH(NMERGE,*) containing the SPH homogenization factors.
MAT2	integer array of dimension MAT2(*) containing the mixture index per macro-region.

VOL2	real array of dimension VOL2(*) containing the volume of macro-regions.
KEY2	integer array of dimension KEY2(*) containing the pointer to flux values in unknown vector.
MERG2	integer array of dimension MERG2(*) containing the index of merged macro-regions.
SIGMA	real array of dimension SIGMA(0:*) used for temporary storage.
SIGMS	real array of dimension SIGMS(*) used for temporary storage.
COURIN	real array of dimension COURIN(*) used for temporary storage.
VOLMER	real array of dimension VOLMER(*) used for temporary storage.
SIGT	real array of dimension SIGT(NMERGE,*) used for temporary storage.
SIGW	real array of dimension SIGW(NMERGE,*) used for temporary storage.
DIFF	real array of dimension DIFF(NMERGE,*) used for temporary storage
FLXMER	real array of dimension FLXMER(NMERGE,*) used for temporary storage.
SUNMER	real array of dimension SUNMER(NMERGE,NGCOND,*) used for temporary storage.
FUNKNO	real array of dimension FUNKNO(NUN2,*) used for temporary storage.
FACTOR	real array of dimension FACTOR(*) used for temporary storage.
SOURCE	real array of dimension SOURCE(*) used for temporary storage.
CURH	real array of dimension CURH(NREGIO,NGROUP,*) used for temporary storage.

Called by

DRAGON routine(s) : SPHDRV

Calling

DRAGON routine(s) : SPHDIF, SPHREF, SPHTRA

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, SETARA, RLSARA, XABORT

14.3.4 SPHGEO

Purpose To recover the information from a GEOMETRY and to compute a corresponding macro-geometry.

Syntax CALL SPHGEO(MAXPTS, MAXMER, IPGEO1, IPGEO2, IPRINT, NREGIO, NMERGE,
IMERGE, XX, YY, INUM, IGEN, IORI, IMAT, NMC)

Author(s) A. Hébert

Description of input parameters

MAXPTS	integer scalar variable containing the maximum number of cells.
MAXMER	integer scalar variable containing the maximum number of merged regions.
IPGEO1	integer scalar variable for accessing the reference GEOMETRY data structure to be read.

IPGEO2 integer scalar variable for accessing the homogenization GEOMETRY data structure to be read.

IPRINT integer scalar variable containing the print flag.

NREGIO integer scalar variable containing the number of regions.

Description of output parameters

NMERGE integer scalar variable containing the number of regions merged.

IMERGE integer array of dimension IMERGE(*) containing the position of merged region.

Description of work parameters

XX real array of dimension XX(*) used for temporary storage.

YY real array of dimension YY(*) used for temporary storage.

INUM integer array of dimension INUM(*) used for temporary storage.

IGEN integer array of dimension IGEN(*) used for temporary storage.

IORI integer array of dimension IORI(*) used for temporary storage.

IMAT integer array of dimension IMAT(*) used for temporary storage.

NMC integer array of dimension NMC(*) used for temporary storage.

Called by

DRAGON routine(s) : SPHDRV

Calling

DRAGON routine(s) : READEU, XCGDIM, XCGGEO

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMPUT, SETARA, RLSARA, XABORT

14.3.5 SPHREF

<i>Purpose</i>	To calculate the reference merged/condensed set of cross sections to be used by an SPH homogenization module.
----------------	---

Syntax CALL SPHREF(IPFLUX, IPMACR, IPSYS, IPRINT, ITRANC, ILEAKS, B2, NGROUP,
NGCOND, NBMIX, NREGIO, NMERGE, NIFISS, MATCOD, VOLUME,
KEYFLX, IGCOND, IMERGE, FLUXES, VOLMER, FLXMER, SUMMER,
SIGT, SIGW, COURIN, CURH, PRODUC, SIGMA, NJJ, IJJ, IPOS,
XSCAT, WORK, DIFF)

Author(s) A. Hébert

Description of input parameters

IPFLUX integer scalar variable for accessing the FLUXUNK data structure to be read.

IPMACR integer scalar variable for accessing the MACROLIB data structure to be read.

IPSYS	integer scalar variable for accessing the ASMPIJ data structure to be read.
IPRINT	integer scalar variable containing the print flag.
ITRANC	integer scalar variable containing the type of transport correction.
ILEAKS	integer scalar variable containing the leakage option.
B2	real array of dimension B2(4) containing the square buckling.
NGROUP	integer scalar variable containing the number of groups.
NGCOND	integer scalar variable containing the number of groups condensed.
NBMIX	integer scalar variable containing the number of mixtures.
NREGIO	integer scalar variable containing the number of regions.
NMERGE	integer scalar variable containing the number of regions merged.
NFISS	integer scalar variable containing the number of fissile isotopes.
MATCOD	integer array of dimension MATCOD(*) containing the mixture index per region.
VOLUME	real array of dimension VOLUME(*) containing the volume of regions.
KEYFLX	integer array of dimension KEYFLX(*) containing the position of average fluxes.
IGCOND	integer array of dimension IGCOND(*) containing the limit condensed groups.
IMERGE	integer array of dimension IMERGE(*) containing the position of merged region.
FLUXES	real array of dimension FLUXES(NREGIO,*) containing the fluxes.

Description of output parameters

VOLMER	real array of dimension VOLMER(*) containing the merged and condensed volumes.
FLXMER	real array of dimension FLXMER(NMERGE,*) containing the merged and condensed fluxes.
SUNMER	real array of dimension SUNMER(NMERGE,NGCOND,*) containing the merged and condensed production cross section.
SIGT	real array of dimension SIGT(NMERGE,*) containing the merged and condensed total cross section.
SIGW	real array of dimension SIGW(NMERGE,*) containing the merged and condensed within group scattering.
COURIN	real array of dimension COURIN(*) containing the merged and condensed ingoing currents.
CURH	real array of dimension CURH(NREGIO,NGROUP,*) containing the merged and condensed averaged heterogeneous B_N currents.

Description of work parameters

PRODUC	real array of dimension PRODUC(NREGIO,NGCOND,*) used for temporary storage.
SIGMA	real array of dimension SIGMA(0:*) used for temporary storage.
NJJ	integer array of dimension NJJ(*) used for temporary storage.

IJJ integer array of dimension IJJ(*) used for temporary storage.
 IPOS integer array of dimension IPOS(*) used for temporary storage.
 XSCAT real array of dimension XSCAT(*) used for temporary storage.
 WORK real array of dimension WORK(NREGION,*) used for temporary storage.
 DIFF real array of dimension DIFF(*) used for temporary storage.

Called by

DRAGON routine(s) : SPHEQU

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, SETARA, RLSARA, XABORT

14.3.6 SPHTRA

Purpose To perform transport calculation over the macro-geometry in a single condensed group.

Syntax CALL SPHTRA(IPTRK, IFTRAK, NDOOR, KSPH, IPRINT, NREG, NBMIX, MAT, VOL, ILK, CTITRE, COURIN, SIGMA, SIGMS, SOURCE, FUNKNO, PIJSYM, FLXTOT, WORK)

Author(s) A. Hébert

Description of input parameters

IPTRK integer scalar variable for accessing the TRACKING data structure to be read.
 IFTRAK integer scalar variable for accessing the sequential binary TRACKING file to be read.
 NDOOR character*12 scalar variable containing the name of the tracking module to be used.
 KSPH integer scalar variable containing the SPH normalization option where:
 1. average flux normalization;
 2. selengut normalization;
 3. selengut normalization with surface leakage.
 IPRINT integer scalar variable containing the print flag.
 NREG integer scalar variable containing the number of macro-regions.
 NBMIX integer scalar variable containing the number of material mixtures.
 MAT integer array of dimension MAT(*) containing the mixture index per macro-region.
 VOL real array of dimension VOL(*) containing the volume of macro-regions.
 ILK logical scalar variable containing the leakage switch.

CTITRE character*72 scalar variable containing the title.

COURIN real scalar variable containing the averaged incoming current.

SIGMA real array of dimension SIGMA(0:NBMIX) containing the total macroscopic cross sections per macro-mixture.

SIGMS real array of dimension SIGMS(NBMIX) used for temporary storage.

SOURCE real array of dimension SOURCE(*) containing the fission and out-of-group diffusion sources.

Description of output parameters

FUNKNO real array of dimension FUNKNO(*) containing the neutron flux.

Description of work parameters

PIJSYM real array of dimension PIJSYM(*) used for temporary storage.

FLXTOT real scalar variable containing the integrated flux.

WORK real array of dimension WORK(NREG,NREG+1) used for temporary storage.

Called by

DRAGON routine(s) : SPHEQU

Calling

DRAGON routine(s) : EXCELP, JPMP, SYBILP

UTILIB routine(s) : ALSB

GANLIB routine(s) : LCMCL, LCMOP, XABORT

14.4 The BIVAC 2-D Diffusion Routines

The BIVAC 2-D diffusion routines are either called directly by the SHPDIF routine (see Section 14.3.1) or by the BIVACT routine according to the following structure:

Structure of the BIVAC tracking driver: STRBIV

```

BIVACT
|----- BIVTRK
|         |----- BIVCOL
|         |----- BIVDKN
|         |----- BIVPKN
|         |----- BIVPRH
|         |----- READ3D  ->
|         |----- BIVDFH
|         |----- BIVSBH

```

Here the routine READ3D is described in Section 6.3.1.

14.4.1 BIVACT

Purpose To track BIVAC type 2-D geometry.

Syntax CALL BIVACT(NENTRY, HENTRY, IENTRY, JENTRY, KENTRY)

Author(s) A. Hébert

Description of input parameters

- NENTRY** integer variable containing the number of data structures transferred to this module.
- HENTRY** one dimensional character*12 array HENTRY(*i*) containing the name of a data structure transferred to this module. Here $1 \leq i \leq \text{NENTRY}$.
- IENTRY** one dimensional integer array IENTRY(*i*) containing a data structure type identifier where:
- IENTRY(*i*)=1 for a linked list;
 - IENTRY(*i*)=2 for a direct access XSM format file;
 - IENTRY(*i*)=3 for a sequential binary file;
 - IENTRY(*i*)=4 for a sequential ASCII file.
- All the other values of IENTRY(*i*) are illegal. Here $1 \leq i \leq \text{NENTRY}$.
- JENTRY** one dimensional integer array JENTRY(*i*) containing a data structure mode identifier where:
- JENTRY(*i*)=0 if a new data structure is to be created;
 - JENTRY(*i*)=1 if an existing data structure can be modified;
 - JENTRY(*i*)=2 if an existing data structure can be accessed but not modified (read-only mode).
- All the other values of JENTRY(*i*) are illegal. Here $1 \leq i \leq \text{NENTRY}$.
- KENTRY** one dimensional integer array KENTRY(*i*) containing the data structure access key. For a file, this key is equivalent to a unit while for a linked list it represent the address in memory where this linked list is located. Here $1 \leq i \leq \text{NENTRY}$.

Called by

DRAGON routine(s) : SPHDRV

Calling

DRAGON routine(s) : BIVTRK

UTILIB routine(s) :

GANLIB routine(s) : LCMGET, LCMPUT, REDGET, SETARA, RLSARA, XABORT

14.4.2 BIVCOL

Purpose To select the unit matrices (mass, stiffness, etc.) for a finite element approximation.

Syntax CALL BIVCOL(IPTRK, IMPX, IELEM, ICOL)

Author(s) A. Hébert

Description of parameters

IPTRK integer scalar variable containing the pointer to the TRACKING data structure.

IMPX	integer scalar variable containing the print parameter.
IELEM	integer scalar variable containing the degree of the Lagrangian finite elements.
ICOL	integer scalar variable containing the type of quadrature where: <ul style="list-style-type: none"> • ICOL=1 is for analytical integration; • ICOL=2 is for Gauss-Lobatto integration; • ICOL=3 is for Gauss-Legendre integration.

Called by

DRAGON routine(s) : BIVTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMPUT, LCMSIX, XABORT

14.4.3 BIVDFH

Purpose To assign region numbers to a mesh centered finite difference discretization of a 2-D hexagonal geometry.

Syntax CALL BIVDFH(MAXEV, MAXKN, IMPX, ISPLH, LX, SIDE, NELEM, NUN,
IHEx, NCODE, ZCODE, MAT, VOL, IDL, KN, QFR, BFR, MUW)

Author(s) A. Hébert

Description of input/output parameters

MAXEV	integer scalar variable containing the number of hexagon if ISPLH=1 or the number of triangles if ISPLH>1.
MAXKN	integer scalar variable containing the dimension for arrays KN and QFR.
IMPX	integer scalar variable containing the print parameter.
ISPLH	integer scalar variable containing the type of mesh splitting. It takes the value of 1 for a hexagons mesh and a value >1 for a triangular mesh.
LX	integer scalar variable containing the number of hexagons.
SIDE	real scalar variable containing the side of an hexagon.
NELEM	integer scalar variable containing the number of finite elements.
NUN	integer scalar variable containing the number of unknowns per group.
IHEX	integer scalar variable containing the type of boundary condition.
NCODE	integer array of dimension NCODE(4) containing the type of hexagonal boundary condition.
ZCODE	real array of dimension ZCODE(*) containing the albedos.

MAT	integer array of dimension MAT(*) containing the mixture index assigned to each hexagon.
VOL	real array of dimension VOL(*) containing the volume of each hexagon.
IDL	integer array of dimension IDL(*) containing the position of the average flux component associated with each hexagon.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered external surfaces.
BFR	real array of dimension BFR(*) containing the element-ordered surface fractions.
MUW	integer array of dimension MUW(*) containing the compressed storage mode indices.

Called by

DRAGON routine(s) : BIVTRK

Calling

DRAGON routine(s) : BIVSBH

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA

14.4.4 BIVDKN

Purpose To assign region numbers to a mixed-dual finite element discretization in a 2-D geometry.

Syntax CALL BIVDKN(MAXEV, IMPX, LX, LY, CYLIND, IELEM, ICOL, L4, NCODE, ZCODE, MAT, VOL, XXX, YYY, XX, YY, DD, KN, QFR, BFR, IDL, MU, IP)

Author(s) A. Hébert

Description of input/output parameters

MAXEV	integer scalar variable containing the number of hexagon if ISPLH=1 or the number of triangles if ISPLH>1.
IMPX	integer scalar variable containing the print parameter.
LX	integer scalar variable containing the number of x directed elements.
LY	integer scalar variable containing the number of y directed elements.
CYLIND	logical scalar variable that is .TRUE. if cylindrical regions are present in the cell.
IELEM	integer scalar variable containing the degree of the Lagrangian finite elements.
ICOL	integer scalar variable containing the type of quadrature where: <ul style="list-style-type: none"> • ICOL=1 is for analytical integration; • ICOL=2 is for Gauss-Lobatto integration; • ICOL=3 is for Gauss-Legendre integration.
L4	integer scalar variable containing the total number of unknown.

NCODE	integer array of dimension NCODE(*) containing the type of boundary condition.
ZCODE	real array of dimension ZCODE(*) containing the albedos.
MAT	integer array of dimension MAT(*) containing the mixture index assigned to each hexagon.
VOL	real array of dimension VOL(*) containing the volume of each hexagon.
XXX	real array of dimension XXX(*) containing the Cartesian coordinates along the x axis.
YYY	real array of dimension YYY(*) containing the Cartesian coordinates along the y axis.
XX	real array of dimension XX(*) containing the cartesian mesh along the x axis.
YY	real array of dimension YY(*) containing the cartesian mesh along the Y axis.
DD	real array of dimension DD(*) containing the cylindrical mesh.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered external surfaces.
BFR	real array of dimension BFR(*) containing the element-ordered surface fractions.
IDL	integer array of dimension IDL(*) containing the position of integrated fluxes into unknown vector.
MU	integer array of dimension MU(*) containing the compressed storage mode indices.

Description of work parameters

IP	integer array of dimension IP(*) used for temporary storage.
----	--

Called by

DRAGON routine(s) : BIVTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

14.4.5 BIVF2D

Purpose To perform a mesh corner finite difference or finite element flux calculation in a single energy group for Cartesian geometry.

Syntax CALL BIVF2D(DIFF0, SIGMA, CYLIND, NREG, NUN, LL4, XX, YY, DD, MAT, KN, QFR, BFR, VOL, IDL, MU, SOURCE, LC, T, TS, R, RS, Q, QS, FUNKNO, A11)

Author(s) A. Hébert

Description of input parameters

DIFF0	real array of dimension DIFF0(*) containing the diffusion coefficients.
SIGMA	real array of dimension SIGMA(*) containing the removal macroscopic x-sections.

CYLIND	logical scalar variable containing that takes the value <code>.TRUE.</code> for cylindrical geometry.
NREG	integer scalar variable containing the number of elements in BIVAC.
NUN	integer scalar variable containing the dimension of vector FUNKNO.
LL4	integer scalar variable containing the order of the matrix A11.
XX	real array of dimension XX(*) containing the x -directed mesh spacing.
YY	real array of dimension YY(*) containing the y -directed mesh spacing.
DD	real array of dimension DD(*) containing the cylindrical geometry description.
MAT	integer array of dimension MAT(*) containing the mixture index per region.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered boundary conditions.
BFR	real array of dimension BFR(*) containing the element-ordered surface fractions.
VOL	real array of dimension VOL(*) containing the volume of regions.
IDL	integer array of dimension IDL(*) containing the position of integrated fluxes in unknown vector.
MU	integer array of dimension MU(*) containing the indices used with compressed diagonal storage mode matrix A11.
SOURCE	real array of dimension SOURCE(*) containing the fission and diffusion sources.
LC	integer scalar variable containing the number of polynomials in a complete 1-D basis.
T	real array of dimension T(*) containing the Cartesian linear product vector.
TS	real array of dimension TS(*) containing the cylindrical linear product vector.
R	real array of dimension R(4,5) containing the Cartesian mass matrix.
RS	real array of dimension RS(LC,*) containing the cylindrical mass matrix.
Q	real array of dimension Q(LC,*) containing the Cartesian stiffness matrix.
QS	real array of dimension QS(LC,*) containing the cylindrical stiffness matrix.

Description of output parameters

FUNKNO	real array of dimension FUNKNO(*) containing the finite element unknowns, the element averaged fluxes and the surface-averaged flux.
--------	--

Description of work parameters

A11	real array of dimension A11(*) used for temporary storage.
-----	--

Called by

DRAGON routine(s) : SPHDIF

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLDLF, ALLDLS

GANLIB routine(s) :

14.4.6 BIVF2H

Purpose To perform a mesh corner finite difference or finite element flux calculation in a single energy group.

Syntax CALL BIVF2H(DIFF0, SIGMA, NREG, NUN, LL4, ISPLH, NELEM, SIDE, MAT, KN, QFR, BFR, VOL, IDL, MU, SOURCE, R, RH, QH, RT, QT, FUNKNO, A11)

Author(s) A. Hébert

Description of input parameters

DIFF0	real array of dimension DIFF0(*) containing the diffusion coefficients.
SIGMA	real array of dimension SIGMA(*) containing the removal macroscopic x-sections.
NREG	integer scalar variable containing the number of elements in BIVAC.
NUN	integer scalar variable containing the dimension of vector FUNKNO.
LL4	integer scalar variable containing the order of the matrix A11.
ISPLH	integer scalar variable containing the type of mesh splitting. It takes the value of 1 for a hexagons mesh and a value >1 for a triangular mesh.
NELEM	integer scalar variable containing the number of finite elements.
SIDE	real scalar variable containing the side of an hexagon.
MAT	integer array of dimension MAT(*) containing the mixture index per region.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered boundary conditions.
BFR	real array of dimension BFR(*) containing the element-ordered surface fractions.
VOL	real array of dimension VOL(*) containing the volume of regions.
IDL	integer array of dimension IDL(*) containing the position of integrated fluxes in unknown vector.
MU	integer array of dimension MU(*) containing the indices used with compressed diagonal storage mode matrix A11.
SOURCE	real array of dimension SOURCE(*) containing the fission and diffusion sources.
R	real array of dimension R(2,*) containing a unit matrix.
RH	real array of dimension RH(6,*) containing a unit matrix.
QH	real array of dimension QH(6,*) containing a unit matrix.
RT	real array of dimension RT(3,*) containing a unit matrix.
QT	real array of dimension QT(3,*) containing a unit matrix.

Description of output parameters

FUNKNO real array of dimension FUNKNO(*) containing the flux.

Description of work parameters

A11 real array of dimension A11(*) used for temporary storage.

Called by

DRAGON routine(s) : SPHDIF

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLDLF, ALLDLS

GANLIB routine(s) :

14.4.7 BIVFSH

Purpose To compute the source term calculation for finite element or mesh corner finite differences in hexagonal geometry.

Syntax CALL BIVFSH(IEX, NGCOND, IGR, NMERGE, FLXMER, SUNMER, NREG, NUN, ISPLH, NELEM, SIDE, MAT, KN, QFR, VOL, MERG, COUR, FUNKNO, T, RH, RT, SOURCE, ZGAR1, ZGAR2)

Author(s) A. Hébert

Description of input parameters

IEX integer scalar variable containing the iteration number.

NGCOND integer scalar variable containing the number of groups condensed.

IGR integer scalar variable containing the energy group index.

NMERGE integer scalar variable containing the number of merged regions.

FLXMER real array of dimension FLXMER(NMERGE,*) containing the flux estimate.

SUNMER real array of dimension SUNMER(NMERGE,*) containing the incoming scattering and fission source cross sections.

NREG integer scalar variable containing the number of elements.

NUN integer scalar variable containing the number of unknowns per group.

ISPLH integer scalar variable containing the type of mesh splitting. It takes the value of 1 for a hexagons mesh and a value >1 for a triangular mesh.

NELEM integer scalar variable containing the number of finite elements.

SIDE real scalar variable containing the side of an hexagon.

MAT integer array of dimension MAT(*) containing the mixture index per region.

KN integer array of dimension KN(*) containing the element-ordered unknown list.

QFR	real array of dimension QFR(*) containing the element-ordered boundary conditions.
VOL	real array of dimension VOL(*) containing the volume of regions.
MERG	integer array of dimension MERG(*) containing the index of merged regions.
COUR	real scalar variable containing four times the incoming current per unit surface.
FUNKNO	real array of dimension FUNKNO(NUN,*) containing the previously calculated fluxes.
T	real array of dimension T(3,2) containing a unit matrix.
RH	real array of dimension R(6,3) containing a unit matrix.
RT	real array of dimension RT(3,*) containing a unit matrix.

Description of output parameters

SOURCE	real array of dimension SOURCE(*) containing the source.
--------	--

Description of work parameters

ZGAR1	real array of dimension ZGAR1(*) used for temporary storage.
ZGAR2	real array of dimension ZGAR2(*) used for temporary storage.

Called by

DRAGON routine(s) : SPHDIF

14.4.8 BIVFSO

Purpose To compute the source term for finite element or mesh corner finite differences in Cartesian geometry.

Syntax CALL BIVFSO(IEX, NGCOND, IGR, NMERGE, FLXMER, SUNMER, CYLIND, NREG, NUN, XX, DD, MAT, KN, QFR, VOL, MERG, COUR, FUNKNO, LC, T, TS, R, RS, SOURCE, ZGAR1, ZGAR2)

Author(s) A. Hébert

Description of input parameters

IEX	integer scalar variable containing the iteration number.
NGCOND	integer scalar variable containing the number of groups condensed.
IGR	integer scalar variable containing the energy group index.
NMERGE	integer scalar variable containing the number of merged regions.
FLXMER	real array of dimension FLXMER(NMERGE,*) containing the flux estimate.
SUNMER	real array of dimension SUNMER(NMERGE,*) containing the incoming scattering and fission source cross sections.
CYLIND	logical scalar variable that is <code>.TRUE.</code> if cylindrical regions are present in the cell.
NREG	integer scalar variable containing the number of elements.

NUN	integer scalar variable containing the number of unknowns per group.
XX	real array of dimension XX(*) containing the cartesian mesh along the x axis.
DD	real array of dimension DD(*) containing the cylindrical mesh.
MAT	integer array of dimension MAT(*) containing the mixture per region.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered external surfaces.
VOL	real array of dimension VOL(*) containing the volume of regions.
MERG	integer array of dimension MERG(*) containing the index of merged regions.
COUR	real scalar variable containing four times the incoming current per unit surface.
FUNKNO	real array of dimension FUNKNO(NUN,*) containing the previously calculated fluxes.
LC	integer scalar variable containing the order of the unit matrices.
T	real array of dimension T(*) containing a unit matrix.
TS	real array of dimension TS(*) containing a unit matrix.
R	real array of dimension R(4,5) containing a unit matrix.
RS	real array of dimension RS(LC,*) containing a unit matrix.

Description of output parameters

SOURCE	real array of dimension SOURCE(*) containing the source.
--------	--

Description of work parameters

ZGAR1	real array of dimension ZGAR1(*) used for temporary storage.
ZGAR2	real array of dimension ZGAR2(*) used for temporary storage.

Called by

DRAGON routine(s) : SPHDIF

14.4.9 BIVG2D

Purpose To perform a mixed-dual finite element flux calculation in a single energy group.

Syntax CALL BIVG2D(DIFF0, SIGMA, CYLIND, IELEM, ICOL, NREG, NUN, LL4, XX, YY, DD, MAT, KN, QFR, BFR, VOL, MU, SOURCE, LC, R, V, FUNKNO, A11)

Author(s) A. Hébert

Description of input parameters

DIFF0	real array of dimension DIFF0(*) diffusion coefficients.
SIGMA	real array of dimension SIGMA(*) removal macroscopic cross sections.
CYLIND	logical scalar variable that is <code>.TRUE.</code> if cylindrical regions are present in the cell.

IELEM	integer scalar variable containing the degree of the Lagrangian finite elements.
ICOL	integer scalar variable containing the type of quadrature where: <ul style="list-style-type: none"> • ICOL=1 is for analytical integration; • ICOL=2 is for Gauss-Lobatto integration; • ICOL=3 is for Gauss-Legendre integration.
NREG	integer scalar variable containing the number of elements.
NUN	integer scalar variable containing the dimension of vector FUNKNO.
LL4	integer scalar variable containing the number of unknowns per group.
XX	real array of dimension XX(*) containing the x -directed mesh spacing.
YY	real array of dimension YY(*) containing the y -directed mesh spacing.
DD	real array of dimension DD(*) containing the cylindrical mesh.
MAT	integer array of dimension MAT(*) containing the mixture index assigned to each hexagon.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered external surfaces.
BFR	real array of dimension BFR(*) containing the element-ordered surface fractions.
VOL	real array of dimension VOL(*) containing the volume of each hexagon.
MU	integer array of dimension MU(*) containing the compressed storage mode indices.
SOURCE	real array of dimension SOURCE(*) containing the fission and diffusion sources.
LC	integer scalar variable containing the number of polynomials in a complete 1-D basis.
R	real array of dimension R(LC,*) containing the cartesian mass matrix.
V	real array of dimension V(LC,*) containing the nodal coupling matrix.

Description of output parameters

FUNKNO real array of dimension FUNKNO(*) containing the neutron flux.

Description of work parameters

A11 real array of dimension A11(*) used for temporary storage.

Called by

DRAGON routine(s) : SPHDIF

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLDLF, ALLDLS

GANLIB routine(s) : XABORT

14.4.10 BIVG2H

Purpose To perform a mesh corner finite difference or finite element flux calculation in a single energy group.

Syntax CALL BIVG2H(DIFF0, SIGMA, NREG, NUN, LL4, ISPLH, SIDE, MAT, KN, QFR, BFR, VOL, IDL, MU, SOURCE, FUNKNO, A11)

Author(s) A. Hébert

Description of input parameters

DIFF0	real array of dimension DIFF0(*) containing the diffusion coefficients.
SIGMA	real array of dimension SIGMA(*) containing the removal macroscopic x-sections.
NREG	integer scalar variable containing the number of elements in BIVAC.
NUN	integer scalar variable containing the dimension of vector FUNKNO.
LL4	integer scalar variable containing the order of the matrix A11.
ISPLH	integer scalar variable containing the type of mesh splitting. It takes the value of 1 for a hexagons mesh and a value >1 for a triangular mesh.
SIDE	real scalar variable containing the side of an hexagon.
MAT	integer array of dimension MAT(*) containing the mixture index per region.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered boundary conditions.
BFR	real array of dimension BFR(*) containing the element-ordered surface fractions.
VOL	real array of dimension VOL(*) containing the volume of regions.
IDL	integer array of dimension IDL(*) containing the position of integrated fluxes in unknown vector.
MU	integer array of dimension MU(*) containing the indices used with compressed diagonal storage mode matrix A11.
SOURCE	real array of dimension SOURCE(*) containing the fission and diffusion sources.

Description of output parameters

FUNKNO	real array of dimension FUNKNO(*) containing the flux.
--------	--

Description of work parameters

A11	real array of dimension A11(*) used for temporary storage.
-----	--

Called by

DRAGON routine(s) : SPHDIF

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLDLF, ALLDLS

GANLIB routine(s) :

14.4.11 BIVGSH

Purpose To compute the source term calculation for a mesh centered finite differences in hexagonal geometry.

Syntax CALL BIVGSH(IEX, NGCOND, IGR, NMERGE, FLXMER, SUNMER, NREG, NUN, LL4, ISPLH, SIDE, MAT, KN, QFR, VOL, DIFF0, MERG, COUR, FUNKNO, SOURCE, ZGAR1, ZGAR2)

Author(s) A. Hébert

Description of input parameters

IEX	integer scalar variable containing the iteration number.
NGCOND	integer scalar variable containing the number of groups condensed.
IGR	integer scalar variable containing the energy group index.
NMERGE	integer scalar variable containing the number of merged regions.
FLXMER	real array of dimension FLXMER(NMERGE,*) containing the flux estimate.
SUNMER	real array of dimension SUNMER(NMERGE,*) containing the incoming scattering and fission source cross sections.
NREG	integer scalar variable containing the number of elements.
NUN	integer scalar variable containing the number of unknowns per group.
LL4	integer scalar variable containing the order of the system matrices.
ISPLH	integer scalar variable containing the type of mesh splitting. It takes the value of 1 for a hexagons mesh and a value >1 for a triangular mesh.
SIDE	real scalar variable containing the side of an hexagon.
MAT	integer array of dimension MAT(*) containing the mixture index per region.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered boundary conditions.
VOL	real array of dimension VOL(*) containing the volume of regions.
DIFF0	real array of dimension DIFF0(*) containing the diffusion coefficients.
MERG	integer array of dimension MERG(*) containing the index of merged regions.
COUR	real scalar variable containing four times the incoming current per unit surface.
FUNKNO	real array of dimension FUNKNO(NUN,*) containing the previously calculated fluxes.

Description of output parameters

SOURCE real array of dimension SOURCE(*) containing the source.

Description of work parameters

ZGAR1 real array of dimension ZGAR1(*) used for temporary storage.

ZGAR2 real array of dimension ZGAR2(*) used for temporary storage.

Called by

DRAGON routine(s) : SPHDIF

14.4.12 BIVGSO

Purpose To compute the source term for a mixed-dual formulation of the finite element technique in a 2-D Cartesian geometry.

Syntax CALL BIVGSO(IEX, NGCOND, IGR, NMERGE, FLXMER, SUNMER, CYLIND, IELEM,
NREG, NUN, MAT, XX, DD, KN, QFR, VOL, MERG, COUR,
FUNKNO, SOURCE, ZGAR1, ZGAR2)

Author(s) A. Hébert

Description of input parameters

IEX integer scalar variable containing the iteration number.

NGCOND integer scalar variable containing the number of groups condensed.

IGR integer scalar variable containing the energy group index.

NMERGE integer scalar variable containing the number of merged regions.

FLXMER real array of dimension FLXMER(NMERGE,*) containing the flux estimate.

SUNMER real array of dimension SUNMER(NMERGE,*) containing the incoming scattering and fission source cross sections.

CYLIND logical scalar variable that is **.TRUE.** if cylindrical regions are present in the cell.

IELEM integer scalar variable containing the degree of the Lagrangian finite elements.

NREG integer scalar variable containing the number of elements.

NUN integer scalar variable containing the number of unknowns per group.

MAT integer array of dimension MAT(*) containing the mixture per region.

XX real array of dimension XX(*) containing the cartesian mesh along the x axis.

DD real array of dimension DD(*) containing the cylindrical mesh.

KN integer array of dimension KN(*) containing the element-ordered unknown list.

QFR real array of dimension QFR(*) containing the element-ordered external surfaces.

VOL real array of dimension VOL(*) containing the volume of regions.

MERG integer array of dimension MERG(*) containing the index of merged regions.

COUR real scalar variable containing four times the incoming current per unit surface.

FUNKNO real array of dimension FUNKNO(NUN,*) containing the previously calculated fluxes.

Description of output parameters

SOURCE real array of dimension SOURCE(*) containing the source.

Description of work parameters

ZGAR1 real array of dimension ZGAR1(*) used for temporary storage.

ZGAR2 real array of dimension ZGAR2(*) used for temporary storage.

Called by

DRAGON routine(s) : SPHDIF

14.4.13 BIVPKN

Purpose To assign region numbers to a mesh corner finite difference or primal finite element discretization in a 2-D geometry.

Syntax CALL BIVPKN(MAXEV, IMPX, LX, LY, CYLIND, IELEM, L4, NCODE, ZCODE, MAT, VOL, XXX, YYY, XX, YY, DD, KN, QFR, BFR, MU, IP, IWRK)

Author(s) A. Hébert

Description of input/output parameters

MAXEV integer scalar variable containing the number of hexagon if ISPLH=1 or the number of triangles if ISPLH>1.

IMPX integer scalar variable containing the print parameter.

LX integer scalar variable containing the number of x directed elements.

LY integer scalar variable containing the number of y directed elements.

CYLIND logical scalar variable that is `.TRUE.` if cylindrical regions are present in the cell.

IELEM integer scalar variable containing the degree of the Lagrangian finite elements.

L4 integer scalar variable containing the total number of unknown.

NCODE integer array of dimension NCODE(*) containing the type of boundary condition.

ZCODE real array of dimension ZCODE(*) containing the albedos.

MAT integer array of dimension MAT(*) containing the mixture index assigned to each hexagon.

VOL real array of dimension VOL(*) containing the volume of each hexagon.

XXX real array of dimension XXX(*) containing the Cartesian coordinates along the x axis.

YYY real array of dimension YYY(*) containing the Cartesian coordinates along the y axis.

XX real array of dimension XX(*) containing the cartesian mesh along the x axis.

YY real array of dimension YY(*) containing the cartesian mesh along the y axis.

DD real array of dimension DD(*) containing the cylindrical mesh.

KN integer array of dimension KN(*) containing the element-ordered unknown list.

QFR real array of dimension QFR(*) containing the element-ordered external surfaces.

BFR real array of dimension BFR(*) containing the element-ordered surface fractions.

MU integer array of dimension MU(*) containing the compressed storage mode indices.

Description of work parameters

IP integer array of dimension IP(*) used for temporary storage.

IWRK integer array of dimension IWRK(*) used for temporary storage.

Called by

DRAGON routine(s) : BIVTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

14.4.14 BIVPRH

Purpose To generate the region numbers corresponding to a mesh corner finite difference or linear Lagrangian finite element discretization of a 2-D hexagonal geometry.

Syntax CALL BIVPRH(MAXEV, MAXKN, IMPX, ISPLH, LX, IHEX, NCODE, ZCODE, MAT, SIDE, LL4, NELEM, VOL, KN, QFR, BFR, MUW, IGAR)

Author(s) A. Hébert

Description of input/output parameters

MAXEV integer scalar variable containing the number of hexagon if ISPLH=1 or the number of triangles if ISPLH>1.

MAXKN integer scalar variable containing the dimension for arrays KN and QFR.

IMPX integer scalar variable containing the print parameter.

ISPLH integer scalar variable containing the type of mesh splitting. It takes the value of 1 for a hexagons mesh and a value >1 for a triangular mesh.

LX integer scalar variable containing the number of hexagons.

IHEX integer scalar variable containing the type of boundary condition.

NCODE integer array of dimension NCODE(4) containing the type of hexagonal boundary condition.

ZCODE real array of dimension ZCODE(*) containing the albedo corresponding to boundary condition.

MAT integer array of dimension MAT(*) containing the mixture index assigned to each hexagon.

SIDE real scalar variable containing the side of an hexagon.

LL4	integer scalar variable containing the number of elements after mesh-splitting.
NELEM	integer scalar variable containing the number of finite elements.
VOL	real array of dimension VOL(*) containing the volume of each hexagon.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered external surfaces.
BFR	real array of dimension BFR(*) containing the element-ordered surface fractions.
MUW	integer array of dimension MUW(*) containing the compressed storage mode indices.

Description of work parameters

IGAR	integer array of dimension IGAR(*) used for temporary storage.
------	--

Called by

DRAGON routine(s) : BIVTRK

Calling

DRAGON routine(s) : BIVSBH

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

14.4.15 BIVSBH

Purpose To assign region numbers to an hexagonal 2-D geometry with or without triangular mesh-splitting.

Syntax CALL BIVSBH(MAXEV, MAXKN, IMPX, ISPLH, LX, SIDE, LL4, IHEX, NCODE, MAT, VOL, KN, QFR, IGAR, KN2, QFR2)

Author(s) A. Hébert

Description of input/output parameters

MAXEV	integer scalar variable containing the number of hexagon if ISPLH=1 or the number of triangles if ISPLH>1.
MAXKN	integer scalar variable containing the dimension for arrays KN and QFR.
IMPX	integer scalar variable containing the print parameter.
ISPLH	integer scalar variable containing the type of mesh splitting. It takes the value of 1 for a hexagons mesh and a value >1 for a triangular mesh.
LX	integer scalar variable containing the number of hexagons.
SIDE	real scalar variable containing the side of an hexagon.
LL4	integer scalar variable containing the number of elements after mesh-splitting.
IHEX	integer scalar variable containing the type of boundary condition.

NCODE	integer array of dimension NCODE(4) containing the type of hexagonal boundary condition.
MAT	integer array of dimension MAT(*) containing the mixture index assigned to each hexagon.
VOL	real array of dimension VOL(*) containing the volume of each hexagon.
KN	integer array of dimension KN(*) containing the element-ordered unknown list.
QFR	real array of dimension QFR(*) containing the element-ordered external surfaces.

Description of work parameters

IGAR	integer array of dimension IGAR(*) used for temporary storage.
KN2	integer array of dimension KN2(*) used for temporary storage.
QFR2	real array of dimension QFR2(*) used for temporary storage.

Called by

DRAGON routine(s) : BIVDFH, BIVPRH

Calling

DRAGON routine(s) : NEIGHB

UTILIB routine(s) :

GANLIB routine(s) : XABORT

14.4.16 BIVTRK

Purpose To recover the geometry and perform a BIVAC diffusion tracking.

Syntax CALL BIVTRK(MAXPTS, IPTRK, IPGEOM, IMPX, IELEM, ICOL, ISPLH, MAT, VOL, IDL)

Author(s) A. Hébert

Description of parameters

MAXPTS	integer scalar variable containing the maximum space for region storage.
IPTRK	integer scalar variable containing the pointer to the TRACKING data structure.
IPGEOM	integer scalar variable containing the pointer to the GEOMETRY data structure.
IMPX	integer scalar variable containing the print flag.
IELEM	integer scalar variable containing the order of the diffusion method considered.
ICOL	integer scalar variable containing the type of quadrature considered.
ISPLH	integer scalar variable containing the type of hexagonal mesh-splitting.
MAT	integer array of dimension MAT(*) containing the mixture in each region.
VOL	real array of dimension VOL(*) containing the volume of each region.
IDL	integer array of dimension IDL(*) containing the position of integrated fluxes in the unknown vector.

Called by

DRAGON routine(s) : BIVACT

Calling

DRAGON routine(s) : BIVCOL, BIVDFH, BIVDKN, BIVPKN, BIVPRH, READ3D

UTILIB routine(s) :

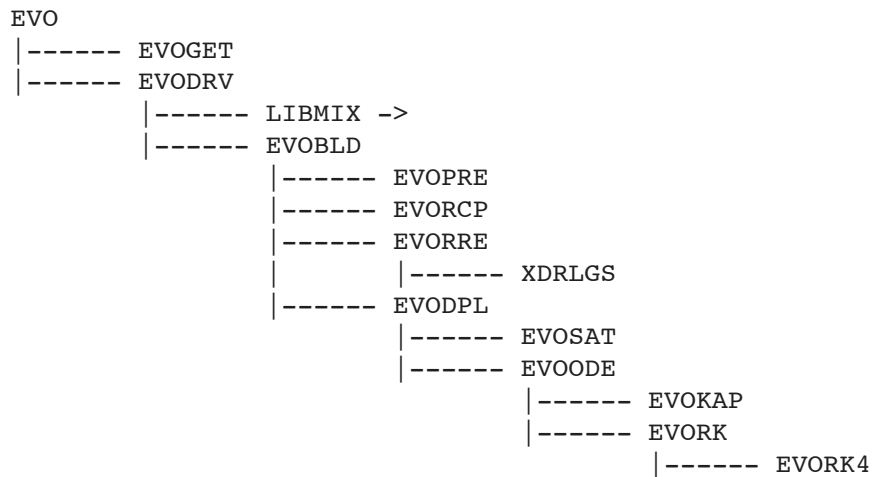
GANLIB routine(s) : LCMGET, LCMPOF, LCMPUT, SETARA, RLSARA, XABORT

15 THE MODULE FOR ISOTOPIC DEPLETION

15.1 Structure of EVO:

The EVO: module can be represented by the following tree:

Structure of the depletion module: EVO



15.2 General Routines Description

15.2.1 EVOBLD

Purpose To compute the depletion reaction rates, perform flux normalization and call to solve the depletion system for each depleting mixture.

Syntax CALL EVOBLD(IPDEPL, IPLIB , IMPX , INDREC, NBISO , NGROUP, NPROC , ISONAM, AWRISO, NCOMB , NDEPL , NDFI , NDFP , NHEAVY, NLIGHT, NOTHER, NBXR , EPS1 , EPS2 , EXPMAX, H1 , ITYPE , INR , FIT , XT , ITIXS , DELTA , FNORM , JM , YDPL , FLX , VX , IDR , RER , KPAR , BPAR , YIELD , MU1 , IMA , SIG , SFIS , LP , QF)

Author(s) A. Hébert

Description of input/output parameters

IPDEPL integer scalar variable containing the pointer to the BURNUP data structure.

IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.

IMPX integer scalar variable containing the print flag.

INDREC	integer scalar variable containing the depletion step with: <ol style="list-style-type: none"> 1. for beginning of depletion; 2. otherwise.
NBISO	integer scalar variable containing the number of isotopes/materials including non-depleting ones.
NGROUP	integer scalar variable containing the number of energy groups.
NPROC	integer scalar variable containing the number of microscopic cross sections to process.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the alias names of isotopes.
AWRISO	real array of dimension AWRISO(NBISO) containing the atomic weight isotopes.
NCOMB	integer scalar variable containing the number of depleting mixtures.
NDEPL	integer scalar variable containing the number of depleting nuclides.
NDFI	integer scalar variable containing the number of direct fissile isotopes.
NDFP	integer scalar variable containing the number of direct fission products.
NHEAVY	integer scalar variable containing the number of heavy isotopes.
NLIGHT	integer scalar variable containing the number of light isotopes.
NOTHER	integer scalar variable containing the number of other isotopes.
NBXR	integer scalar variable containing the maximum number of parent reaction.
EPS1	real scalar variable containing the required accuracy for ordinary differential equation solver.
EPS2	real scalar variable containing the required accuracy for constant power iterations.
EXPMAX	real scalar variable containing the isotope saturating limit.
H1	real scalar variable containing the guessed first stepsize.
ITYPE	integer scalar variable containing the type of solution method with: <ol style="list-style-type: none"> 1. for fifth-order Runge-Kutta method; 2. fourth-order Kaps-Rentrop method.
INR	integer scalar variable containing the power normalization procedure with: <ul style="list-style-type: none"> • with INR=0 for out-of-core depletion (0 power); • with INR=1 for constant flux depletion; • with INR=2 for constant power depletion.
FIT	real scalar variable containing the power normalization factor: <ul style="list-style-type: none"> • in $n/cm^2/s$ if INR=1; • in kw/kg of initial heavy elements if INR=2.
XT	real array of dimension XT(2) containing the initial and final time for the depletion.
ITIXS	integer scalar variable containing the flag for time dependent cross sections with: <ul style="list-style-type: none"> • with ITIXS=0 for constant cross section;

- with ITIXS=1 for cross section that depends linearly on time.

DELTA	real array of dimension DELTA(2) containing the increment in fuel burnup for this stage and in neutron exposure for this stage.
FNORM	real array of dimension FNORM(2) containing the DRAGON flux normalization factor.
JM	integer array of dimension JM(NDEPL,NCOMB) containing the position in isotope list of each depleting nuclide.
YDPL	real array of dimension YDPL(NDEPL+1,2,NCOMB) containing the initial/final number density of isotope in the depletion chain.
FLX	real array of dimension FLX(NGROUP,2,NCOMB) containing the initial/final volume averaged neutron fluxes.
VX	real array of dimension VX(NCOMB) containing the volumes of the depleting mixtures.
IDR	integer array of dimension IDR(MAXR,NDEPL) containing the reaction identifier.
RER	real array of dimension RER(MAXR,NDEPL) containing the reaction constant.
KPAR	integer array of dimension KPAR(NBXR,NDEPL) containing the reduced reaction type matrix.
BPAR	real array of dimension BPAR(NBXR,NDEPL) containing the reduced branching ratio matrix.
YIELD	real array of dimension YIELD(NDFI,NDFP) containing the fission yield.

Description of work parameters

MU1	integer array of dimension MU1(NDEPL+1) used for temporary storage.
IMA	integer array of dimension IMA(NDEPL+1) used for temporary storage.
SIG	real array of dimension SIG(NDEPL,5,2,NCOMB) used for temporary storage.
SFIS	real array of dimension SFIS(NHEAVY,2) used for temporary storage.
LP	integer array of dimension LP(NDEPL) used for temporary storage.
QF	real array of dimension QF(NHEAVY) used for temporary storage.

Called by

DRAGON routine(s) : EVODRV

Calling

DRAGON routine(s) : EVODPL, EVOPRE, EVORCP, EVORRE

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMPUT, SETARA, RLSARA, XABORT

15.2.2 EVODPL

Purpose To solve the isotopic depletion equations taking into account the saturation phenomena.

Syntax CALL EVODPL(IMPX , YDPL , NVAR , XT , EPS1 , EXPMAX, H1 , ITYPE , MU1 , IMA , MAXA , NSUPF , NFISS , KFISS , YSF , ADPL , BDPL , KSAT , IPERM , YST1 , YSAT , MU12 , IMA2 , ADPL2 , BDPL2 , YSF2 , KFIS2)

Author(s) A. Hébert

Description of input parameters

IMPX	integer scalar variable containing the print flag.
YDPL	real array of dimension YDPL(*) containing the initial/final number densities.
NVAR	integer scalar variable containing the number of nuclides in the complete depletion chain.
XT	real array of dimension XT(*) containing the initial and final value of the independent variable.
EPS1	real scalar variable containing the required accuracy for the ODE solver.
EXPMAX	real scalar variable containing the saturation parameter.
H1	real scalar variable containing the guessed first stepsize.
ITYPE	integer scalar variable containing the type of solution method with: <ul style="list-style-type: none"> 1. for fifth-order Runge-Kutta method; 2. fourth-order Kaps-Rentrop method.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in vector ADPL.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in vector ADPL.
MAXA	integer scalar variable containing the first dimension of vectors ADPL and ADPL2.
NSUPF	integer scalar variable containing the number of depleting fission products.
NFISS	integer scalar variable containing the number of fissile isotopes producing fission products.
KFISS	integer array of dimension KFISS(*) containing the position in chain of the fissile isotopes.
YSF	real array of dimension YSF(NFISS,NSUPF,*) containing the initial/final product of the fission yields and fission rates.
ADPL	real array of dimension ADPL(MAXA,2) containing the initial/final depletion matrix.
BDPL	real array of dimension BDPL(NVAR,2) containing the initial/final depletion source.

Description of work parameters

KSAT	integer array of dimension KSAT(*) used for temporary storage.
IPERM	integer array of dimension IPERM(*) used for temporary storage.
YST1	real array of dimension YST1(*) used for temporary storage.
YSAT	real array of dimension YSAT(*) used for temporary storage.
MU12	integer array of dimension MU12(*) used for temporary storage.
IMA2	integer array of dimension IMA2(*) used for temporary storage.

ADPL2 real array of dimension ADPL2(MAXA,*) used for temporary storage.
 BDPL2 real array of dimension BDPL2(NVAR,*) used for temporary storage.
 YSF2 real array of dimension YSF2(NFISS,NSUPF,*) used for temporary storage.
 KFIS2 integer array of dimension KFIS2(*) used for temporary storage.

Called by

DRAGON routine(s) : EVOBLD

Calling

DRAGON routine(s) : EVOODE, EVOSAT

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

15.2.3 EVODRV

Purpose To control the isotopic depletion calculation

Syntax CALL EVODRV(IPDEPL, IPLIB , IPRINT, INDREC, NBISO , NGROUP, NBMIX , NREGIO,
 NTIME , NPROC , NDEPL , NCOMB , NREGCE, ITYPE , INR , ISAVE , ITIXS ,
 RPAR , XT , ISONAM, ISONRF, AWRISO, ISONDP, TIMES , MIX , DEN , MAT
 , VOL , FLUXES, MASK , MASKL , JM , MILVO , YDPL , FLX , VX , ISOCMB
)

Author(s) A. Hébert and G. Marleau

Description of input/output parameters

IPDEPL integer scalar variable containing the pointer to the BURNUP data structure.
 IPLIB integer scalar variable containing the pointer to the MICROLIB data structure.
 IMPX integer scalar variable containing the print flag.
 INDREC integer scalar variable containing the depletion step with:
 1. for beginning of depletion;
 2. otherwise.
 NBISO integer scalar variable containing the number of isotopes/materials including non-depleting ones.
 NGROUP integer scalar variable containing the number of energy groups.
 NBMIX integer scalar variable containing the number of mixtures.
 NREGIO integer scalar variable containing the number of isotopes.
 NTIME integer scalar variable containing the number of time steps already saved +1.
 NPROC integer scalar variable containing the number of microscopic cross sections to process.
 NDEPL integer scalar variable containing the number of depleting nuclides.

NCOMB	integer scalar variable containing the number of depleting mixtures.
NREGCE	integer scalar containing the variable number of depleting and energy production mixtures.
ITYPE	integer scalar variable containing the type of solution method with: <ol style="list-style-type: none"> 1. for fifth-order Runge-Kutta method; 2. fourth-order Kaps-Rentrop method.
INR	integer scalar variable containing the power normalization procedure with: <ul style="list-style-type: none"> • with INR=0 for out-of-core depletion (0 power); • with INR=1 for constant flux depletion; • with INR=2 for constant power depletion.
ISAVE	integer scalar variable containing the status of the last calculation.
ITIXS	integer scalar variable containing the flag for time dependent cross sections (=0 on/=1 off): <ul style="list-style-type: none"> • with ITIXS=0 for constant cross section; • with ITIXS=1 for cross section that depends linearly on time.
RPAR	real array of dimension RPAR(5) containing the burnup parameters.
XT	real array of dimension XT(5) containing the time table.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the alias names of isotopes.
ISONRF	integer array of dimension ISONRF(3,NBISO) containing the reference names of isotopes.
AWRISO	real array of dimension AWRISO(NBISO) containing the atomic weight isotopes.
ISONDP	integer array of dimension ISONDP(2,NBISO) containing the names of depleting isotopes.
TIMES	real array of dimension TIMES(NTIME+2) containing the time step saved.
MIX	integer array of dimension MIX(NBISO) containing the mix number of each isotope.
DEN	real array of dimension DEN(NBISO) containing the density of each isotope.
MAT	integer array of dimension MAT(NREGIO) containing the mixture type assigned to each region.
VOL	real array of dimension VOL(NREGIO) containing the volumes.
FLUXES	real array of dimension FLUXES(NREGIO,NGROUP) containing the resulting average fluxes obtained using the input internal.

Description of work parameters

MASK	logical array of dimension MASK(NBMIX) used for temporary storage.
MASKL	logical array of dimension MASKL(NGROUP) used for temporary storage.
JM	integer array of dimension JM(NDEPL,NREGCE) used for temporary storage.
MILVO	integer array of dimension MILVO(NREGCE) used for temporary storage.
YDPL	real array of dimension YDPL(NDEPL+1,2,NREGCE) used for temporary storage.
FLX	real array of dimension FLX(NGROUP,2,NREGCE) used for temporary storage.

VX real array of dimension VX(NREGCE) used for temporary storage.

ISOCMB integer array of dimension ISOCMB(NDEPL*NREGCE) used for temporary storage.

Called by

DRAGON routine(s) : EVO

Calling

DRAGON routine(s) : EVOBLD, LIBMIX

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

15.2.4 EVOGET

Purpose To read for isotopic depletion calculation options.

Syntax CALL EVOGET(IPRINT, ITYPE, ITIXS, IEXTR, IGLOB, INR, RPAR, XT)

Author(s) A. Hébert and G. Marleau

Description of parameters

IPRINT integer scalar variable containing the print flag.

ITYPE integer scalar variable containing the depletion step with:

1. for beginning of depletion;
2. otherwise.

ITIXS integer scalar variable containing the flag for time dependent cross sections (=0 on/=1 off):

- with ITIXS=0 for constant cross section;
- with ITIXS=1 for cross section that depends linearly on time.

IEXTR integer scalar variable containing the flag for power extrapolation.

IGLOB integer scalar variable containing the flag for power computation option.

INR integer scalar variable containing the power normalization procedure with:

- with INR=0 for out-of-core depletion (0 power);
- with INR=1 for constant flux depletion;
- with INR=2 for constant power depletion.

RPAR real array of dimension RPAR(5) containing the burnup parameters.

XT real array of dimension XT(5) containing the time parameters.

Called by

DRAGON routine(s) : EVO

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : REDGET, XABORT

15.2.5 EVOKAP

Purpose To integrate burnup equations using Kaps-Rentop method.

Syntax CALL EVOKAP(Y , N , X , HTRY , EPS , YSCAL , HDID , HNEXT , MU1 , IMA , MAXA , NSUPF , NFISS , KFISS , YSF , ADPL , BDPL , DYDX , TEMP , YSAV , DYSAV , DFDX , AK , ASS)

Author(s) A. Hébert

Description of input/output parameters

Y	real array of dimension Y(*) containing the dependent variable vector.
N	integer scalar variable containing the dimension of the dependent variable vector.
X	real scalar variable containing the independent variable.
HTRY	real scalar variable containing the stepsize to be attempted.
EPS	real scalar variable containing the required accuracy.
YSCAL	real array of dimension YSCAL(*) containing the vector against which the error is scaled.
HDID	real scalar variable containing the stepsize that was actually accomplished.
HNEXT	real scalar variable containing the estimated next stepsize.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in depletion matrix.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in depletion matrix.
MAXA	integer scalar variable containing the first dimension of depletion matrix.
NSUPF	integer scalar variable containing the number of depleting fission products.
NFISS	integer scalar variable containing the number of fissile isotopes producing fission products.
KFISS	integer array of dimension KFISS(*) containing the position in chain of the fissile isotopes.
YSF	real array of dimension YSF(NFISS,NSUPF,*) containing the product of the fission yields and fission rates.
ADPL	real array of dimension ADPL(MAXA,*) containing the depletion matrix.
BDPL	real array of dimension BDPL(N,*) containing the depletion source.

Description of work parameters

DYDX	real array of dimension DYDX(*) used for temporary storage.
------	---

IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in depletion matrix.
MAXA	integer scalar variable containing the first dimension of depletion matrix.
NSUPF	integer scalar variable containing the number of depleting fission products.
NFISS	integer scalar variable containing the number of fissile isotopes producing fission products.
KFISS	integer array of dimension KFISS(*) containing the position in chain of the fissile isotopes.
YSF	real array of dimension YSF(NFISS,NSUPF,*) containing the product of the fission yields and fission rates.
ADPL	real array of dimension ADPL(MAXA,2) containing the depletion matrix.
BDPL	real array of dimension BDPL(NVAR,2) containing the depletion source.

Description of work parameters

YSCAL	real array of dimension YSCAL(*) used for temporary storage.
Y	real array of dimension Y(*) used for temporary storage.

Called by

DRAGON routine(s) : EVODPL

Calling

DRAGON routine(s) : EVOKAP, EVORK

UTILIB routine(s) :

GANLIB routine(s) : SETARA, RLSARA, XABORT

15.2.7 EVOPRE

Purpose To store depletion matrix in sparse mode for a single mixture.

Syntax CALL EVOPRE(NDEPL , NDFI , NDFP , NBXR , NHEAVY, IDR , KPAR , BPAR , YIELD , SIG , QF , LCOOL , NDEPLT, NID , NIF , NIH , NIL , LP , MU1 , IMA , MXDADP, ADPL , BDPL , KFISS , YSF)

Author(s) A. Hébert and G. Marleau

Description of input/output parameters

NDEPL	integer scalar variable containing the number of depleting nuclides.
NDFI	integer scalar variable containing the number of direct fissile isotopes.
NDFP	integer scalar variable containing the number of direct fission products.
NBXR	integer scalar variable containing the maximum number of parent reaction.
NHEAVY	integer scalar variable containing the number of heavy isotopes.
IDR	integer array of dimension IDR(MAXR,NDEPL) containing the reaction identifier.

KPAR	integer array of dimension KPAR(NBXR,NDEPL) containing the reduced reaction type matrix.
BPAR	real array of dimension BPAR(NBXR,NDEPL) containing the reduced branching ratio matrix.
YIELD	real array of dimension YIELD(NDFI,NDFP) containing the fission yield.
SIG	real array of dimension SIG(NDEPL,5,MXTIMS) containing the reaction rates.
QF	real array of dimension QF(NHEAVY) containing the fission energy.
LCOOL	logical scalar variable containing the logical for out of core depletion.
NDEPLT	integer scalar variable containing the number of depleting isotopes to treat.
NID	integer scalar variable containing the number of depleting isotopes in this fuel region.
NIF	integer scalar variable containing the number of fissile isotopes in this fuel region.
NIH	integer scalar variable containing the number of heavy isotopes in this fuel region.
NIL	integer scalar variable containing the number of fissile products in this fuel region.
MU1	integer array of dimension MU1(NID+1) containing the position diagonal element in ADPL.
IMA	integer array of dimension IMA(NID+1) containing the position of the first element in ADPL.
MXDADP	integer scalar variable containing the first dimension of vector ADPL.

Description of work parameters

LP	integer array of dimension LP(NDEPL) used for temporary storage.
ADPL	real array of dimension ADPL(MXDADP,MXTIMS) used for temporary storage.
BDPL	real array of dimension BDPL(NID+1,MXTIMS) used for temporary storage.
KFISS	integer array of dimension KFISS(NIF) used for temporary storage.
YSF	real array of dimension YSF(NIF,NIL+1,MXTIMS) used for temporary storage.

Called by

DRAGON routine(s) : EVOBLD

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : XABORT

15.2.8 EVORCP

Purpose To determine the row and column profile of the ADPL matrix.

Syntax CALL EVORCP(IMPX , NCOMB , NDEPL , NDFI , NDFP , NBXR , EXPMAX, XT , IDR , RER ,
KPAR , YIELD , SIG , LCOOL , NDEPLT, NID , NIF , LP , MU1 , IMA , IPERM
, DIAG)

Author(s) A. Hébert and G. Marleau

Description of input/output parameters

IMPX	integer scalar variable containing the print flag.
NCOMB	integer scalar variable containing the number of depleting mixtures.
NDEPL	integer scalar variable containing the number of depleting nuclides.
NDFI	integer scalar variable containing the number of direct fissile isotopes.
NDFP	integer scalar variable containing the number of direct fission products.
NBXR	integer scalar variable containing the maximum number of parent reaction.
EXPMAX	real scalar variable containing the isotope saturating limit.
XT	real array of dimension XT(2) containing the initial and final time for the depletion.
IDR	integer array of dimension IDR(MAXR,NDEPL) containing the reaction identifier.
RER	real array of dimension RER(MAXR,NDEPL) containing the reaction constant.
KPAR	integer array of dimension KPAR(NBXR,NDEPL) containing the reduced reaction type matrix.
YIELD	real array of dimension YIELD(NDFI,NDFP) containing the fission yield.
SIG	real array of dimension SIG(NDEPL,5,2) used for temporary storage.
LCOOL	logical scalar variable containing the logical for out of core depletion.
NDEPLT	integer scalar variable containing the number of depleting isotopes to treat.
NID	integer scalar variable containing the number of depleting isotopes in this fuel region.
NIF	integer scalar variable containing the number of fissile isotopes in this fuel region.

Description of work parameters

LP	integer array of dimension LP(NDEPL) used for temporary storage.
MU1	integer array of dimension MU1(NDEPL+1) used for temporary storage.
IMA	integer array of dimension IMA(NDEPL+1) used for temporary storage.
IPERM	integer array of dimension IPERM(NDEPLT) used for temporary storage.
DIAG	real array of dimension DIAG(NDEPLT) used for temporary storage.

Called by

DRAGON routine(s) : EVOBLD

15.2.9 EVORK

Purpose To integrate burnup equations using Runge-Kutta method.

Syntax CALL EVORK (Y , N , X , HTRY , EPS , YSCAL , HDID , HNEXT , MU1 , IMA , MAXA , NSUPF , NFISS , KFISS , YSF , ADPL , BDPL , DYDX , TEMP , YSAV , DYSAV , TEMR , AK)

Author(s) A. Hébert

Description of input/output parameters

Y	real array of dimension Y(*) containing the dependent variable vector.
N	integer scalar variable containing the dimension of the dependent variable vector.
X	real scalar variable containing the independent variable.
HTRY	real scalar variable containing the stepsize to be attempted.
EPS	real scalar variable containing the required accuracy.
YSCAL	real array of dimension YSCAL(*) containing the vector against which the error is scaled.
HDID	real scalar variable containing the stepsize that was actually accomplished.
HNEXT	real scalar variable containing the estimated next stepsize.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in depletion matrix.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in depletion matrix.
MAXA	integer scalar variable containing the first dimension of depletion matrix.
NSUPF	integer scalar variable containing the number of depleting fission products.
NFISS	integer scalar variable containing the number of fissile isotopes producing fission products.
KFISS	integer array of dimension KFISS(*) containing the position in chain of the fissile isotopes.
YSF	real array of dimension YSF(NFISS,NSUPF,*) containing the product of the fission yields and fission rates.
ADPL	real array of dimension ADPL(MAXA,*) containing the depletion matrix.
BDPL	real array of dimension BDPL(N,*) containing the depletion source.

Description of work parameters

DYDX	real array of dimension DYDX(*) used for temporary storage.
TEMP	real array of dimension TEMP(*) used for temporary storage.
YSAV	real array of dimension YSAV(*) used for temporary storage.
DYSAV	real array of dimension DYSAV(*) used for temporary storage.
TEMR	real array of dimension TEMR(*) used for temporary storage.
AK	real array of dimension AK(N,*) used for temporary storage.

Called by

DRAGON routine(s) : EVOODE

Calling

DRAGON routine(s) : EVORK4

UTILIB routine(s) : ALLUM

GANLIB routine(s) : XABORT

15.2.10 EVORK4

Purpose To control time step advance in burnup equations using the Runge-Kutta solution method.

Syntax CALL EVORK4(Y , DYDX , N , X , H , YOUT , MU1 , IMA , MAXA , NSUPF , NFISS , KFISS ,
YSF , ADPL , BDPL , AK , TEMR)

Author(s) A. Hébert

Description of input/output parameters

Y	real array of dimension Y(*) containing the dependent variable vector.
DYDX	real array of dimension DYDX(*) containing the derivative of the initial dependent variable vector.
N	integer scalar variable containing the dimension of the dependent variable vector.
X	real scalar variable containing the independent variable.
H	real scalar variable containing the stepsize to be attempted.
YOUT	real array of dimension YOUT(*) containing the final dependent variable vector.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in depletion matrix.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in depletion matrix.
MAXA	integer scalar variable containing the first dimension of depletion matrix.
NSUPF	integer scalar variable containing the number of depleting fission products.
NFISS	integer scalar variable containing the number of fissile isotopes producing fission products.
KFISS	integer array of dimension KFISS(*) containing the position in chain of the fissile isotopes.
YSF	real array of dimension YSF(NFISS,NSUPF,*) containing the product of the fission yields and fission rates.
ADPL	real array of dimension ADPL(MAXA,*) containing the depletion matrix.
BDPL	real array of dimension BDPL(N,*) containing the depletion source.

Description of work parameters

AK	real array of dimension AK(N,*) used for temporary storage.
TEMR	real array of dimension TEMR(*) used for temporary storage.

Called by

DRAGON routine(s) : EVORK

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALLUM

GANLIB routine(s) :

15.2.11 EVORRE

Purpose To compute the depletion reaction rates and total fission production.

Syntax CALL EVORRE(IPLIB , NBISO , NGROUP, ISONAM, NCOMB , NDEPL , NDFI , NHEAVY, XT
, ITIXS , JM , YDPL , LCOOL , FLX , VX , IDR , RER , VTOT , SIG , SFIS , QF
, IBLOC , NPROC , INDPRO, ITYPRO, XSREC)

Author(s) G. Marleau

Description of input parameters

IPLIB	integer scalar variable containing the pointer to the MICROLIB data structure.
NBISO	integer scalar variable containing the number of isotopes/materials including non-depleting ones.
NGROUP	integer scalar variable containing the number of energy groups.
ISONAM	integer array of dimension ISONAM(3,NBISO) containing the alias names of isotopes.
NCOMB	integer scalar variable containing the number of depleting mixtures.
NDEPL	integer scalar variable containing the number of depleting nuclides.
NDFI	integer scalar variable containing the number of direct fissile isotopes.
NHEAVY	integer scalar variable containing the number of heavy isotopes.
XT	real array of dimension XT(2) containing the initial and final time for the depletion.
ITIXS	integer scalar variable containing the flag for time dependent cross sections with: <ul style="list-style-type: none"> • with ITIXS=0 for constant cross section; • with ITIXS=1 for cross section that depends linearly on time.
JM	integer array of dimension JM(NDEPL,NCOMB) containing the position in HNAME list of each depleting nuclide.
YDPL	real array of dimension YDPL(NDEPL+1,2,NCOMB) containing the initial/final number density of isotope in the depletion chain.
LCOOL	logical scalar variable containing the zero flux burnup flag.
FLX	real array of dimension FLX(NGROUP,2,NCOMB) containing the initial/final volume averaged neutron fluxes.
VX	real array of dimension VX(NCOMB) containing the volumes of the depleting mixtures.

KSAT	integer array of dimension KSAT(*) containing the position in chain of the saturating nuclides.
YST1	real array of dimension YST1(*) containing the number densities for all isotopes.
YSAT	real array of dimension YSAT(*) containing the number densities of the saturating isotopes.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in depletion matrix.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in depletion matrix.
MAXA	integer scalar variable containing the dimension of depletion matrix.
NSUPF	integer scalar variable containing the number of depleting fission products.
NFISS	integer scalar variable containing the number of fissile isotopes producing fission products.
KFISS	integer array of dimension KFISS(*) containing the position in chain of the fissile isotopes.
YSF	real array of dimension YSF(NFISS,*) containing the product of the fission yields and fission rates.
ADPL	real array of dimension ADPL(*) containing the depletion matrix.
BDPL	real array of dimension BDPL(*) containing the depletion source.

Description of work parameters

KEV	integer array of dimension KEV(*) used for temporary storage.
YSTG	real array of dimension YSTG(*) used for temporary storage.
A22	real array of dimension A22(NSAT,*) used for temporary storage.
A21	real array of dimension A21(NSAT,*) used for temporary storage.
A12	real array of dimension A12(NVAR-NSAT,*) used for temporary storage.
MGAR	integer array of dimension MGAR(*) used for temporary storage.
IGAR	integer array of dimension IGAR(*) used for temporary storage.
AGAR	real array of dimension AGAR(*) used for temporary storage.
BGAR	real array of dimension BGAR(*) used for temporary storage.
YSFG	real array of dimension YSFG(NFISS,*) used for temporary storage.
GAR	real array of dimension GAR(*) used for temporary storage.

Called by

DRAGON routine(s) : EVODPL

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALINV

GANLIB routine(s) : XABORT

16 THE MODULE FOR REACTOR DATABASE CREATION

16.1 Structure of CPO :

The CPO : module can be represented by the following tree:

Structure of the reactor database creation module: CPO

```

CPO
|----- CPOISO
|----- CPODRV
          |----- CPOMAR
          |----- CPOMAW
          |          |----- XDRLGS
          |----- CPOMIC
          |          |----- XDRLGS
          |----- CPOREM
          |----- XDRNED

```

16.2 General Routines Description

16.2.1 CPODRV

Purpose To recover cross section information located on directory CURNAM or on a family of directory with prefix CURNAM.

Syntax CALL CPODRV(IPCPO, IPEDIT, IPDEPL, IPRINT, CURNAM, CTITRE, NAMCPO, NGROUP, NMERGE, NBMICR, NIFISS, MXBURN, NL, NISCPO, NPROC, ILEAKS, NXXXZ, ITRANC, NEDMAC, HVECT, IEXTRC, NSBS, ISOCPO, ISOFIS, MIXFIS, ISOTMP, IMXTMP, IDIMIX, NBIMRG, ICOMIX, VOLMER, ENERGY, INDPRO, ITYPRO, TIME, BURN, WIRRAD, DENCPO, DENTMP, DXSMIC, DSCMIC, DXSMAC, DSCMAC, IBSTEP, EMJTMP, EMJMAC, DMJCPO)

Author(s) A. Hébert and G. Marleau

Description of parameters

IPCPO	integer scalar variable for accessing the CPO data structure to be created.
IPEDIT	integer scalar variable for accessing the EDITING data structure to be read.
IPDEPL	integer scalar variable for accessing the BURNUP data structure to be read.
IPRINT	integer scalar variable containing the print parameter.
CURNAM	character*12 scalar variable containing the name of the output directory.
CTITRE	integer array of dimension CTITRE(18) containing the title.

NAMCPO	character*8 scalar variable containing the name of the material mixture sub-directory.
NGROUP	integer scalar variable containing the number of energy groups in output data.
NMERGE	integer scalar variable containing the number of output regions.
NBMICR	integer scalar variable containing the maximum number of isotopes.
NFISS	integer scalar variable containing the number of fissile isotopes.
MXBURN	integer scalar variable containing the maximum number of output burnup sets.
NL	integer scalar variable containing the number of Legendre orders.
NISCPO	integer scalar variable containing the number of CPO isotopes treated.
NPROC	integer scalar variable containing the number of microscopic cross section to process.
ILEAKS	integer scalar variable containing the leakage model.
NXXXZ	integer scalar variable containing the maximum dimension of ISO dependent vector.
ITRANC	integer scalar variable containing the type of transport correction in the CPO data structure.
NEDMAC	integer scalar variable containing the number of cross section in the EDITING data structure.
HVECT	character array of dimension HVECT(NEDMAC)*6 containing the name of cross section in the EDITING data structure.
IEXTRC	integer scalar variable containing the type of extraction.
NSBS	integer scalar variable containing the number of sub-burnup step considered.
ISOCPO	integer array of dimension ISOCPO(3,NXXXZ) containing the name of the isotopes on the CPO data structure.
ISOFIS	integer array of dimension ISOFIS(2,(NFISS+1)) containing the name of fissile isotopes.
MIXFIS	integer array of dimension MIXFIS(NMERGE,(NFISS+1)) containing the material of fissile isotopes.
ISOTMP	integer array of dimension ISOTMP(3,NXXXZ) containing the name of isotopes in the EDITING data structure.
IMXTMP	integer array of dimension IMXTMP(NXXXZ) containing the mixture of isotopes in the EDITING data structure.
IDIMIX	integer array of dimension IDIMIX(NMERGE,NXXXZ) containing the isotopes identifier for each mixture in the CPO data structure.
NBIMRG	integer array of dimension NBIMRG(NMERGE) containing the final number of isotope per region.
ICOMIX	integer array of dimension ICOMIX(NMERGE,NXXXZ) containing the pointer to the isotope for each region in the CPO data structure.
VOLMER	real array of dimension VOLMER(NMERGE) containing the merge volume.
ENERGY	real array of dimension ENERGY(NGROUP+1) containing the energy.
INDPRO	integer array of dimension INDPRO(NPROC) containing the identifier for cross section processing.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing the identifier for cross section processed.

TIME	real array of dimension TIME(MXBURN) containing the time steps.
BURN	real array of dimension BURN(MXBURN) containing the burnup.
WIRRAD	real array of dimension WIRRAD(MXBURN) containing the irradiation.
DENCPO	double precision array of dimension DENCPO(NXXXZ) containing the density of the isotopes in the CPO data structure.
DENTMP	real array of dimension DENTMP(NXXXZ) containing the density of the isotopes in the EDITING data structure.
DXSMIC	double precision array of dimension DXSMIC(NGROUP,NPROC) containing the microscopic vector cross section.
DSCMIC	double precision array of dimension DSCMIC(NGROUP,NGROUP,NL) containing the microscopic scattering matrix cross section.
DXSMAC	double precision array of dimension DXSMAC(NGROUP,NPROC,NMERGE) containing the macroscopic vector cross section.
DSCMAC	double precision array of dimension DSCMAC(NGROUP,NGROUP,NL,NMERGE) containing the macroscopic scattering matrix cross section.
IBSTEP	integer array of dimension IBSTEP(MXBURN) containing the sub-burnup step considered.
EMJTMP	real array of dimension EMJTMP(NXXXZ) containing the fission energy per isotopes.
EMJMAC	real array of dimension EMJMAC(NMERGE) containing the fission energy for macroscopic.
DMJCPO	double precision array of dimension DMJCPO(2,NXXXZ) containing the fission energy for macroscopic.

Called by

DRAGON routine(s) : CPO

Calling

DRAGON routine(s) : CPOMAR, CPOMAW, CPOMIC, CPOREM, XDRNED

UTILIB routine(s) : XDRDBL, XDRSET

GANLIB routine(s) : LCMGET, LCMPUT, LCMSIX, SETARA, RLSARA

16.2.2 CPOISO

Purpose To identify isotopes to be extracted from macroscopic xs and isotopes included in new combined isotopes.

Syntax CALL CPOISO(IPEDIT, IPRINT, IEXTRC, NMERGE, MAXISO, MAXISM, NBMICR, NIFISS, NISCPO, NISEXT, ISOCPO, ISOEXT, ISOORD, ISOFIS, MIXFIS, ISOTMP, IMXTMP, IDETMP, IDIMIX, NBIMRG, ICOMIX)

Author(s) A. Hébert and G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be read.
IPRINT	integer scalar variable containing the print parameter.
IEXTRC	integer scalar variable containing the type of extraction.
NMERGE	integer scalar variable containing the number of region.
MAXISO	integer scalar variable containing the maximum number of isotopes permitted.
MAXISM	integer scalar variable containing the maximum number of isotopes per region.
NBMICR	integer scalar variable containing the maximum number of isotopes in EDITING data structure.
NFISS	integer scalar variable containing the number of fissile isotopes in EDITING data structure.
NISCPO	integer scalar variable containing the number of CPO isotopes treated.
NISEXT	integer scalar variable containing the number of extracted isotopes treated.
ISOCPO	integer array of dimension ISOCPO(3,MAXISO) containing the CPO name of isotopes.
ISOEXT	integer array of dimension ISOEXT(3,MAXISO) containing the name of extracted isotopes.
ISOORD	integer array of dimension ISOORD(MAXISO) containing the location of extracted isotopes in CPO.
ISOFIS	integer array of dimension ISOFIS(2,(NFISS+1)) containing the name of fissile isotopes.
MIXFIS	integer array of dimension MIXFIS(NMERGE,(NFISS+1)) containing the material of fissile isotopes.
ISOTMP	integer array of dimension ISOTMP(3,NBMICR) containing the name of isotopes in EDITING data structure.
IMXTMP	integer array of dimension IMXTMP(NBMICR) containing the mixture of isotopes in EDITING data structure.
IDETMP	integer array of dimension IDETMP(NBMICR) containing the extracted isotopes number associated with EDITING isotope.

Description of output parameters

IDIMIX	integer array of dimension IDIMIX(NMERGE,NBMICR) containing the isotopes identifier in each CPO mixture.
NBIMRG	integer array of dimension NBIMRG(NMERGE) containing the final number of isotope per region.
ICOMIX	integer array of dimension ICOMIX(NMERGE,MAXISM) containing the pointer to CPO isotope per region.

Called by

DRAGON routine(s) : CPO

16.2.3 CPOMAR

Purpose To get macroscopic cross section from reference EDITING structure.

Syntax CALL CPOMAR(IPEDIT, NGROUP, NMERGE, NL, NIFISS, NEDMAC, HVECT, IVECT, NPROC, ILEAKS, DXSMAC, DSCMAC, EMJMAC, DISFC, SCATC, IJJ, NJJ, DNUFI)

Author(s) G. Marleau

Description of input parameters

IPEDIT	integer scalar variable for accessing the EDITING data structure to be read.
NGROUP	integer scalar variable containing the number of energy groups in output data.
NMERGE	integer scalar variable containing the number of output regions.
NL	integer scalar variable containing the number of Legendre orders.
NIFISS	integer scalar variable containing the number of fissile isotopes.
NEDMAC	integer scalar variable containing the number of edit cross section.
HVECT	character array of dimension HVECT(NEDMAC)*6 containing the name of additional editing cross section.
IVECT	integer array of dimension IVECT(NEDMAC) containing the location of additional editing cross section.
NPROC	integer scalar variable containing the number of microscopic cross section to process.
ILEAKS	integer scalar variable containing the leakage model.

Description of output parameters

DXSMAC	double precision array of dimension DXSMAC(NGROUP,NPROC,NMERGE) containing the averaged region and group cross section.
DSCMAC	double precision array of dimension DSCMAC(NGROUP,NGROUP,NL,NMERGE) containing the scattering rates.
EMJMAC	real array of dimension EMJMAC(NMERGE) containing the energy per fission.
DISFC	real array of dimension DISFC(NGROUP) containing the disadvantage factor.

Description of work parameters

SCATC	real array of dimension SCATC(NMERGE*NGROUP) containing the compress scattering matrix.
IJJ	integer array of dimension IJJ(NMERGE) containing the position of first diffusion group.
NJJ	integer array of dimension NJJ(NMERGE) containing the number of diffusion group.
DNUFI	double precision array of dimension DNUFI(NMERGE,NIFISS+1) containing the fission source.

Called by

DRAGON routine(s) : CPODRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRDBL, XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX

16.2.4 CPOMAW

Purpose To put macroscopic cross section on CPO structure.

Syntax CALL CPOMAW(IPCPO, NGROUP, NL, NPROC, INDPRO, ITYPEPRO, DXSMAC, DSCMAC, DXSREM, DSCREM, DISFC, XSREC, XSCAT, SCATC, IJJ, NJJ, DMJMAC)

Author(s) G. Marleau

Description of input parameters

IPCPO	integer scalar variable for accessing the CPO data structure to be created.
NGROUP	integer scalar variable containing the number of groups condensed.
NL	integer scalar variable containing the number of Legendre orders.
NPROC	integer scalar variable containing the number of microscopic cross section to process.
INDPRO	integer array of dimension INDPRO(NPROC) containing the identifier for cross section processing.
ITYPRO	integer array of dimension ITYPEPRO(NPROC) containing the identifier for cross section processed.
DXSMAC	double precision array of dimension DXSMAC(NGROUP,NPROC) containing the averaged region/group vector cross section.
DSCMAC	double precision array of dimension DSCMAC(NGROUP,NGROUP,NL) containing the averaged region/group scattering cross section.
DXSREM	double precision array of dimension DXSREM(NGROUP,NPROC) containing the averaged region/group cross section with microscopic contribution removed.
DSCREM	double precision array of dimension DSCREM(NGROUP,NGROUP,NL) containing the scattering rates with microscopic contribution removed.
DISFC	real array of dimension DISFC(NGROUP) containing the disadvantage factor.

Description of work parameters

XSREC	real array of dimension XSREC(NGROUP,NPROC) containing the microscopic vector cross section.
XSCAT	real array of dimension XSCAT(NGROUP,NGROUP,NL) containing the compress scattering matrix.
SCATC	real array of dimension SCATC(NGROUP*NGROUP) containing the compress scattering matrix.
IJJ	integer array of dimension IJJ(NGROUP) containing the position of first scattering group.
NJJ	integer array of dimension NJJ(NGROUP) containing the number of scattering group.
DMJMAC	double precision scalar variable containing the energy.

Called by

DRAGON routine(s) : CPODRV

Calling

DRAGON routine(s) : XDRLGS

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMPUT, LCMSIX

16.2.5 CPOMIC

Purpose To compute microscopic cross section.

Syntax CALL CPOMIC(IPCPO, IPEDIT, IPRINT, NGROUP, NMERGE, NBMICR, NL, IMRG, ISOR, NPROC, ISOTMP, IDIMIX, INDPRO, ITYPRO, DENCPO, DENTMP, DXSMIC, DSCMIC, EMJTMP, DMJCPO, DFLUX, XSREC, XSCAT, SCATC, IJJ, NJJ)

Author(s) G. Marleau

Description of input parameters

IPCPO	integer scalar variable for accessing the CPO data structure to be created.
IPEDIT	integer scalar variable for accessing the EDITING data structure to be read.
IPRINT	integer scalar variable containing the print parameter.
NGROUP	integer scalar variable containing the number of energy groups in output data.
NMERGE	integer scalar variable containing the number of regions merged.
NBMICR	integer scalar variable containing the maximum number of isotopes.
NL	integer scalar variable containing the number of Legendre orders.
IMRG	integer scalar variable containing the merge region.
ISOR	integer scalar variable containing the CPO isotope number.
NPROC	integer scalar variable containing the number of microscopic cross section to process.
ISOTMP	integer array of dimension ISOTMP(3,NBMICR) containing the name of isotopes in edit.
IDIMIX	integer array of dimension IDIMIX(NMERGE,NBMICR) containing the isotopes identifier in each CPO material.
INDPRO	integer array of dimension INDPRO(NPROC) containing the identifier for cross section processing.
ITYPRO	integer array of dimension ITYPRO(NPROC) containing the identifier for cross section processed.
DENCPO	double precision array of dimension DENCPO(NBMICR) containing the CPO isotopes concentration.
DENTMP	real array of dimension DENTMP(NBMICR) containing the isotopes concentration.
EMJTMP	real array of dimension EMJTMP(NBMICR) containing the fission energy per isotopes.

Description of input/output parameters

DXSMIC	double precision array of dimension DXSMIC(NGROUP,NPROC) containing the micro vector cross section.
DSCMIC	double precision array of dimension DSCMIC(NGROUP,NGROUP,NL) containing the micro scattering matrix cross section.
DFLUX	double precision array of dimension DFLUX(NGROUP) containing the flux.
DMJCPO	double precision array of dimension DMJCPO(2,NBMICR) containing the fission energy.

Description of work parameters

XSREC	real array of dimension XSREC(NGROUP,NPROC) containing the micro vector cross section.
XSCAT	real array of dimension XSCAT(NGROUP,NGROUP,NL) containing the compress scattering.
SCATC	real array of dimension SCATC(NGROUP*NGROUP) containing the compress scattering.
IJJ	integer array of dimension IJJ(NGROUP) containing the position of first diffusion group.
NJJ	integer array of dimension NJJ(NGROUP) containing the number of diffusion group.

Called by

DRAGON routine(s) : CPODRV

Calling

DRAGON routine(s) : XDRLGS

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMSIX

16.2.6 CPOREM

Purpose To remove CPO isotope cross section from macroscopic cross section.

Syntax CALL CPOREM(NGROUP, NL, NPROC, INDPRO, DENCPO, DXSMIC, DSCMIC, DXSREM, DSCREM)

Author(s) G. Marleau

Description of input parameters

NGROUP	integer scalar variable containing the number of groups condensed.
NL	integer scalar variable containing the number of Legendre orders.
NPROC	integer scalar variable containing the number of microscopic cross section to process.
INDPRO	integer array of dimension INDPRO(NPROC) containing the identifier for cross section processing.
DENCPO	double precision scalar variable containing the cPO isotopes concentration.
DXSMIC	double precision array of dimension DXSMIC(NGROUP,NPROC) containing the micro vector cross section.

DSCMIC double precision array of dimension DSCMIC(NGROUP,NGROUP,NL) containing the micro scat matrix cross section.

Description of input/output parameters

DXSREM double precision array of dimension DXSREM(NGROUP,NPROC) containing the averaged region/group cross section.

DSCREM double precision array of dimension DSCREM(NGROUP,NGROUP,NL) containing the scattering rates.

Called by

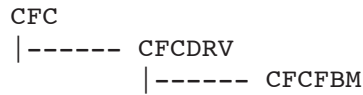
DRAGON routine(s) : CPODRV

17 THE MODULE FOR FEEDBACK DATABASE CREATION

17.1 Structure of CFC :

The CFC : module can be represented by the following tree:

Structure of the feedback database creation module: CFC



17.2 General Routines Description

17.2.1 CFCDRV

Purpose To prepare data for the Feedback model.

Syntax CALL CFCDRV(KENTRY, NBURN, NGRP, NISO, NL, IMPX, TOTAL, ZNUG, DIFFX, DIFFY, DIFFZ, H, IJJ, NJJ, MIJ, MNJ, SCAT, WORK3, IPOS, HISO, DENSIT, EFJ, TMREF, SMREF, DMREF, DMRFY, DMRFZ, CTITRE, REFC, JTAB, TEX, FMREF, HMREF, DELTA, IXS, NXS)

Author(s) M.T. sissaoui

Description of parameters

KENTRY	integer array of dimension KENTRY(*) containing the data structures to process.
NBURN	integer scalar variable containing the number of burnup steps.
NGRP	integer scalar variable containing the number of energy groups.
NISO	integer scalar variable containing the 1+number of extracted isotopes.
NL	integer scalar variable containing the number of Legendre orders.
IMPX	integer scalar variable containing the print flag.
TOTAL	real array of dimension TOTAL(NGRP,*) containing the reference total macroscopic cross sections.
ZNUG	real array of dimension ZNUG(NGRP,*) containing the reference ν fission macroscopic cross sections.
DIFFX	real array of dimension DIFFX(NGRP,*) containing the reference x -directed diffusion coefficients.
DIFFY	real array of dimension DIFFY(NGRP,*) containing the reference y -directed diffusion coefficients.
DIFFZ	real array of dimension DIFFZ(NGRP,*) containing the reference z -directed diffusion coefficients.
H	real array of dimension H(NGRP,*) containing the reference H -factors.
IJJ	integer array of dimension IJJ(*) used for temporary storage.
NJJ	integer array of dimension NJJ(*) used for temporary storage.

MIJ	integer array of dimension MIJ(*) used for temporary storage.
MNJ	integer array of dimension MNJ(*) used for temporary storage.
SCAT	real array of dimension SCAT(NBURN,*) containing the reference scattering macroscopic cross sections.
WORK3	real array of dimension WORK3(*) used for temporary storage.
IPOS	integer array of dimension IPOS(*) used for temporary storage.
HISO	real array of dimension HISO(*) containing the isotopes name.
DENSIT	real array of dimension DENSIT(*) containing the isotopes density.
EFJ	real array of dimension EFJ(*) containing the fission energy.
TMREF	real array of dimension TMREF(NGRP,NBURN,*) containing the temporary total macroscopic cross sections.
SMREF	real array of dimension SMREF(NISO,NL,NGRP,*) containing the temporary ν fission macroscopic cross sections.
DMRFX	real array of dimension DMRFX(NGRP,NBURN,*) containing the temporary x -directed diffusion coefficients.
DMRFY	real array of dimension DMRFY(NGRP,NBURN,*) containing the temporary y -directed diffusion coefficients.
DMRFZ	real array of dimension DMRFZ(NGRP,NBURN,*) containing the temporary z -directed diffusion coefficients.
CTITRE	character*72 scalar variable containing the title.
REFC	real array of dimension REFC(NBURN,*) used for temporary storage.
JTAB	integer array of dimension JTAB(*) used for temporary storage.
TEX	character*9 scalar variable containing the data base name.
FMREF	real array of dimension FMREF(NGRP,NBURN,*) used for temporary storage.
HMREF	real array of dimension HMREF(NGRP,NBURN,*) used for temporary storage.
DELTA	real array of dimension DELTA(NBURN,*) used for temporary storage.
IXS	integer array of dimension IXS(NXS) used for temporary storage.
NXS	integer scalar variable containing the NL+20.

Called by

DRAGON routine(s) : CFC

Calling

DRAGON routine(s) : CFCFBM

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMNXT, LCMPUT, LCMSIX, SETARA, RLSARA, XABORT

17.2.2 CFCFBM

Purpose To compute and store the FBM coefficients.

Syntax CALL CFCFBM(TEXT1, TEXT2, IPLISU, IPLISD, IPFBM, NGRP, NBUM, NISM, NBURN, NISO, HISO, NL, IMPX, TOTAL, ZNUG, DIFFX, DIFFY, DIFFZ, H, IJJ, NJJ, SCAT, MIJ, MNJ, TMREF, SMREF, DMREFX, DMREFY, DMREFZ, TOTAF, ZNUF, DXF, DYF, DZF, HF, SCATF, WORK3, IPOS, REFC, TMICR, SMICR, DMICRX, DMICRY, DMICRZ, DELTA, DENSIT, TFR, TCR, TMR, XIR, TEXT, TEXTR, NB, FMICR, HMICR, FMREF, HMREF, JTAB, MIXP, PWR, V, EFJ, IXS, IXYZ)

Author(s) M.T. Sissaoui

Description of parameters

TEXT1	character*8 scalar variable containing the name of the first feedback coefficient.
TEXT2	character*8 scalar variable containing the name of the second feedback coefficient.
IPLISU	integer scalar variable containing the address of a CPO structure.
IPLISD	integer scalar variable containing the address of a CPO structure.
IPFBM	integer scalar variable containing the address of the RDB structure.
NGRP	integer scalar variable containing the name of the record.
NBUM	integer scalar variable containing the maximum number of burnup steps.
NISM	integer scalar variable containing the number of fissile isotopes.
NBURN	integer scalar variable containing the number of burnup steps.
NISO	integer scalar variable containing the number of isotopes.
HISO	integer array of dimension HISO(*) containing the names of the isotopes.
NL	integer scalar variable containing the number of Legendre orders for scattering.
IMPX	integer scalar variable containing the print flag.
TOTAL	real array of dimension TOTAL(NGRP,*) containing the reference total macroscopic cross sections.
ZNUG	real array of dimension ZNUG(NGRP,*) containing the reference ν fission macroscopic cross sections.
DIFFX	real array of dimension DIFFX(NGRP,*) containing the reference x -directed diffusion coefficients.
DIFFY	real array of dimension DIFFY(NGRP,*) containing the reference y -directed diffusion coefficients.
DIFFZ	real array of dimension DIFFZ(NGRP,*) containing the reference z -directed diffusion coefficients.
H	real array of dimension H(NGRP,*) containing the reference H -factors.
IJJ	integer array of dimension IJJ(*) used for temporary storage.
NJJ	integer array of dimension NJJ(*) used for temporary storage.

SCAT	real array of dimension SCAT(NBUM,*) containing the reference scattering macroscopic cross sections.
MIJ	integer array of dimension MIJ(*) used for temporary storage.
MNJ	integer array of dimension MNJ(*) used for temporary storage.
TMREF	real array of dimension TMREF(NGRP,NBUM,*) containing the temporary total macroscopic cross sections.
SMREF	real array of dimension SMREF(NISM,NBUM,NL,NGRP,*) containing the temporary ν fission macroscopic cross sections.
DMREFX	real array of dimension DMREFX(NGRP,NBUM,*) containing the temporary x -directed diffusion coefficients.
DMREFY	real array of dimension DMREFY(NGRP,NBUM,*) containing the temporary y -directed diffusion coefficients.
DMREFZ	real array of dimension DMREFZ(NGRP,NBUM,*) containing the temporary z -directed diffusion coefficients.
TOTAF	real array of dimension TOTAF(NGRP,*) containing the final total macroscopic cross sections.
ZNUF	real array of dimension ZNUF(NGRP,NBUM,*) containing the final ν fission macroscopic cross sections.
DXF	real array of dimension DXF(NGRP,NBUM,*) containing the final x -directed diffusion coefficients.
DYF	real array of dimension DYF(NGRP,NBUM,*) containing the final y -directed diffusion coefficients.
DZF	real array of dimension DZF(NGRP,NBUM,*) containing the final z -directed diffusion coefficients.
HF	real array of dimension HF(NGRP,NBUM,*) containing the final H -factors.
SCATF	real array of dimension SCATF(2,NBUM,NL,NGRP,*) containing the final scattering macroscopic cross sections.
WORK3	real array of dimension WORK3(*) used for temporary storage.
IPOS	integer array of dimension IPOS(*) used for temporary storage.
REFC	real array of dimension REFC(NBUM,*) used for temporary storage.
TMICR	real array of dimension TMICR(NGRP,NBUM,*) containing the feedback total macroscopic cross sections.
SMICR	real array of dimension SMICR(2,NISM,NBUM,NL,NGRP,*) containing the feedback ν fission macroscopic cross sections.
DMICRX	real array of dimension DMICRX(NGRP,NISM,NBUM,*) containing the feedback x -directed diffusion coefficients.
DMICRY	real array of dimension DMICRY(NGRP,NISM,NBUM,*) containing the feedback y -directed diffusion coefficients.
DMICRZ	real array of dimension DMICRZ(NGRP,NISM,NBUM,*) containing the feedback z -directed diffusion coefficients.

DELTA	real array of dimension DELTA(NBUM,2) used for temporary storage.
DENSIT	real array of dimension DENSIT(*) containing the number densities for the isotopes.
TFR	real scalar variable containing the reference fuel temperature.
TCR	real scalar variable containing the reference coolant temperature.
TMR	real scalar variable containing the reference moderator temperature.
XIR	real scalar variable containing the reference xenon concentration.
TEXT	character*12 array of dimension TEXT(2) containing the names of feedback directory on the CPO file.
TEXTR	character*12 scalar variable containing the name of the record.
NB	integer scalar variable containing the number of CPO file required for feedback calculation.
FMICR	real array of dimension FMICR(NGRP,NISM,NBUM,*) containing the feedback microscopic fission cross section.
HMICR	real array of dimension HMICR(NGRP,NBUM,*) containing the feedback microscopic H -factor.
FMREF	real array of dimension FMREF(NGRP,NBUM,*) containing the reference microscopic fission cross section.
HMREF	real array of dimension HMREF(NGRP,NBUM,*) containing the reference microscopic H -factor.
JTAB	integer array of dimension JTAB(*) used for temporary storage.
MIXP	integer scalar variable containing the type of perturbation where MIXP=0 implies individual perturbations and MIXP=1 implies coupled perturbations.
PWR	real scalar variable not used by this routine.
V	real array of dimension V(NBUM,8,*) used for temporary storage.
EFJ	real array of dimension EFJ(*) containing the fission energy for each fissile isotope.
IXS	integer array of dimension IXS(*) used for temporary storage.
IXYZ	integer scalar variable indicating the presence (IXYZ=1) or absence (IXYZ=0) of directional diffusion coefficients.

Called by

DRAGON routine(s) : CFCDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMPUT, LCMSIX, XABORT

18 THE LIBRARY INFORMATION MODULE

18.1 Structure of INFO:

The INFO: module can be represented by the following tree:

Structure of the library information module main routine: INF

```

INF
|----- INFAPL
|----- INFDR
|----- INFTR1
|----- INFTR2
|----- INFWAT
|----- INFWD4
|----- INFWIM

```

18.2 General Routines Description

18.2.1 INFAPL

Purpose To recover mass for isotopes in APOLIB libraries.

Syntax CALL INFAPL(CFILNA, IPRINT, NBISO , HNAMIS, AWR)

Author(s) R. Roy

Description of input parameters

CFILNA character*8 scalar variable containing the APOLIB file name.

IPRINT integer scalar variable containing the print flag.

NBISO integer scalar variable containing the number of isotopes to be processed.

HNAMIS character array of dimension HNAMIS(NBISO)*8 containing the name of the isotopes to be processed.

Description of output parameters

AWR real array of dimension AWR(NBISO) containing the atomic weight of the isotopes processed.

Called by

DRAGON routine(s) : INF

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : KDROPN, KDRCLS, XABORT

18.2.2 INFDR

Purpose To recover mass for isotopes in DRAGON type libraries.

Syntax CALL INFDR(CFILNA, IPRINT, NBISO , HNAMIS, AWRISO)

Author(s) R. Roy

Description of input parameters

CFILNA character*8 scalar variable containing the DRAGON type file name.

IPRINT integer scalar variable containing the print flag.

NBISO integer scalar variable containing the number of isotopes to be processed.

HNAMIS character array of dimension HNAMIS(NBISO)*8 containing the name of the isotopes to be processed.

Description of output parameters

AWRISO real array of dimension AWRISO(NBISO) containing the atomic weight of the isotopes processed.

Called by

DRAGON routine(s) : INF

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : LCMCL , LCMGET, LCMLN, LCMLIB, LCMOP , LCMSIX, XABORT

18.2.3 INFTR1

Purpose To recover mass for isotopes in NJOY-89 MATXS type libraries.

Syntax CALL INFTR1(CFILNA, IPRINT, NBISO , HNAMIS, AWRISO)

Author(s) R. Roy

Description of input parameters

CFILNA character*8 scalar variable containing the WIMS-AECL type file name.

IPRINT integer scalar variable containing the print flag.

NBISO integer scalar variable containing the number of isotopes to be processed.

HNAMIS character array of dimension HNAMIS(NBISO)*8 containing the name of the isotopes to be processed.

Description of output parameters

AWRISO real array of dimension AWRISO(NBISO) containing the atomic weight of the isotopes processed.

Called by

DRAGON routine(s) : INF

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRCAS, XDREED

GANLIB routine(s) : KDROPN, KDRCLS, XABORT

18.2.4 INFTR2

Purpose To recover mass for isotopes in NJOY-91 MATXS type libraries.

Syntax CALL INFTR2(CFILNA, IPRINT, NBISO , HNAMIS, AWRISO)

Author(s) R. Roy

Description of input parameters

CFILNA character*8 scalar variable containing the NJOY-91 MATXS type file name.

IPRINT integer scalar variable containing the print flag.

NBISO integer scalar variable containing the number of isotopes to be processed.

HNAMIS character array of dimension HNAMIS(NBISO)*8 containing the name of the isotopes to be processed.

Description of output parameters

AWRISO real array of dimension AWRISO(NBISO) containing the atomic weight of the isotopes processed.

Called by

DRAGON routine(s) : INF

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDREED

GANLIB routine(s) : KDROPN, KDRCLS, XABORT

18.2.5 INFWAT

Purpose To compute heavy and light water density.

Syntax CALL INFWAT(TEMPC , PURWGT, DENSTY)

Author(s) R. Roy

Description of input parameters

TEMPC real scalar variable containing the water temperature.

PURWGT real scalar variable containing the isotopic purity in weight % of D₂O.

Description of output parameters

DENSTY real scalar variable containing the density of water (heavy or light).

Called by

DRAGON routine(s) : INF

Calling

DRAGON routine(s) :

UTILIB routine(s) : AIKINT

GANLIB routine(s) :

18.2.6 INFWD4

Purpose To recover mass for isotopes in WIMSD4 type libraries.

Syntax CALL INFWD4(CFILNA, IPRINT, NBISO , HNAMIS, AWRISO)

Author(s) G. Marleau

Description of input parameters

CFILNA character*8 scalar variable containing the WIMSD4 type file name.

IPRINT integer scalar variable containing the print flag.

NBISO integer scalar variable containing the number of isotopes to be processed.

HNAMIS character array of dimension HNAMIS(NBISO)*8 containing the name of the isotopes to be processed.

Description of output parameters

AWRISO real array of dimension AWRISO(NBISO) containing the atomic weight of the isotopes processed.

Called by

DRAGON routine(s) : INF

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : KDROPN, KDRCLS, XABORT

18.2.7 INFWIM

Purpose To recover mass for isotopes in WIMS-AECL type libraries.

Syntax CALL INFWIM(CFILNA, IPRINT, NBISO , HNAMIS, AWR)

Author(s) R. Roy

Description of input parameters

CFILNA character*8 scalar variable containing the WIMS-AECL type file name.

IPRINT integer scalar variable containing the print flag.

NBISO integer scalar variable containing the number of isotopes to be processed.

HNAMIS character array of dimension HNAMIS(NBISO)*8 containing the name of the isotopes to be processed.

Description of output parameters

AWR real array of dimension AWR(NBISO) containing the atomic weight of the isotopes processed.

Called by

DRAGON routine(s) : INF

Calling

DRAGON routine(s) :

UTILIB routine(s) : OPNIND, REDIND, CLSIND, UPCKIC

GANLIB routine(s) : KDROPN, SETARA, RLSARA, XABORT

19 THE MODULE FOR PRE-HOMOGENIZATION

19.1 Structure of MRG :

The MRG : module can be represented by the following tree:

Structure of the pre-homogenization module: MRG

```
MRG
|----- MRGGET
|----- MRGLIN
|----- MRGVOL
|----- MRGVST
```

19.2 General Routines Description

19.2.1 MRGGET

Purpose To read merge options parameters.

Syntax CALL MRGGET(IPRINT, NSOUTO, NVOUTO, NSOUTN, NVOUTN, IUPD , IMERGE, MIXN ,
ALBEDN)

Author(s) G. Marleau

Description of input parameters

IPRINT integer scalar variable containing the print level.
NSOUTO integer scalar variable containing the old number of surfaces.
NVOUTO integer scalar variable containing the old number of regions.

Description of output parameters

NSOUTN integer scalar variable containing the new number of surfaces.
NVOUTN integer scalar variable containing the new number of regions.
IUPD integer array of dimension IUPD(4) containing the type of merge required.
IMERGE integer array of dimension IMERGE(-NSOUTO:NVOUTO) containing the merged position.
MIXN integer array of dimension MIXN(NVOUTO) containing the new material for old regions.
ALBEDN real array of dimension ALBEDN(6) containing the new surface albedo.

Called by

DRAGON routine(s) : MRG

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : REDGET, XABORT

19.2.2 MRGLIN

Purpose To merge volume surface information on track file.

Syntax CALL MRGLIN(IPRINT, IFTRKO, NSOUTO, NVOUTO, IFTRKN, IMERGE, MXSEG , NRSEG , PATH)

Author(s) G. Marleau

Description of input parameters

IPRINT integer scalar variable containing the print level.
 IFTRKO integer scalar variable containing the old tracking file unit.
 NSOUTO integer scalar variable containing the old number of surfaces.
 NVOUTO integer scalar variable containing the old number of regions.
 IFTRKN integer scalar variable containing the new tracking file unit.
 IMERGE integer array of dimension IMERGE(-NSOUTO:NVOUTO) containing the merged position.
 MXSEG integer scalar variable containing the maximum segment length on tracking file.

Description of work parameters

NRSEG integer array of dimension NRSEG(MXSEG) containing the segment pointer.
 PATH real array of dimension PATH(MXSEG) containing the segment length.

Called by

DRAGON routine(s) : MRG

19.2.3 MRGVOL

Purpose To merge information on data structure.

Syntax CALL MRGVOL(IUPD , NSOUTO, NVOUTO, NSOUTN, NVOUTN, NUNN , IMERGE, MIXN , MATO , VOLO , MATN , VOLN , KEYN , MATRTO, MATRTN, MAXMN , NETVOL, NETSUR, KEYRO , MATRO , KEYRN , MATRN)

Author(s) G. Marleau

Description of input parameters

IUPD integer array of dimension IUPD(4) containing the type of merge required.
 NSOUTO integer scalar variable containing the old number of surfaces.
 NVOUTO integer scalar variable containing the old number of regions.

NSOUTN	integer scalar variable containing the new number of surfaces.
NVOUTN	integer scalar variable containing the new number of regions.
NUNN	integer scalar variable containing the new number of unknowns.
IMERGE	integer array of dimension IMERGE(-NSOUTO:NVOUTO) containing the merged position.
MIXN	integer array of dimension MIXN(NVOUTO) containing the new material for old regions.
MATO	integer array of dimension MATO(NVOUTO) containing the old material per region.
VOLO	real array of dimension VOLO(NVOUTO) containing the old volumes.
NETVOL	integer scalar variable containing the number of original regions.
NETSUR	integer scalar variable containing the number of original surfaces.
KEYRO	integer array of dimension KEYRO(-NETSUR:NETVOL) containing the old regional KEYMRG.
MATRO	integer array of dimension MATRO(-NETSUR:NETVOL) containing the old regional MATALB.

Description of output parameters

MATN	integer array of dimension MATN(NVOUTN) containing the new material per region.
VOLN	real array of dimension VOLN(NVOUTN) containing the new volumes.
KEYN	integer array of dimension KEYN(NUNN) containing the new KEYFLX.
MAXMN	integer scalar variable containing the new maximum number of mixture.
KEYRN	integer array of dimension KEYRN(-NETSUR:NETVOL) containing the new regional KEYMRG.
MATRN	integer array of dimension MATRN(-NETSUR:NETVOL) containing the new regional MATALB.

Description of work parameters

MATRTO	integer array of dimension MATRTO(NSOUTO) used for temporary storage.
MATR TN	integer array of dimension MATR TN(NSOUTN) used for temporary storage.

Called by

DRAGON routine(s) : MRG

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

19.2.4 MRGVST

Purpose To merge volume surface information on track file.

Syntax CALL MRGVST(IPRINT, IUPD , NSOUTO, NVOUTO, NSOUTN, NVOUTN, IMERGE, MIXN ,
MATO , VOLO , MATN , VOLN)

Author(s) G. Marleau

Description of input parameters

IPRINT integer scalar variable containing the print level.

IUPD integer array of dimension IUPD(4) containing the type of merge required.

NSOUTO integer scalar variable containing the old number of surfaces.

NVOUTO integer scalar variable containing the old number of regions.

NSOUTN integer scalar variable containing the new number of surfaces.

NVOUTN integer scalar variable containing the new number of regions.

IMERGE integer array of dimension IMERGE(-NSOUTO:NVOUTO) containing the merged position.

MIXN integer array of dimension MIXN(NVOUTO) containing the new material for old regions.

MATO integer array of dimension MATO(-NSOUTO:NVOUTO) containing the old material per region.

VOLO real array of dimension VOLO(-NSOUTO:NVOUTO) containing the old volumes.

Description of output parameters

MATN integer array of dimension MATN(-NSOUTN:NVOUTN) containing the new material per region.

VOLN real array of dimension VOLN(-NSOUTN:NVOUTN) containing the new volumes.

Called by

DRAGON routine(s) : MRG

Calling

DRAGON routine(s) :

UTILIB routine(s) :

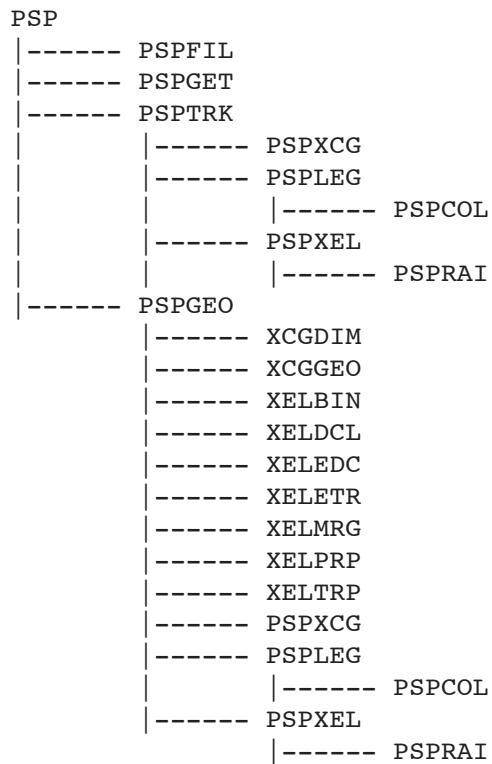
GANLIB routine(s) : XABORT

20 THE MODULE FOR PLOTTING

20.1 Structure of PSP:

The PSP: module can be represented by the following tree:

Structure of the plotting module: PSP



20.2 General Routines Description

20.2.1 PSPCOL

Purpose To pick a color number from a n-color set

Syntax CALL PSPCOL(ITCOL, NCOL, ICOL, RGB)

Author(s) G. Marleau

Description of input parameters

ITCOL integer scalar variable containing the type of color set.

NCOL integer scalar variable containing the maximum number of color in set.

ICOL integer scalar variable containing the requested color number.

Description of output parameters

RGB real array of dimension RGB(4) color intensity.

Called by

DRAGON routine(s) : PSPLEG

20.2.2 PSPFIL

Purpose To analyze a PSP file.

Syntax CALL PSPFIL(ISPSP, JSPSP, NAMPSP, NPAGE)

Author(s) G. Marleau

Description of parameters

ISPSP integer scalar variable containing the PSP file unit.

JSPSP integer scalar variable containing the PSP file mode.

NAMPSP character*12 scalar variable containing the PSP file name.

NPAGE integer scalar variable containing the page number.

Called by

DRAGON routine(s) : PSP

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSHEAD, PSPAGE

GANLIB routine(s) : XABORT

20.2.3 PSPGEO

Purpose To analyze geometry for plotting in PostScript format.

Syntax CALL PSPGEO(IPRINT, ISPSP, ITYPE, ICOLR, IPGEOM, NAMFIL, NAMLEG, NUNKNO,
 FLUX)

Author(s) G. Marleau

Description of parameters

IPRINT integer scalar variable containing the print level.

ISPSP integer scalar variable containing the PSP file unit.

ITYPE integer scalar variable containing the type of graphic.

ICOLR integer scalar variable containing the color set used.

IPGEOM integer scalar variable containing the pointer to the GEOMETRY data structure.

NAMFIL character*12 scalar variable containing the geometry file name.

NAMLEG character*24 scalar variable containing the legend name.

NUNKNO integer scalar variable containing the number of unknown.

FLUX real array of dimension FLUX(NUNKNO) containing the fluxes.

Called by

DRAGON routine(s) : PSP

Calling

DRAGON routine(s) : PSPLEG, PSPXCG, PSPXEL, XCGDIM, XCGGEO, XELBIN, XELDCL, XELEDCL, XELETR, XELMRG, XELPRP, XELTRP

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, SETARA, RLSARA, XABORT

20.2.4 PSPGET

Purpose To read the PSP : option parameters.

Syntax CALL PSPGET(IPRINT, ITYPE, ICOLOR)

Author(s) G. Marleau

Description of parameters

IPRINT integer scalar variable containing the print level.

ITYPE integer scalar variable containing the type of graphic.

ICOLOR integer scalar variable containing the color set used.

Called by

DRAGON routine(s) : PSP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : REDGET, XABORT

20.2.5 PSPLEG

Purpose To associate a color to a region and print legend.

Syntax CALL PSPLEG(IPRINT, ISPSP, ITYPE, ICOLOR, NSUR, NVOL, NAMLEG, NUNKNO, FLUX, NREGT, MATALB, KEYMRG, KEYFLX, COLREG)

Author(s) G. Marleau

Description of parameters

IPRINT	integer scalar variable containing the print level.
ISPSP	integer scalar variable containing the PSP file unit.
ITYPE	integer scalar variable containing the type of graphic.
ICOLR	integer scalar variable containing the color set used.
NSUR	integer scalar variable containing the negative value of the number of outer surface.
NVOL	integer scalar variable containing the maximum number of regions.
NAMLEG	character*24 scalar variable containing the legend name.
NUNKNO	integer scalar variable containing the number of unknowns.
FLUX	real array of dimension FLUX(NUNKNO) containing the unknown vector.
NREGT	integer scalar variable containing the dimension of KEYFLX vector.
MATALB	integer array of dimension MATALB(NSUR:NVOL) containing the albedo-material of regions.
KEYMRG	integer array of dimension KEYMRG(NSUR:NVOL) containing the merge index.
KEYFLX	integer array of dimension KEYFLX(NVOL) containing the flux location.
COLREG	real array of dimension COLREG(4,NVOL) containing the region color.

Called by

DRAGON routine(s) : PSPGEO, PSPTRK

Calling

DRAGON routine(s) : PSPCOL

UTILIB routine(s) : PSFILL, PSFREG, PSLINW, PSSREG, PSTEXT

GANLIB routine(s) :

20.2.6 PSPRAI

Purpose To find rectangular/annular intersection and order points for plotting.

Syntax CALL PSPRAI(MXSEG, NPTS, XYPOS, CENTER, RCIRC, NSEG, IORDER, RADANG)

Author(s) G. Marleau

Description of input parameters

MXSEG	integer scalar variable containing the maximum number of segments.
NPTS	integer scalar variable containing the number of corners.
XYPOS	real array of dimension XYPOS(2,NPTS) containing the <i>x</i> and <i>y</i> position of corners.

CENTER real array of dimension CENTER(2) containing the x and y position of annulus center.

RCIRC real scalar variable containing the annulus radius.

Description of output parameters

NSEG integer scalar variable containing the number of region intersection.

IORDER integer array of dimension IORDER(MXSEG) containing the type of region intersected.

RADANG real array of dimension RADANG(2,MXSEG) containing the segments intersection points.

Called by

DRAGON routine(s) : PSPXEL

20.2.7 PSPTRK

Purpose To plot geometry in PostScript format from a TRACKING structure.

Syntax CALL PSPTRK(IPRINT, ISPSP, ITYPE, ICOLR, IPTRKT, NAMFIL, NAMLEG, NUNKNO,
 FLUX)

Author(s) G. Marleau

Description of parameters

IPRINT integer scalar variable containing the print level.

ISPSP integer scalar variable containing the PSP file unit.

ITYPE	integer scalar variable containing the type of graphic.
-------	---

ICOLR integer scalar variable containing the color set used.

IPTRKT integer scalar variable containing the pointer to the TRACKING data structure.

NAMFIL character*12 scalar variable containing the geometry file name.

NAMLEG character*24 scalar variable containing the legend name.

NUNKNO integer scalar variable containing the number of unknown.

FLUX real array of dimension FLUX(NUNKNO) containing the fluxes.

Called by

DRAGON routine(s) : PSP

Calling

DRAGON routine(s) : PSPLEG, PSPXCG, PSPXEL

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMSIX, SETARA, RLSARA, XABORT

20.2.8 PSPXCG

Purpose To generate graphics for 2-D cluster geometry.

Syntax CALL PSPXCG(IPRINT, ISPSP, ICOLR, NBAN, NRT, MSROD, NSURX, NSUR, NVOL, COTE, RAN, NRODS, RODS, RODR, NRINFO, NRODR, NXRI, KEYMRG, COLREG)

Author(s) G. Marleau

Description of parameters

IPRINT	integer scalar variable containing the print level.
ISPSP	integer scalar variable containing the PSP file unit.
ICOLR	integer scalar variable containing the color set used.
NBAN	integer scalar variable containing the number of concentric regions.
NRT	integer scalar variable containing the number of rod types.
MSROD	integer scalar variable containing the maximum number of sub-rods per rods.
NSURX	integer scalar variable containing the number of surfaces.
NSUR	integer scalar variable containing the number of surfaces.
NVOL	integer scalar variable containing the number of regions.
COTE	real scalar variable containing the y dimension for rectangle.
RAN	real array of dimension RAN(NBAN) containing the radius/lattice side of region.
NRODS	integer array of dimension NRODS(3,NRT) containing the integer description of rod type.
RODS	real array of dimension RODS(2,NRT) containing the description of rod of a given type.
RODR	real array of dimension RODR(MSROD,NRT) containing the sub-rods radius.
NRINFO	integer array of dimension NRINFO(2,NBAN) containing the annular region content.
NRODR	integer array of dimension NRODR(NRT) containing the sub-rods region.
NXRI	integer array of dimension NXRI(NRT,NBAN) containing the annular region content multi-rod.
KEYMRG	integer array of dimension KEYMRG(NSUR:NVOL) containing the merge index.
COLREG	real array of dimension COLREG(4,NVOL) containing the region color.

Called by

DRAGON routine(s) : PSPGEO, PSPTRK

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSFCIR, PSFILL, PSFREG, PSLINW, PSMOVE, PSSARC, PSSCIR, PSSREG

GANLIB routine(s) :

20.2.9 PSPXEL

Purpose To generate graphics for 2-D assembly geometry.

Syntax CALL PSPXEL(IPRINT, ISPSP, ICOLR, NDIM, NSUR, NVOL, NTOTCL, MAXR, MINDIM, MAXDIM, KEYMRG, INDEX, REMESH, COLREG)

Author(s) G. Marleau

Description of parameters

IPRINT	integer scalar variable containing the print level.
ISPSP	integer scalar variable containing the PSP file unit.
ICOLR	integer scalar variable containing the color set used.
NDIM	integer scalar variable containing the number of dimensions.
NSUR	integer scalar variable containing the number of surfaces.
NVOL	integer scalar variable containing the number of zones.
NTOTCL	integer scalar variable containing the number of cylinders.
MAXR	integer scalar variable containing the dimension of REMESH vector.
MINDIM	integer array of dimension MINDIM(NTOTCL) containing the minimum index values for axes.
MAXDIM	integer array of dimension MAXDIM(NTOTCL) containing the maximum index values for axes.
KEYMRG	integer array of dimension KEYMRG(NSUR:NVOL) containing the merge index.
INDEX	integer array of dimension INDEX(4,NSUR:NVOL) containing the numbering of surfaces and zones.
REMESH	real array of dimension REMESH(MAXR) containing the meshing.
COLREG	real array of dimension COLREG(4,NVOL) containing the region color.

Called by

DRAGON routine(s) : PSPGEO, PSPTRK

Calling

DRAGON routine(s) : PSPRAI

UTILIB routine(s) : PSFILL, PSFRAI, PSFREG, PSLINW, PSMOVE, PSSRAI, PSSREG

GANLIB routine(s) :

21 ADDITIONAL DRAGON ROUTINES

21.1 General Utility Routines

21.1.1 XDREXP

Purpose To create linear interpolation tables for the exponential function.

Syntax CALL XDREXP(DEX, NBEX)

Author(s) R. Roy

Description of input parameters

DEX double precision variable representing the interval Δx used in the table for the exponential function.

NBEX integer variable m giving the order of the exponential table. The tables are created for $0 \leq x \leq m\Delta x$. For values of $x > m\Delta x$, one assumes that $\exp(x) = 0$.

21.1.2 XDRKIN

Purpose To create quadratic interpolation tables for Bickley function: $Ki_1(x)$, $Ki_2(x)$, $Ki_3(x)$, $Ki_4(x)$, $Ki_5(x)$.

Syntax CALL XDRKIN(DX, NBX, MLOG, C0, C1, C2)

Author(s) R. Roy

Description of input parameters

DX double precision variable representing the interval Δx used in the table for $Ki_n(x)$.

NBX integer variable m giving the order of the $Ki_n(x)$ tables. The tables are created for $0 \leq x \leq m\Delta x$. For values of $x > m\Delta x$, one assumes that $Ki_n(x) = 0$.

MLOG one dimensional integer array containing the number of intervals $M_n = \text{MLOG}(n)$ used for the tables representing the logarithmic singularities in $Ki_n(x)$. Here $1 \leq n \leq 5$.

Description of work arrays

C0 two dimensional double precision array of dimensions C0(n,m) where:

$$1 \leq n \leq 5 \text{ and } 0 \leq m \leq \text{NBX}.$$

C1 two dimensional double precision array of dimensions C1(n,m) where:

$$1 \leq n \leq 5 \text{ and } 0 \leq m \leq \text{NBX}.$$

C2 two dimensional double precision array of dimensions C2(n,m) where:

$$1 \leq n \leq 5 \text{ and } 0 \leq m \leq \text{NBX}.$$

21.1.3 XDRVER

Purpose To read DRAGON version number and release date.

Syntax CALL XDRVER(IMVERS, ISVERS, IVDATE)

Author(s) G. Marleau

Description of output parameters

IMVERS integer variable containing the version number (IMVERS=3 for release 3.04).

ISVERS integer variable containing the subversion number (ISVERS=4 for release 3.04).

IVDATE one dimensional integer array containing the year IVDATA(1), the month number IVDATA(2) and the day of the month IVDATA(3) identifying the date at which this version of DRAGON was released.

21.2 Microscopic Cross Sections Processing Routines

21.2.1 XDRLGS

Purpose To read or save the microscopic cross sections associated with an isotope on a MICROLIB data structure.

Syntax CALL XDRLGS(IPLIB,IGS,NPROC,MINLEG,MAXLEG,IORD, NGROUP,INDPRO,
ITYPRO,XSREC,SCAT,XSSCMP, NJJ,IJJ)

Author(s) G. Marleau

Description of input parameters

IPLIB integer variable containing the access key to the LIBRARY data structure.

IGS integer variable containing the type of operation that will be performed. The only values permitted for IGS are:

- IGS=-2 to read scattering cross section matrix only ;
- IGS=-1 to read all the cross sections possible;
- IGS=1 to save all the cross sections possible;
- IGS=2 to save scattering cross section matrix only.

NPROC integer variable containing the number of vector and matrix cross section to process. By definition NPROC=20+MAXLEG+1.

MINLEG integer variable containing the minimum Legendre polynomial order for the scattering cross section matrix to process.

MAXLEG integer variable containing the maximum Legendre polynomial order for the scattering cross section matrix to process.

IORD integer variable containing the order of the power series expansion in time t used for the cross section. The only values permitted for IORD are:

- IORD=1 constant terms in the power series expansion (t^0);

- IORD=2 linear terms in the power series expansion (t^1);
- IORD=3 quadratic terms in the power series expansion (t^2).

NGROUP integer variable containing the number of energy groups.

INDPRO one dimensional integer array $INDPRO(i)$ containing a series of flag to indicate if a given cross section type is to be processed ($INDPRO(i) > 0$) or not ($INDPRO(i) = 0$).

Description of input/output parameters

ITYPRO one dimensional integer array $ITYPRO(i)$ returning a series of flag to indicate if a given cross section type has been processed ($ITYPRO(i) > 0$) or not ($ITYPRO(i) = 0$).

XSREC real array of dimension $XSREC(NGROUP, NPROC)$ containing the vector cross sections.

SCAT real array of dimension $SCAT(NGROUP, NGROUP, MAXLEG-MINLEG+1)$ containing the scattering cross sections matrix. Here $SCAT(g, h, l)$ is for the scattering from group g to group h and Legendre order l .

Description of work parameters

XSSCMP real array of dimension $XSSCMP(NGROUP*NGROUP)$ used for temporary storage of the compressed scattering cross section matrix.

NJJ integer array of dimension $NJJ(NGROUP)$ used for temporary storage of the number of group with scattering to each group.

IJJ integer array of dimension $IJJ(NGROUP)$ used for temporary storage of the first group with scattering to each group.

Called by

DRAGON routine(s) : CPOMAW, CPOMIC, EDIMIC, EVORRE, LIBDEN, LIBDRA, LIBTR1, LIBTR2, LIBWD4, LIBWIM

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMPUT, XABORT

21.2.2 XDRLPR

Purpose To print the microscopic cross sections associated with an isotope.

Syntax CALL XDRLPR(NPROC, MINLEG, MAXLEG, IORD, NGROUP, INDPRO, ITYPRO, XSREC, SCAT)

Author(s) G. Marleau

Description of input parameters

NPROC integer variable containing the number of vector and matrix cross section to process. By definition $NPROC = 20 + MAXLEG + 1$.

MINLEG	integer variable containing the minimum Legendre polynomial order for the scattering cross section matrix to process.
MAXLEG	integer variable containing the maximum Legendre polynomial order for the scattering cross section matrix to process.
IORD	integer variable containing the order of the power series expansion in time t used for the cross section. The only values permitted for IORD are: <ul style="list-style-type: none"> • IORD=1 constant terms in the power series expansion (t^0); • IORD=2 linear terms in the power series expansion (t^1); • IORD=3 quadratic terms in the power series expansion (t^2).
NGROUP	integer variable containing the number of energy groups.
INDPRO	one dimensional integer array INDPRO(i) containing a series of flag to indicate if a given cross section type is to be processed (INDPRO(i) > 0) or not (INDPRO(i) = 0).
ITYPRO	one dimensional integer array ITYPRO(i) returning a series of flag to indicate if a given cross section type has been processed (ITYPRO(i) > 0) or not (ITYPRO(i) = 0).
XSREC	real array of dimension XSREC(NGROUP,NPROC) containing the vector cross sections.
SCAT	real array of dimension SCAT(NGROUP,NGROUP,MAXLEG-MINLEG+1) containing the scattering cross sections matrix. Here SCAT(g,h,l) is for the scattering from group g to group h and Legendre order l .

Called by

DRAGON routine(s) : EDIMIC, LIBWD4, LIBWIM

21.2.3 XDRNED

Purpose To set up for reading or saving microscopic cross section on a MICROLIB data structure.

Syntax CALL XDRNED(NPROC, MINLEG, MAXLEG, ILEAKS, NED, HVECT, IVECT, INDPRO)

Author(s) G. Marleau

Description of input parameters

NPROC	integer variable containing the number of vector and matrix cross section to process. By definition NPROC=20+MAXLEG+1.
MINLEG	integer variable containing the minimum Legendre polynomial order for the scattering cross section matrix to process.
MAXLEG	integer variable containing the maximum Legendre polynomial order for the scattering cross section matrix to process.
ILEAKS	integer scalar variable to specify which leakage cross section are required. Here <ul style="list-style-type: none"> • ILEAKS=2 for direction independent equivalent transport cross section; • ILEAKS=3 for directional equivalent transport cross section.
NED	integer scalar variable describing the number of the additional editing cross section.

HVECT character array of dimension HVECT(NED)*6 containing the names of the additional editing cross section.

Description of output parameters

IVECT integer array of dimension IVECT(NED) containing the pointer to the additional editing cross section.

INDPRO one dimensional integer array INDPRO(*i*) containing a series of flag to indicate if a given cross section type is to be processed (INDPRO(*i*) > 0) or not (INDPRO(*i*) = 0).

Called by

DRAGON routine(s) : CPODRV, EDIMIC, LIBLIB, LIBMIX

Calling

DRAGON routine(s) :

UTILIB routine(s) : XDRSET

GANLIB routine(s) :

21.3 Geometry Analysis Utility Routines

The LDRASS routine can be represented by the following tree:

Structure of routine: LDRASS

```

LDRASS
|----- LDRCEL
|         |----- LDRGEO

```

21.3.1 LDRASS

Purpose To read a geometry and verify if it is compatible for cell assembly.

Syntax LDRASS=LDRASS(IPGEOM, LEVEL, IPRT)

Author(s) R. Roy

Description of input parameters

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

LEVEL integer scalar variable describing the geometry level.

IPRT integer scalar variable describing the level of output transferred to the output file.

Description of output parameters

LDRASS logical scalar variable describing if the geometry is valid (.TRUE.) for the assembly.

Called by

DRAGON routine(s) : EXCELT, XL3

Calling

DRAGON routine(s) : LDRCEL

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMNXT, SETARA, RLSARA, XABORT

21.3.2 LDRCEL

Purpose To verify if two cells can be connected in an assembly along a specific axis.

Syntax LDRCEL=LDRCEL(IPGEOM, IT1, JT1, IT2, JT2, CELLT, NTYPES, IAXIS, NDIM, IPRT)

Author(s) R. Roy

Description of input parameters

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.

IT1 integer scalar variable describing the type for the first cell.

JT1 integer scalar variable describing the turn for the first cell.

IT2 integer scalar variable describing the type for the second cell.

JT2 integer scalar variable for describing the turn for the second cell.

CELLT integer array of dimension CELLT(3*NTYPES) containing the names of the different cell types.

NTYPES integer scalar variable for describing the number of cell types.

IAXIS integer scalar variable for describing the coupling axis.

NDIM integer scalar variable for describing the number of dimensions for the cells.

IPRT integer scalar variable describing the level of output transferred to the output file.

Description of output parameters

LDRCEL logical scalar variable describing if the cell coupling is adequate (.TRUE.) or not (.FALSE.).

Called by

DRAGON routine(s) : LDRASS

Calling

DRAGON routine(s) : LDRGEO

UTILIB routine(s) : XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMSIX, SETARA, RLSARA, XABORT

21.3.3 LDRGEO

Purpose To compare two sub-geometry.

Syntax LDRGEO=LDRGEO(IPGEOM, GEON1, GEON2, IMPX)

Author(s) R. Roy

Description of input parameters

IPGEOM integer scalar variable for accessing the GEOMETRY data structure to be analyzed.
 GEON1 character*12 scalar variable containing the name of the first sub-geometry.
 GEON2 character*12 scalar variable containing the name of the second sub-geometry.
 IPRT integer scalar variable describing the level of output transferred to the output file.

Description of output parameters

LDRGEO logical scalar variable that is **.TRUE.** if both sub-geometry are identical (apart from their material contents) and **.FALSE.** otherwise.

Called by

DRAGON routine(s) : LDRCEL

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : KDROPN, KDRCLS, LCMEXP, LCMGET, LCMLN, LCMSIX, SETARA, RLSARA, XABORT

21.4 GOXS Files Processing Routines

21.4.1 GXSINI

Purpose To initialize GOXS format and to read energy group information stored on the MACROLIB.

Syntax CALL GXSINI(IPMACR, IPRINT, IUGOXS, NBMIX, NGROUP, NBELEM, NEXTMI, NUMMAT, NEXTRE, NUDEPR, NUMREC, LIREAD, NFILCN, IFILCN)

Author(s) G. Marleau

Description of input parameters

IPMACR integer scalar variable containing the pointer to the MACROLIB.
 IPRINT integer scalar variable containing the print level.
 IUGOXS integer scalar variable containing the maximum number of mixtures.
 NBMIX integer scalar variable containing the unit for cross section file.
 NGROUP integer scalar variable containing the maximum number of groups.
 NBELEM integer scalar variable containing the number of material to add.
 NEXTMI integer scalar variable containing the next material to read.
 NUMMAT integer scalar variable containing the maximum number of material.

NEXTRE integer scalar variable containing the next record to read.
 NUDEPR integer scalar variable containing the starting data set to skip.
 NUMREC integer scalar variable containing the last data set to skip.
 LIREAD logical scalar variable containing the read option.
 NFILCN integer scalar variable containing the dimension of the array IFILCN.

Description of output parameters

IFILCN integer array of dimension IFILCN(NFILCN) containing the GOXS file integer data.

Called by

DRAGON routine(s) : MACDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : GXSDIM, XDREED

GANLIB routine(s) : LCMGET, LCMPUT, SETARA, RLSARA, XABORT

21.4.2 GXSGET

Purpose To read cross sections on GOXS file.

Syntax CALL GXSGET(IPMACR, IUGOXS, NBMIX, NGROUP, NANISO, NBELEM, NEXTMI, NEXTRE, NFILCN, IFILCN, KEXS, KMXS, KINS, KXSS, IPERMU, XSTOTL, XSTRAN, XSFISS, XSSCAT, XSWORK, IEDXS, XSPRIN, INDSCT, XSSMAT)

Author(s) G. Marleau

Description of parameters

IPMACR integer scalar variable containing the pointer to the MACROLIB.
 IUGOXS integer scalar variable containing the maximum number of mixtures.
 NBMIX integer scalar variable containing the unit for cross section file.
 NGROUP integer scalar variable containing the maximum number of groups.
 NANISO integer scalar variable containing the Legendre order for scattering.
 NBELEM integer scalar variable containing the number of material to add.
 NEXTMI integer scalar variable containing the next material to read.
 NEXTRE integer scalar variable containing the next record to read.
 NFILCN integer scalar variable containing the dimension of the array IFILCN.
 IFILCN integer array of dimension IFILCN(NFILCN) containing the GOXS file integer data.
 KEXS integer scalar variable containing the dimension of the cross section vector.

KMXS	integer scalar variable containing the dimension of XSPRIN vector.
KINS	integer scalar variable containing the dimension of INDSCT vector.
KXSS	integer scalar variable containing the dimension of XSSMAT vector.
IPERMU	integer array of dimension IPERMU(NBMIX) containing the permutation vector.
XSTOTL	real array of dimension XSTOTL(NBMIX,NGROUP) containing the total cross section of mixture.
XSTRAN	real array of dimension XSTRAN(NBMIX,NGROUP) containing the transport correction cross section of mixture.
XSFISS	real array of dimension XSFISS(NBMIX,NGROUP,3) containing the fission cross section of mixture.
XSSCAT	real array of dimension XSSCAT(NGROUP,NBMIX,NANISO,NGROUP) containing the scattering cross section of mixture/group.
XSWORK	real array of dimension XSWORK(NBMIX) containing the work cross section vector.
IEDXS	integer array of dimension IEDXS(KEXS) containing the position of primary cross section.
XSPRIN	real array of dimension XSPRIN(KMXS) containing the main cross sections.
INDSCT	integer array of dimension INDSCT(KINS) containing the scattering cross section indicators.
XSSMAT	real array of dimension XSSMAT(KXSS) containing the scattering cross section matrix.

Called by

DRAGON routine(s) : MACDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : GXSDIM, XDREED, XDRSDB, XDRSET

GANLIB routine(s) : LCMGET, LCMLen, LCMput, LCMSIX, SETARA, RLSARA

21.4.3 GXSPUT

Purpose To transfer information from the MACROLIB to the GOXS file.

Syntax CALL GXSPUT(IPMACR, IWGOXS, NBMIX, NGROUP, NANISO, NEXTRI, NFILCN, IFILCN, KEXS, XSGEN, NIJJ, IRNIJJ, XSSCAT, RSCAT)

Author(s) G. Marleau

Description of parameters

IPMACR	integer scalar variable containing the pointer to the MACROLIB.
IWGOXS	integer scalar variable containing the maximum number of mixtures.
NBMIX	integer scalar variable containing the unit for cross section file.
NGROUP	integer scalar variable containing the maximum number of groups.

NANISO	integer scalar variable containing the Legendre order for scattering.
NEXTRI	integer scalar variable containing the next material to read.
NFILCN	integer scalar variable containing the dimension of the array IFILCN.
IFILCN	integer array of dimension IFILCN(NFILCN) containing the GOXS file integer data.
KEXS	integer scalar variable containing the dimension of the cross section vector.
XSGEN	real array of dimension XSGEN(NBMIX*KEXS) containing the general cross section vector.
NIJJ	integer array of dimension NIJJ(NANISO,NBMIX,2) containing the number of scattering group.
IRNIJJ	integer array of dimension IRNIJJ(NBMIX) containing the temporary work vector for NIJJ.
XSSCAT	real array of dimension XSSCAT(NGROUP*NANISO*NBMIX) containing the scattering cross section matrix.
RSCAT	real array of dimension RSCAT(NGROUP*NBMIX) containing the temporary scattering matrix.

Called by

DRAGON routine(s) : MACDRV

Calling

DRAGON routine(s) :

UTILIB routine(s) : GXSDIM, XDRITE, XDRSET

GANLIB routine(s) : LCMGET, LCMLLEN, LCMSIX, SETARA, RLSARA

22 UTILITY ROUTINES

22.1 General Utility Routines

22.1.1 GUCTOI

Purpose To convert a character string to an integer array.

Syntax CALL GUCTOI(CARVAR, INTVAR, NC4 , NELEM)

Author(s) G. Marleau

Description of parameters

CARVAR character array of dimension CARVAR(NELEM)*(*) containing the character string to convert.

INTVAR integer array of dimension INTVAR(NC4,NELEM) that will contain the integer equivalent of the character string.

NC4 integer scalar variable containing the number of character*4 elements in CARVAR(1).

NELEM integer scalar variable containing the number of elements in the character string to convert.

22.1.2 GUITOC

Purpose To convert integer array to a character string.

Syntax CALL GUITOC(INTVAR, CARVAR, NC4 , NELEM)

Author(s) G. Marleau

Description of parameters

INTVAR integer array of dimension INTVAR(NC4,NELEM) containing the resulting integer variable after translation to translate.

CARVAR character array of dimension CARVAR(NELEM)*(*) containing the character variable to translate.

NC4 integer scalar variable containing the number of CHARACTER*4 blocks in CARVAR to translate.

NELEM integer scalar variable containing the number of elements generated in INTVAR.

22.1.3 UPCKIC

Purpose To unpack characters from an integer array.

Syntax CALL UPCKIC(IV , VC , N)

Author(s) WIMS–AECL routine

Description of parameters

IV integer array of dimension IV(*) containing the ANSI interpretation of each characters.
 VC character array of dimension VC(N)*8 containing the character strings to unpack.
 N integer scalar variable containing the number of integer to unpack.

22.1.4 GXSDIM

Purpose To initialize the dimensions of a GOXS file.

Syntax CALL GXSDIM(MULT , FMT)

Author(s) G. Marleau

Description of parameters

MULT integer scalar variable the number of words required to store a CHARACTER*6 variable.
 FMT character*5 scalar variable containing the FORTRAN format required to read a CHARACTER*6 variable.

22.1.5 OPNIND, CLSIND, REDIND

Purpose To open, read and close a direct access file containing a WIMS–AECL library.

Syntax CALL OPNIND(IUNIT , INDEX , LINDEX)

CALL CLSIND(IUNIT)

CALL REDIND(IUNIT , INDEX , LINDEX, DATA, NWORDS, KEY)

Author(s) G. Marleau

Description of parameters

IUNIT integer scalar variable containing the file unit associated with the WIMS–AECL library.
 INDEX integer array of dimension INDEX(LINDEX) containing the index table (master index for OPNIND).
 LINDEX integer scalar variable containing the length of the index table.
 DATA integer array of dimension DATA(NWORDS) containing the data array to retrieve from file.
 NWORDS integer scalar variable containing the length of the data array to retrieve from file.
 KEY integer scalar variable containing the location of the data array in the index table.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : KDRCLS, XABORT

22.1.6 XDRCAS

Purpose To transform a character string to upper case or lower case.

Syntax CALL XDRCAS(DIR , TEXT)

Author(s) G. Marleau

Description of parameters

DIR character*(*) scalar variable containing the direction of conversion where:

- DIR=LOWTOUP means that the lower case characters are transformed to upper case characters;
- DIR=UPTOLOW means that the upper case characters are transformed to lower case characters.

TEXT character*(*) scalar variable containing the character variable to be converted.

22.1.7 XDRDBL

Purpose To initialize a double precision array to a value.

Syntax CALL XDRDBL(VECTOR, NMOTS , VALEUR)

Author(s) G. Marleau

Description of parameters

VECTOR double precision array of dimension VECTOR(NMOTS) containing the vector to initialize.

NMOTS integer scalar variable containing the numbers of elements in the vector to initialize.

VALEUR double precision scalar variable containing the initialization value.

22.1.8 XDREED, XDRITE

Purpose To read or write CCCC format records.

Syntax CALL XDREED(IUCCCC, NUMREC, ARRAY , NWDS)

CALL XDRITE(IUCCCC, NUMREC, ARRAY , NWDS)

Author(s) G. Marleau

Description of parameters

IUCCCC integer scalar variable containing the unit number associated with the input/output binary file.

NUMREC integer scalar variable containing the record number to read or write.

ARRAY real array of dimension ARRAY(NWDS) containing the elements to transfer from or to the binary file.

NWDS integer scalar variable containing the number of words to read or write.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.1.9 XDRSDB

Purpose To transfer information between a double precision array and a single precision array.

Syntax CALL XDRSDB(NBELEM, RVECT , DBVECT, KDIR)

Author(s) G. Marleau

Description of parameters

NBELEM integer scalar variable containing the number of words to translate.

RVECT real array of dimension RVECT(*) containing the single precision data.

DBVECT double precision array of dimension DBVECT(*) containing the double precision data.

KDIR integer scalar variable containing the flag for direction of translation such that:

- KDRI=1 means that the double precision vector will be translated to single precision;
- KDRI=2 means that the single precision vector will be translated to double precision.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.1.10 XDRSET

Purpose To initialize a real or integer array to a value.

Syntax CALL XDRSET(VECTOR, NMOTS , VALEUR)

Author(s) G. Marleau

Description of parameters

VECTOR real array of dimension VECTOR(NMOTS) containing the vector to initialize.

NMOTS integer scalar variable containing the number of words to initialize.

VALEUR real scalar variable containing the reference initialization value.

22.2 Special Function Routines

22.2.1 AK0BES

Purpose To compute the Bessel function $K_0(x)$.

Syntax AK0BES=AK0BES(X)

Author(s) R. Roy

Description of input parameters

X double precision scalar variable containing the point x at which the Bessel function $K_0(x)$ is to be evaluated.

Description of output parameters

AK1BES double precision scalar variable containing $K_0(x)$.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.2.2 AK1BES

Purpose To compute the Bessel function $K_1(x)$.

Syntax AK1BES=AK1BES(X)

Author(s) R. Roy

Description of input parameters

X double precision scalar variable containing the point x at which the Bessel function $K_1(x)$ is to be evaluated.

Description of output parameters

AK1BES double precision scalar variable containing $K_1(x)$.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.2.3 AKIN10

Purpose To evaluate the Bickley functions $Ki_n(x)$ for n taking values from 1 to 10.

Syntax CALL AKIN10(X , AKIN)

Author(s) R. Roy

Description of input parameters

X double precision scalar variable containing the point x at which the Bickley functions are to be evaluated.

Description of output parameters

AKIN double precision array of dimension AKIN(10) containing $Ki_n(x)$ for $n = 1, 10$.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.2.4 TABEN

Purpose To compute $E_n(x)$, the exponential integral of order n .

Syntax TABEN =TABEN (L , X)

Author(s) R. Roy

Description of input parameters

L integer scalar variable the order $n=L$ of the exponential integral.

X real scalar variable the point x at which exponential integral $E_n(x)$. is to be evaluated

Description of output parameters

TABEN real scalar variable containing $E_n(x)$.

22.2.5 TABKI

Purpose To evaluate the Bickley functions $Ki_n(x)$ from quadratic tables.

Syntax TABKI =TABKI (L , X)

Author(s) R. Roy

Description of input parameters

L integer scalar variable containing the order $n=L$ of the Bickley function.

X real scalar variable containing the point x at which the Bickley function $Ki_n(x)$. is to be evaluated

Description of output parameters

TABKI real scalar variable containing $Ki_n(x)$.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.2.6 AFERF

Purpose To evaluate the error function $\text{erf}(x)$.

Syntax AFERF =AFERF (XX)

Author(s) R. Roy

Description of input parameters

XX real scalar variable containing the point x at which the error function is to be evaluated.

Description of output parameters

AFERF real scalar variable containing the value of the error function $\text{erf}(x)$ evaluated point at point x .

22.3 Double Precision Complex Algebra Routines

22.3.1 DCAABS

Purpose To evaluate the absolute value of a double precision complex variable.

Syntax CALL DCAABS(DRES , DCABS)

Author(s) G. Marleau

Description of parameters

DRES double precision scalar variable containing $Z = |X|$ where X is a double precision complex variable.

DCABS double precision array of dimension DCABS(2) containing the double precision complex variable X . The first element of DCABS contains the real part of X and the second element its imaginary part.

Called by

DRAGON routine(s) : ALGUER, ALPADE, ALPLSF, ALSBC , DCADIV, DCAPOW

22.3.2 DCADIV

Purpose To evaluate the inverse of a double precision complex variable.

Syntax CALL DCADIV(DCRES , DCDIV)

Author(s) G. Marleau

Description of parameters

DCRES double precision array of dimension DCRES(2) containing $Z = 1/X$ where X and Z are all double precision complex variable. The first element of DCRES contains the real part of Z and the second element its imaginary part.

DCDIV double precision array of dimension DCDIV(2) containing the double precision complex variable X . The first element of DCDIV contains the real part of X and the second element its imaginary part.

Called by

DRAGON routine(s) : ALGUER, ALPLSF, ALPOLY, ALSBC

Calling

DRAGON routine(s) :

UTILIB routine(s) : DCAABS

GANLIB routine(s) :

22.3.3 DCAPOW

Purpose To evaluate a double precision complex variable to a fixed power.

Syntax CALL DCAPOW(DCRES , DCROOT, DPOW)

Author(s) G. Marleau

Description of parameters

DCRES double precision array of dimension DCRES(2) containing $Z = X^Y$ where X , Y and Z are all double precision complex variable. The first element of DCRES contains the real part of Z and the second element its imaginary part.

DCROOT double precision array of dimension DCROOT(2) containing the double precision complex variable X . The first element of DCROOT contains the real part of X and the second element its imaginary part.

DPOW double precision scalar variable containing the double precision complex variable Y . The first element of DCPOW contains the real part of Y and the second element its imaginary part.

Called by

DRAGON routine(s) : ALGUER, ALROOT

Calling

DRAGON routine(s) :

UTILIB routine(s) : DCAABS

GANLIB routine(s) :

22.4 Polynomial Interpolation Routines

22.4.1 ALGUER

Purpose To find one root of a polynomial.

Syntax CALL ALGUER(A , M , X , ITS)

Author(s) A. Hébert

Description of input parameters

A double precision array of dimension A(2,M+1) with the first element being the real part of the polynomial coefficients and the second element being the imaginary part of the polynomial coefficients.

M integer scalar variable containing the polynomial order.

Description of output parameters

X double precision array of dimension X(2) containing the complex single root.

ITS integer scalar variable containing the number of iteration required to find this root.

Called by

DRAGON routine(s) : ALROOT

Calling

DRAGON routine(s) :

UTILIB routine(s) : DCAABS, DCADIV, DCAPOW

GANLIB routine(s) : XABORT

22.4.2 ALPADE

Purpose To compute the polynomial coefficients of a Pade collocation.

Syntax CALL ALPADE(NORIN , X , Y , EPSRID, NOR , A , B , PREC , IERR)

Author(s) A. Hébert

Description of parameters

NORIN integer scalar variable such that 2*NORIN+1 is the number of collocation point.

X real array of dimension X(0:2*NORIN) containing the abscissa of the collocation points.

Y real array of dimension Y(0:2*NORIN) containing the ordinates of the collocation points.

EPSRID double precision scalar variable containing the ϵ used in polynomial simplification.

LREAL logical scalar variable that is **.TRUE.** when we want to get rid of complex roots.

Description of output parameters

NOR	integer scalar variable containing the order of the polynomials.
A	double precision array of dimension A(0:NORIN) containing the polynomial coefficients of the numerator of the Pade approximation.
B	double precision array of dimension B(0:NORIN) containing the polynomial coefficients of the denominator of the Pade approximation.
PREC	real scalar variable containing the accuracy of the fit.
IERR	integer scalar variable containing the warning flag if the Pade collocation failed.

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALROOT, DCAABS

GANLIB routine(s) : XABORT

22.4.3 ALPLSF

Purpose To compute the polynomial coefficients of a Pade approximation using a direct least square procedure.

Syntax CALL ALPLSF(NORIN , X , Y , EPSRID, LREAL , NOR , A , B , PREC)

Author(s) A. Hébert

Description of input parameters

NORIN	integer scalar variable such that $2 \cdot \text{NORIN} + 1$ is the number of collocation point.
X	real array of dimension X(0:2*NORIN) containing the abscissa of the collocation points.
Y	real array of dimension Y(0:2*NORIN) containing the ordinates of the collocation points.
EPSRID	double precision scalar variable containing the ϵ used in polynomial simplification.
LREAL	logical scalar variable that is <code>.TRUE.</code> when we want to get rid of complex roots.

Description of output parameters

NOR	integer scalar variable containing the order of the polynomials.
A	double precision array of dimension A(0:NORIN) containing the polynomial coefficients of the numerator of the Pade approximation.
B	double precision array of dimension B(0:NORIN) containing the polynomial coefficients of the denominator of the Pade approximation.
PREC	real scalar variable containing the accuracy of the fit.

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALROOT, ALSVDF, ALSVDS, DCAABS, DCADIV

GANLIB routine(s) : XABORT

22.4.4 ALPOLY

Purpose To find the partial fraction representation of a polynomial.

Syntax CALL ALPOLY(B , NOR , ROOTS , DENOM , COEF)

Author(s) A. Hébert

Description of input parameters

B double precision array of dimension B(0:NOR) containing the polynomial coefficients of the denominator of the Pade approximation.

NOR integer scalar variable containing the polynomial order.

ROOTS double precision array of dimension ROOTS(2,NOR+1) containing the complex double precision roots.

Description of output parameters

DENOM complex array of dimension DENOM(NOR+1) containing the complex roots.

COEF complex array of dimension COEF(NOR+1) containing the complex expansion coefficients.

Calling

DRAGON routine(s) :

UTILIB routine(s) : DCADIV

GANLIB routine(s) :

22.4.5 ALROOT

Purpose To find the complex double precision roots of a polynomial.

Syntax CALL ALROOT(A , M , ROOTS)

Author(s) A. Hébert

Description of input parameters

A double precision array of dimension A(M+1) containing the polynomial coefficients.

M integer scalar variable containing the polynomial order.

Description of output parameters

ROOTS double precision array of dimension ROOTS(2,M) containing the complex double precision roots of the polynomial.

Called by

DRAGON routine(s) : ALPADE, ALPLSF

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGUER, DCAPOW

GANLIB routine(s) : XABORT

22.4.6 AIKINT

Purpose To perform an Aiken interpolation.

Syntax AIKINT=AIKINT(Z , X , Y , N , EPS)

Author(s) E. G. Long (WIMS–AECL routine)

Description of input parameters

Z real scalar variable containing the interpolation point z .
X real array of dimension X(N) containing the table of points x at which the function is tabulated.
Y real array of dimension Y(N) containing the value of the function $y(x)$ at points x .
N integer scalar variable containing the number of tabulated points.
EPS real scalar variable containing the interpolation error permitted.

Description of output parameters

AIKINT real scalar variable containing the interpolated function $y(z)$.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.4.7 ALDFIT

Purpose To performs linear least squares fitting to a polynomial of a specified order in one independent variable using the Forsythe method.

Syntax CALL ALDFIT(N , MA , X , Y , W , PARAM , GAMMA , POLY , PP)

Author(s) A. Hébert

Description of input parameters

N integer scalar variable number of data points.
MA integer scalar variable the order of the polynomial.
X double precision array of dimension X(N) containing the array of values of independent variable.
Y double precision array of dimension Y(N) containing the array of values of dependent variable.
W double precision array of dimension W(N) containing the array of weights.

Description of output parameters

PARAM double precision array of dimension PARAM(0:MA) containing the coefficients of the fitted polynomial.

Description of work parameters

GAMMA double precision array of dimension GAMMA(MA,3) used for temporary storage.

POLY double precision array of dimension POLY(N,0:2) used for temporary storage.

PP double precision array of dimension PP(0:MA,0:2) used for temporary storage.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.5 Quadrature Routines*22.5.1 ALCACT*

Purpose To generate polar quadrature sets.

Syntax CALL ALCACT(LCACT , NG , XG , WG)

Author(s) R. Roy

Description of input parameters

LCACT integer scalar variable containing the type of quadrature where:

- LCACT=1 imply equal weight quadrature sets;
- LCACT=2 imply uniform angles quadrature sets;
- LCACT=3 imply optimal quadrature sets for Bickley functions.

NG integer scalar variable containing the number of integration points.

Description of output parameters

XG real array of dimension XG(NG) containing the integration points.

WG real array of dimension WG(NG) containing the integration weights.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.5.2 ALGJP

Purpose To compute Gauss-Jacobi integration points and weights for integration between 0.0 and 1.0 to the order specified.

Syntax CALL ALGJP (NGPT , ZJKSI , WJKSI)

Author(s) R. Roy

Description of input parameters

NGPT integer scalar variable containing the number of points.

Description of output parameters

ZJKSI real array of dimension ZJKSI(*) containing the integration points.

WJKSI real array of dimension WJKSI(*) containing the integration weights.

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALGPT

GANLIB routine(s) :

22.5.3 ALGPT

Purpose To compute Gauss integration points and weights for integration limits and to the order specified.

Syntax CALL ALGPT (NGPT , XINF , XSUP , ZGKSI , WGKSI)

Author(s) R. Roy

Description of input parameters

NGPT integer scalar variable containing the number of points.

XINF real scalar variable containing the lower integration limit.

XSUP real scalar variable containing the upper integration limit.

Description of output parameters

ZGKSI real array of dimension ZGKSI(*) containing the integration points.

WGKSI real array of dimension WGKSI(*) containing the integration weights.

Called by

DRAGON routine(s) : ALGJP

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.6 Linear Algebra Routines

22.6.1 ALDERV

Purpose To compute the numerical derivation of an array of values using the order 4 Ceschino method (compatible with cubic splines).

Syntax CALL ALDERV(N , X , Y , WK)

Author(s) A. Hébert

Description of input parameters

N integer scalar variable containing the number of points.

X real array of dimension X(*) containing the abscissas x .

Y real array of dimension Y(*) containing the ordinates $y(x)$.

Description of output parameters

WK real array of dimension WK(2,*) containing the derivatives $y'(x)$.

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.6.2 ALEIGD

Purpose To find the fundamental eigenvalue λ and corresponding eigenvector $\vec{\phi}$ of equation $(A - \lambda B)\vec{\phi} = 0$ using the inverse power method.

Syntax CALL ALEIGD(A , B , N , EVAL , EJECT , EPS , ITER , GAR , IND)

Author(s) A. Hébert

Description of input parameters

A double precision array of dimension A(N,*) containing the matrix A .

B double precision array of dimension B(N,*) containing the matrix B .

N integer scalar variable containing the dimension of matrices A and B .

EVAL double precision scalar variable containing the fundamental eigenvalue λ .

EJECT double precision array of dimension EJECT(*) containing the initial estimate and converged value of eigenvector $\vec{\phi}$.

EPS double precision scalar variable containing the stopping criterion.

ITER integer scalar variable containing the number of iterations.

Description of work parameters

GAR double precision array of dimension GAR(*) containing the used for temporary storage.
 IND integer array of dimension IND(N) containing the used for temporary storage.

Calling

DRAGON routine(s) :

UTILIB routine(s) : ALINVD

GANLIB routine(s) : XABORT

22.6.3 ALDLFV

Purpose To perform an in-place LDL^T factorization of a symmetric positive definite matrix A of dimension N in compressed diagonal storage mode.

Syntax CALL ALDLFV(NG , L4 , ASS , MU1 , T)

Author(s) A. Hébert

Description of input/output parameters

NG integer scalar variable containing the dimensions of the coefficient matrix.
 L4 integer scalar variable containing the order N of the coefficient matrix.
 ASS double precision array of dimension ASS(NG,*) containing at input. the coefficient matrix in compressed diagonal and at output the LDL^T factors of the coefficient matrix in compressed diagonal storage.
 MU1 integer array of dimension MU1(*) containing the position of each diagonal element in vector ASS.

Description of work parameters

T double precision array of dimension T(NG,2) used for temporary storage.

22.6.4 ALDLSV

Purpose To solve a system of equations involving an operator A that has been factorized using ALDLFV.

Syntax CALL ALDLSV(NG , L4 , MU1 , ASS , F , T)

Author(s) A. Hébert

Description of parameters

NG integer scalar variable containing the number of system to solve.
 L4 integer scalar variable containing the order N of the coefficient matrix.
 MU1 integer array of dimension MU1(*) containing the position of each diagonal element in vector ASS.

ASS double precision array of dimension ASS(NG,*) containing the LDL^T factors of the coefficient matrix in compressed diagonal storage mode.

F double precision array of dimension F(NG,*) containing the right-hand sides of linear systems.

Description of work parameters

T double precision array of dimension T(NG,2) used for temporary storage.

22.6.5 ALINV

Purpose To perform an in-place inversion of a non singular single precision matrix using Gaussian elimination with partial pivoting.

Syntax CALL ALINV (N , A , MAX , IER , IND)

Author(s) A. Hébert

Description of input parameters

N integer scalar variable containing the order of the coefficient matrix.

A real array of dimension A(MAX,*) containing the coefficient matrix to be inverted.

MAX integer scalar variable containing the first dimension of the coefficient matrix.

Description of output parameters

IER integer scalar variable containing the error flag.

Description of work parameters

IND integer array of dimension IND(*) used for temporary storage.

22.6.6 ALINVD

Purpose To perform an in-place inversion of a non singular double precision matrix using Gaussian elimination with partial pivoting.

Syntax CALL ALINVD(N , A , MAX , IER , IND)

Author(s) A. Hébert

Description of input parameters

N integer scalar variable containing the order of the coefficient matrix.

A double precision array of dimension A(MAX,*) containing the coefficient matrix to be inverted.

MAX integer scalar variable containing the first dimension of the coefficient matrix.

Description of output parameters

IER integer scalar variable containing the error flag.

Description of work parameters

IND integer array of dimension IND(*) used for temporary storage.

Called by

DRAGON routine(s) : ALEIGD

22.6.7 ALLDLF

Purpose To LDL^T factorize in place a symmetric positive definite single precision matrix in compressed diagonal storage mode.

Syntax CALL ALLDLF(L4 , ASS , MU1)

Author(s) A. Hébert

Description of parameters

L4 integer scalar variable containing the order of the coefficient matrix.

ASS real array of dimension ASS(*) containing the coefficient matrix in compressed diagonal storage mode.

MU1 integer array of dimension MU1(*) containing the position of each diagonal element in vector ASS.

22.6.8 ALLDLM

Purpose To multiply of a symmetric single precision matrix in compressed diagonal storage mode by a vector.

Syntax CALL ALLDLM(L4 , ASS , VEC , Z , MU1 , ITY)

Author(s) A. Hébert

Description of parameters

L4 integer scalar variable containing the order of the coefficient matrix.

ASS real array of dimension ASS(*) containing the coefficient matrix in compressed diagonal storage mode.

VEC real array of dimension VEC(*) containing the vector to multiply.

Z real array of dimension Z(*) containing the initial value of Z at input if ITY=2 and the solution of the multiplication at output.

MU1 integer array of dimension MU1(*) containing the position of each diagonal element in vector ASS.

ITY integer scalar variable containing the multiplication type flag where:

- ITY=1 is for the product of ASS and VEC;
- ITY=2 is for $Z+(ASS-DIAG(ASS))*VEC$.

22.6.9 ALLDLS

Purpose To solve a symmetric linear system where the single precision coefficient matrix have been LDL^T factorized using ALLDLF.

Syntax CALL ALLDLS(L4 , MU1 , ASS , F)

Author(s) A. Hébert

Description of input parameters

L4 integer scalar variable containing the order of the coefficient matrix.

MU1 integer array of dimension MU1(*) containing the position of each diagonal element in vector ASS.

ASS real array of dimension ASS(*) containing the LDL^T factors of the coefficient matrix in compressed diagonal storage mode.

VEC real array of dimension VEC(*) containing the vector to multiply.

Description of output parameters

F real array of dimension F(*) containing the solution of the linear system.

22.6.10 ALLUF

Purpose To LU factorize a general positive definite single precision matrix in compressed diagonal storage mode.

Syntax CALL ALLUF (L4 , ASS , MU1 , IMA)

Author(s) A. Hébert

Description of parameters

L4 integer scalar variable containing the order of the coefficient matrix.

ASS real array of dimension ASS(*) containing the coefficient matrix in compressed diagonal storage mode.

MU1 integer array of dimension MU1(*) containing the position of each diagonal element in vector ASS.

IMA integer array of dimension IMA(*) containing the position of the first non-zero column element in vector ASS.

22.6.11 ALLUM

Purpose To multiply of a general single precision matrix in compressed diagonal storage mode by a vector.

Syntax CALL ALLUM (L4 , ASS , VEC , Z , MU1 , IMA)

Author(s) A. Hébert

Description of parameters

L4	integer scalar variable containing the order of the coefficient matrix.
ASS	real array of dimension ASS(*) containing the coefficient matrix in compressed diagonal storage mode.
VEC	real array of dimension VEC(*) containing the vector to multiply.
Z	real array of dimension Z(*) containing the result of the multiplication.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in vector ASS.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in vector ASS.

22.6.12 ALLUS

Purpose To solve a single precision system of equations that has been *LU* factorize using ALLUF.

Syntax CALL ALLUS (L4 , MU1 , IMA , ASS , F)

Author(s) A. Hébert

Description of input parameters

L4	integer scalar variable containing the order of the coefficient matrix.
MU1	integer array of dimension MU1(*) containing the position of each diagonal element in vector ASS.
IMA	integer array of dimension IMA(*) containing the position of the first non-zero column element in vector ASS.
ASS	real array of dimension ASS(*) containing the <i>LU</i> factors of the coefficient matrix in compressed diagonal storage mode.

Description of output parameters

F	real array of dimension Z(*) containing the solution of the linear system.
---	--

22.6.13 ALSB

Purpose To solve a linear system of single precision real equations using Gaussian elimination with partial pivoting.

Syntax CALL ALSB (N , IS , B , IER , MAX)

Author(s) A. Hébert

Description of parameters

N	integer scalar variable containing the order of the coefficient matrix.
IS	integer scalar variable containing the number of right hand vectors.
B	real array of dimension B(MAX,*) containing the augmented coefficient matrix and the augmented solution matrix.

IER integer scalar variable containing the error flag such that the matrix is singular if $IER \neq 0$.
 MAX integer scalar variable containing the first dimension of the augmented coefficient matrix.

22.6.14 ALSBC

Purpose To solve a linear system of double precision complex equations using Gaussian elimination with partial pivoting.

Syntax CALL ALSBC (N , IS , B , IER , MAX)

Author(s) A. Hébert

Description of parameters

N integer scalar variable containing the order of the coefficient matrix.
 IS integer scalar variable containing the number of right hand vectors.
 B complex double precision array of dimension B(MAX,*) containing the augmented coefficient matrix and the augmented solution matrix.
 IER integer scalar variable containing the error flag such that the matrix is singular if $IER \neq 0$.
 MAX integer scalar variable containing the first dimension of the augmented coefficient matrix.

Calling

DRAGON routine(s) :

UTILIB routine(s) : DCAABS, DCADIV

GANLIB routine(s) :

22.6.15 ALSBD

Purpose To solve a linear system of double precision real equations using Gaussian elimination with partial pivoting.

Syntax CALL ALSBD (N , IS , B , IER , MAX)

Author(s) A. Hébert

Description of parameters

N integer scalar variable containing the order of the coefficient matrix.
 IS integer scalar variable containing the number of right hand vectors.
 B double precision array of dimension B(MAX,*) containing the augmented coefficient matrix and the augmented solution matrix.
 IER integer scalar variable containing the error flag such that the matrix is singular if $IER \neq 0$.
 MAX integer scalar variable containing the first dimension of matrix the augmented coefficient matrix.

22.6.16 ALSVDF

Purpose To perform a singular value decomposition of a linear system matrix.

Syntax CALL ALSVDF(A , M , N , MP , NP , W , V , RV1)

Author(s) A. Hébert

Description of input/output parameters

A double precision array of dimension A(MP,NP) containing the matrix to decompose on input and the first decomposed matrix on output.

M integer scalar variable containing the first dimension of matrix to decompose.

N integer scalar variable containing the second dimension of matrix to decompose.

MP integer scalar variable containing the first physical dimension of matrix to decompose.

NP integer scalar variable containing the second physical dimension of matrix to decompose.

W double precision array of dimension W(NP) containing the singular value.

V double precision array of dimension V(NP,NP) containing the second decomposed matrix.

Description of work parameters

RV1 double precision array of dimension RV1(NP) used for temporary storage.

Called by

DRAGON routine(s) : ALPLSF

Calling

DRAGON routine(s) :

UTILIB routine(s) :

GANLIB routine(s) : XABORT

22.6.17 ALSVDS

Purpose To solve a linear equation involving an ALSVDF singular value decomposition of the system matrix.

Syntax CALL ALSVDS(U , W , V , M , N , MP , NP , B , X , TMP)

Author(s) A. Hébert

Description of input/output parameters

U double precision array of dimension U(MP,NP) containing first decomposed matrix.

W double precision array of dimension W(NP) containing the singular value.

V double precision array of dimension V(NP,NP) containing the second decomposed matrix.

M integer scalar variable containing the first dimension of decomposed matrix.

N integer scalar variable containing the second dimension of decomposed matrix.
 MP integer scalar variable containing the first physical dimension of decomposed matrix.
 NP integer scalar variable containing the second physical dimension of decomposed matrix.
 B double precision array of dimension B(MP) containing the source vector.
 X double precision array of dimension X(NP) containing the solution vector.

Description of work parameters

TMP double precision array of dimension TMP(NP) used for temporary storage.

Called by

DRAGON routine(s) : ALPLSF

22.7 PostScript Routines

Most of these subroutines were adapted with permission from the PSPLLOT FORTRAN library from Nova Southeastern University.^[6]

22.7.1 PSCPUT

Purpose To transfer command line to file.

Syntax CALL PSCPUT(ISPSP , CMDSTR)

Author(s) Adapted from routine FILLER in PSPLLOT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

CMDSTR character*132 scalar variable containing the PostScript command line.

Called by

DRAGON routine(s) : PSCUTP, PSFARC, PSFCIR, PSFILL, PSFRAI, PSFREG, PSHEAD, PSLINW, PSMOVE, PSPAGE, PSSARC, PSSCIR, PSSRAI, PSSREG, PSTEXT

22.7.2 PSCUTP

Purpose To cut a PostScript page.

Syntax CALL PSCUTP(ISPSP)

Author(s) G. Marleau

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.3 PSFARC

Purpose To fill an arc from a circle.

Syntax CALL PSFARC(ISPSP , XYCENT, RADIUS, ANGR)

Author(s) Adapted from routine ARC in PSPLLOT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

XYCENT real array of dimension XYCENT(2) containing the (x, y) position at which the circle is centered.

RADIUS real scalar variable containing the radius of the circle to fill.

ANGR real array of dimension ANGR(2) containing the angles covering the arc of circle.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.4 PSFCIR

Purpose To fill a circle.

Syntax CALL PSFCIR(ISPSP , XYCENT, RADIUS)

Author(s) Adapted from routine CIRCLE in PSPLLOT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

XYCENT real array of dimension XYCENT(2) containing the (x, y) position at which the circle is centered.

RADIUS real scalar variable containing the radius of the circle to fill.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.5 PSFILL

Purpose To define gray level or color fill pattern.

Syntax CALL PSFILL(ISPSP , IFILL , GRYCOL)

Author(s) G. Marleau

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

IFILL integer scalar variable containing the fill type where:

- IFILL=1 indicates that GRAY levels are provided;
- IFILL=2 indicates that RGB color patterns are provided;
- IFILL=3 indicates that CMYK color patterns are provided;
- IFILL=4 indicates that HSB color patterns are provided.

GRYCOL real array of dimension GRYCOL(4) containing the gray level or color intensity.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.6 PSFRAI

Purpose To fill rectangular/annular intersection.

Syntax CALL PSFRAI(ISPSP , NSEG , IORDER, CENTER, RADANG)

Author(s) G. Marleau

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

NSEG integer scalar variable containing the number of line segments +1.

IORDER integer array of dimension IORDER(NSEG) containing the type of line segment following a specific point where:

- IORDER=-2 means that an arc begins;
- IORDER=-1 means that an arc ends;
- IORDER=0 means that a the set of line segments form a closed path;
- IORDER=1 means that a line segments begins.

CENTER real array of dimension CENTER(2) containing the (x, y) position at which the circle is centered.

RADANG real array of dimension RADANG(2,NSEG) containing the segment (x, y) intersection points with respect to the annular region center at which the circle is centered.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT, PSMOVE

GANLIB routine(s) :

22.7.7 PSFREG

Purpose To fill a figure represented by line segments.

Syntax CALL PSFREG(ISPSP , NPTS , XYPTS)

Author(s) Adapted from routine FILRGNC in PSPLIT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

NPTS integer scalar variable containing the number of line segments + 1.

XYPTS real array of dimension XYPTS(2,NPTS) containing the (x, y) points defining the line segments.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.8 PSHEAD

Purpose To create PostScript file header.

Syntax CALL PSHEAD(ISPSP , NAMPS, PROGNM)

Author(s) Adapted from routine PSINIT in PSPLIT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

NAMPS character*12 scalar variable containing the PostScript file name.

PROGNM character*6 scalar variable containing the calling program name.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.9 PSLINW

Purpose To set PostScript line width

Syntax CALL PSLINW(ISPSP , WLINE)

Author(s) Adapted from routine SETLW in PSPLLOT package.

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

WLINE real scalar variable containing the width of the line.

Called by

DRAGON routine(s) : PSPAGE

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.10 PSMOVE

Purpose To move the reference point of the plot.

Syntax CALL PSMOVE(ISPSP , XYPOS , ITMOVE)

Author(s) Adapted from routine PLOT in PSPLLOT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

XYPOS real array of dimension XYPOS(2) containing the (x, y) position of the new reference point.

ITMOVE integer scalar variable containing the type of displacement.

Called by

DRAGON routine(s) : PSFRAI, PSPAGE, PSSRAI

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.11 PSPAGE

Purpose To define a new PostScript page.

Syntax CALL PSPAGE(ISPSP , NPAGE , XYPOS)

Author(s) Adapted from routine CHOPIT in PSPLIT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

NPAGE integer scalar variable containing the page number.

XYPOS real array of dimension XYPOS(2) containing (x, y) origin of the page.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT, PSLINW, PSMOVE

GANLIB routine(s) :

22.7.12 PSSARC

Purpose To draw an arc from a circle.

Syntax CALL PSSARC(ISPSP , XYCENT, RADIUS, ANGR)

Author(s) Adapted from routine ARC in PSPLIT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

XYCENT real array of dimension XYCENT(2) containing the (x, y) position at which the circle is centered.

RADIUS real scalar variable containing the radius of the circle to draw.

ANGR real array of dimension ANGR(2) containing the angles covering the arc of circle.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.13 PSSCIR

Purpose To draw a circle

Syntax CALL PSSCIR(ISPSP , XYCENT, RADIUS)

Author(s) Adapted from routine CIRCLE in PSPLIT package.

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

XYCENT real array of dimension XYCENT(2) containing the (x, y) position at which the circle is centered.

RADIUS real scalar variable containing the radius of the circle to draw.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.14 PSSRAI

Purpose To draw rectangular/annular intersection.

Syntax CALL PSSRAI(ISPSP , NSEG , IORDER, CENTER, RADANG)

Author(s) G. Marleau

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.

NSEG integer scalar variable containing the number of line segments +1.

IORDER integer array of dimension IORDER(NSEG) containing the type of line segment following a specific point where:

- IORDER=-2 means that an arc begins;
- IORDER=-1 means that an arc ends;
- IORDER=0 means that a the set of line segments form a closed path;
- IORDER=1 means that a line segments begins.

CENTER real array of dimension CENTER(2) containing the (x, y) position at which the circle is centered.

RADANG real array of dimension RADANG(2,NSEG) containing the segment (x, y) intersection points with respect to the annular region center at which the circle is centered.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT, PSMOVE

GANLIB routine(s) :

22.7.15 PSSREG

Purpose To draw a figure represented by line segments.

Syntax CALL PSSREG(ISPSP , NPTS , XYPTS)

Author(s) Adapted from routine FILRGNC in PSPLOT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.
 NPTS integer scalar variable containing the number of line segments + 1.
 XYPTS real array of dimension XYPTS(2,NPTS) containing the (x, y) points defining the line segments.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

22.7.16 PSTEXT

Purpose To print PostScript text.

Syntax CALL PSTEXT(ISPSP , NBCAR , TEXT , XYPOS , HEIGHT, JUST , ANGL)

Author(s) Adapted from routine KELSYMC in PSPLOT package

Description of parameters

ISPSP integer scalar variable containing the PostScript output file unit.
 NBCAR integer scalar variable containing the number of character to print.
 TEXT character*(*) scalar variable containing the text to print.
 XYPOS real array of dimension XYPOS(2) containing the (x, y) position of text.
 HEIGHT real scalar variable containing the text height.
 JUST integer scalar variable containing the justification where:

- JUST=0 is for centered text;
- JUST=1 is for left justified text;
- JUST=2 is for right justified text.

ANGL real scalar variable containing the text rotation angle.

Calling

DRAGON routine(s) :

UTILIB routine(s) : PSCPUT

GANLIB routine(s) :

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INDEX

A

AFERF , 469
 AIKINT, 474
 AK0BES, 467
 AK1BES, 467
 AKIN10, 468
 ALCACT, 475
 ALDERV, 477
 ALDFIT, 474
 ALDLFV, 478
 ALDLSV, 478
 ALEIGD, 477
 ALGJP , 476
 ALGPT , 476
 ALGUER, 471
 ALINV , 479
 ALINVD, 479
 ALLDLF, 480
 ALLDLM, 480
 ALLDLS, 481
 ALLUF , 481
 ALLUM , 481
 ALLUS , 482
 ALPADE, 471
 ALPLSF, 472
 ALPOLY, 473
 ALROOT, 473
 ALSB , 482
 ALSBC , 483
 ALSBD , 483
 ALSVDF, 484
 ALSVDS, 484
 ASM, 7
 ASM: , i, vi, 7, 183, 374
 ASMDRV, 183
 ASMPIJ, 175, 176, 178, 183, 184, 188, 201, 220–222,
 247–249, 254, 260, 261, 267, 268, 271,
 272, 274, 278, 280, 283, 289, 293, 295,
 307, 309–311, 337, 340, 374, 376, 379

B

B, 302, 303
 B1BETA, 301
 B1DIF , 301
 B1HOM , 303
 B1HXS1, 305
 B1HXS2, 305
 B1HXS3, 305
 B1SOL , 307
 BIVACT, 382

BIVCOL, 382
 BIVDFH, 383
 BIVDKN, 384
 BIVF2D, 385
 BIVF2H, 387
 BIVFSH, 388
 BIVFSO, 389
 BIVG2D, 390
 BIVG2H, 392
 BIVGSH, 393
 BIVGSO, 394
 BIVPKN, 395
 BIVPRH, 396
 BIVSBH, 397
 BIVTRK, 398
 BURNUP, 149, 150, 401, 405, 419

C

CFC, 10
 CFC: , xi, 9, 429
 CFCDRV, 429
 CFCFBM, 431
 CLSIND, 464
 COMPLETE, 69, 71, 72
 CPO, 9
 CPO, 9, 419–422, 424, 425, 431, 433
 CPO: , x, 9, 419
 CPODRV, 419
 CPOISO, 421
 CPOMAR, 423
 CPOMAW, 424
 CPOMIC, 425
 CPOREM, 426
 CROWH1, 232
 CROWH2, 232
 CROWR1, 233
 CROWR2, 234

D

DCAABS, 469
 DCADIV, 469
 DCAPOW, 470
 DEPLIT, 69
 DIFF, 302, 303
 DUTURN, 69

E

EDI, 8
 EDI: , i, ix, 8, 337
 EDIBAL, 338

EDIDEL, 339
 EDIDRV, 340
 EDIDST, 343
 EDIDTX, 345
 EDIENE, 349
 EDIGET, 350
 EDIHFC, 352
 EDIISO, 354
 EDILBD, 356
 EDIMIC, 356
 EDIMPR, 359
 EDIMRR, 359
 EDIMXS, 360
 EDIPRR, 361
 EDIPXS, 363
 EDIRAT, 366
 EDISCT, 366
 EDISTA, 369
 EDITING, 337, 338, 340, 342, 343, 345, 351, 352,
 354, 356, 363, 370, 374–376, 419–423, 425
 EDITIS, 369
 EDITXS, 370
 EDIUPS, 371
 EVO, 9
 EVO:, x, 9, 401
 EVOBLD, 401
 EVODPL, 404
 EVODRV, 405
 EVOGET, 407
 EVOKAP, 408
 EVOODE, 409
 EVOPRE, 410
 EVORCP, 411
 EVORK, 413
 EVORK4, 414
 EVORRE, 415
 EVOSAT, 416
 EXCELL:, viii, 7, 247
 EXCELP, 188
 EXCELT, 5
 EXCELT:, iii, 5, 7, 10, 11, 17, 40, 41, 183

F

FLU, 8
 FLU:, i, viii, 8, 267
 FLUACV, 268
 FLUADN, 270
 FLUALB, 271
 FLUASR, 272
 FLUBAL, 274
 FLUBLN, 276
 FLUDB2, 278

FLUDRV, 280
 FLUFUI, 283
 FLUGET, 284
 FLUGFL, 286
 FLUGPI, 287
 FLUINR, 289
 FLULBD, 292
 FLUQFB, 293
 FLUQFC, 293
 FLUQFE, 295
 FLUQFS, 298
 FLUQFX, 299
 FLURFL, 299
 FLUSFL, 300
 FLUXUNK, 267, 270, 280, 282, 284, 286, 289, 295,
 300, 318, 328, 331, 334, 337, 340, 345,
 374, 375, 378

G

GEO, 4
 GEO:, iii, 4, 13
 GEOIN1, 13
 GEOIN2, 14
 GEOIN3, 14
 GEOMETRY, 13–15, 17, 18, 22, 26, 28, 34, 40, 41,
 46, 48, 54–56, 64, 66, 70, 71, 75–77, 82,
 84, 85, 87, 89, 91, 93–95, 97, 247, 248,
 254, 337, 340, 374, 377, 378, 398, 447,
 457–459
 GUCTOI, 463
 GUITOC, 463
 GXSDIM, 464
 GXSGET, 460
 GXINI, 459
 GXSPUT, 461

I

INF, 10
 INFAPL, 435
 INFDR, 436
 INFO:, xi, 10, 435
 INFTR1, 436
 INFTR2, 437
 INFWAT, 437
 INFWD4, 438
 INFWM, 439

J

JPM2, 225
 JPM3, 226
 JPM4, 227
 JPMA, 220
 JPMASB, 222

JPMCP , 223
 JPMDIS, 224
 JPMDIT, 228
 JPMEUR, 82
 JPMF , 310
 JPMFLX, 312
 JPMG2 , 84
 JPMG3 , 85
 JPMGEO, 87
 JPMGG , 89
 JPMGR1, 229
 JPMGR2, 230
 JPMP , 221
 JPMPRF, 90
 JPMRES, 313
 JPMS , 311
 JPMT, 5
 JPMT: , iv, 5, 75, 81, 184
 JPMTRK, 91

K

K, 302, 303
 KELMRG, 18
 KELRNG, 19
 KELSYM, 20

L

L, 302, 303
 LDRASS, 457
 LDRASS, 457
 LDRCEL, 458
 LDRGEO, 458
 LELCHK, 21
 LELCRN, 22
 LHXUNH, 70
 LIB, 6
 LIB: , i, v, 6, 127
 LIBAPL, 128
 LIBBAS, 130
 LIBCMB, 131
 LIBCON, 132
 LIBDEN, 133
 LIBDEP, 135
 LIBDRA, 135
 LIBDRB, 136
 LIBDRC, 138
 LIBEAD, 138
 LIBEDR, 140
 LIBEIR, 140
 LIBENI, 141
 LIBENR, 141
 LIBEPR, 142

LIBEWI, 143
 LIBEWR, 143
 LIBFIS, 144
 LIBINP, 145
 LIBLAG, 147
 LIBLEX, 147
 LIBLIB, 147
 LIBMAC, 149
 LIBMFE, 150
 LIBMIX, 151
 LIBNRG, 152
 LIBRARY, 454
 LIBSEC, 152
 LIBTE2, 153
 LIBTER, 154
 LIBTR1, 155
 LIBTR2, 156
 LIBWD4, 158
 LIBWED, 160
 LIBWET, 161
 LIBWID, 161
 LIBWIM, 162
 LIBWRE, 163
 LIBWRG, 164
 LIBWRI, 165
 LIBWRP, 166
 LIBWSC, 167
 LIBWTE, 168

M

MAC, 6
 MAC: , v, 6, 111
 MACDRV, 111
 MACEFI, 112
 MACIXS, 113
 MACNFI, 114
 MACNXS, 116
 MACPRM, 117
 MACPXS, 118
 MACRDM, 120
 MACROLIB, 111–113, 115–124, 133, 134, 172, 180,
 183, 184, 247, 249, 267, 268, 270, 272,
 274, 277, 280, 289, 294, 295, 298, 299,
 303, 305, 331, 337, 341, 346, 347, 364,
 366, 374, 376, 378, 459–461
 MACROLIB., 122
 MACUPD, 121
 MACWXS, 122
 MACXSR, 123
 MESHST, 71
 MICROLIB, 128, 133, 135, 137, 144, 145, 148–152,
 155, 157, 158, 160, 162, 171, 180, 183,

184, 247, 249, 267, 268, 270, 272, 274,
277, 280, 289, 294, 295, 298, 299, 303,
305, 331, 337, 340, 341, 346, 347, 352,
356, 364, 366, 401, 405, 415, 454, 456

MOC, 8
MOC2AC, 315
MOC2BL, 316
MOC2BN, 317
MOC2DR, 318
MOC2HM, 322
MOC2IO, 323
MOC2I1, 324
MOC2KF, 326
MOC2MH, 326
MOC2WR, 328
MOC3IO, 329
MOC3I1, 330
MOCC:, ix, 8, 315
MOCDRV, 331
MOCGFL, 334
MOCIK3, 335
MOCRWD, 335
MOC SOL, 335
MODULE, 4
MRG, 10
MRG:, xi, 10, 441
MRGGET, 441
MRGLIN, 442
MRGVOL, 442
MRGVST, 443

N

NEIG10, 104
NEIG11, 104
NEIGH1, 104
NEIGH2, 104
NEIGH3, 104
NEIGH4, 104
NEIGH5, 104
NEIGH6, 104
NEIGH7, 104
NEIGH8, 104
NEIGH9, 104
NEIGHB, 103
NUMER3, 98
NUMER4, 99
NUMERC, 101
NUMERH, 102

O

OPNIND, 464

P

PIJAAA, 189
PIJABC, 190
PIJCMP, 191
PIJCPL, 185
PIJI2D, 191
PIJI3D, 193
PIJKST, 193
PIJNOS, 186
PIJNRM, 186
PIJRDG, 194
PIJRGL, 195
PIJRHL, 195
PIJRN1, 196
PIJS2D, 197
PIJS3D, 198
PIJSMD, 187
PIJWPR, 199
PSCPUT, 485
PSCUTP, 485
PSFARC, 486
PSFCIR, 486
PSFILL, 487
PSFRAI, 487
PSFREG, 488
PSHEAD, 488
PSLINW, 489
PSMOVE, 489
PSP, 11
PSP:, xi, 11, 445, 447
PSPAGE, 490
PSPCOL, 445
PSPFIL, 446
PSPGEO, 446
PSPGET, 447
PSPLEG, 447
PSPRAI, 448
PSPTRK, 449
PSPXCG, 450
PSPXEL, 451
PSSARC, 490
PSSCIR, 490
PSSRAI, 491
PSSREG, 491
PSTEXT, 492

Q

QIJABC, 255
QIJCMP, 256
QIJCPL, 257
QIJI3D, 258
QIJNOS, 259

QIJNRM, 259
 QIJPRL, 260
 QIJPRT, 261
 QIJRDG, 261
 QIJRGL, 262
 QIJRHL, 262
 QIJRNL, 263
 QIJSMD, 264
 QIJWPR, 265

R

R120, 69, 71, 72
 R180, 69, 71, 72
 RADIUS, 54–56
 RDB, 431
 READ3D, 93
 READBH, 94
 READEU, 95
 READMT, 97
 RECT1, 234
 RECT2, 235
 REDIND, 464

S

S30, 69, 71, 72
 S90, 69, 71, 72
 SA180, 69, 71, 72
 SA60, 69, 71, 72
 SB180, 69, 71, 72
 SB60, 69, 71, 72
 SHELL1, 235
 SHELL2, 236
 SHI, 7
 SHI :, i, vi, 6, 171
 SHIDAN, 173
 SHIDRV, 171
 SHIJPM, 175
 SHIPIJ, 176
 SHIPST, 178
 SHIRAT, 179
 SHISN2, 180
 SLAB, 237
 SPHDIF, 372
 SPHDRV, 374
 SPHEQU, 375
 SPHGEO, 377
 SPHREF, 378
 SPHTRA, 380
 SPLIT0, 105
 SYBALC, 202
 SYBALP, 203
 SYBALS, 203

SYBCP1, 204
 SYBCP2, 205
 SYBEUR, 77
 SYBHN1, 205
 SYBHN2, 206
 SYBHT1, 207
 SYBHT2, 208
 SYBHTK, 78
 SYBILP, 201
 SYBILT, 5
 SYBILT :, iv, 5, 75
 SYBPRX, 209
 SYBRN1, 210
 SYBRN2, 211
 SYBRTK, 79
 SYBRX2, 211
 SYBRX3, 213
 SYBRX4, 214
 SYBRX5, 216
 SYBRXE, 217
 SYBTRK, 75

T

TABEN, 468
 TABKI, 468
 TRACKING, 17, 21, 28, 46, 53, 64, 65, 70, 71, 75, 76,
 87, 91, 171, 175, 177, 178, 180, 183, 188,
 201, 204, 205, 220, 221, 224, 228, 247,
 248, 254, 267, 268, 278, 280, 289, 307,
 309–311, 331, 337, 372, 375, 380, 382,
 398, 449
 TRFICF, 307
 TRFICS, 308
 TRKHEX, 67
 TUBE1, 237
 TUBE2, 238
 TUBE3D, 239

U

UPCKIC, 463

X

XCGBCM, 53
 XCGDIM, 54
 XCGGEO, 55
 XCGROD, 57
 XCSANA, 106
 XCSCVS, 239
 XCSINT, 240
 XCSNUM, 107
 XCSPIJ, 241
 XCSRNU, 242
 XCSSEG, 108

XCSTRK, 109	XHXTRK, 65
XCWHEX, 58	XL3, 7
XCWICL, 58	XL3DRV, 248
XCWREC, 60	XL3MAC, 249
XCWROD, 61	XL3NTR, 250
XCWSCL, 62	XL3SIG, 251
XCWSRT, 63	XL3TI3, 252
XCWTRK, 64	XL3TRK, 254
XDRCAS, 465	
XDRDBL, 465	
XDREED, 465	
XDREXP, 453	
XDRITE, 465	
XDRKIN, 453	
XDRLGS, 454	
XDRLPR, 455	
XDRNED, 456	
XDRSDB, 466	
XDRSET, 466	
XDRVER, 454	
XELBIN, 22	
XELCMP, 24	
XELCOP, 25	
XELCRN, 25	
XELDCL, 26	
XELDRV, 28	
XELEDC, 29	
XELEQN, 30	
XELETR, 31	
XELGPR, 33	
XELGRD, 34	
XELLIN, 35	
XELLSR, 36	
XELMRG, 38	
XELNTR, 39	
XELPA0, 243	
XELPA1, 243	
XELPA3, 244	
XELPRC, 40	
XELPRP, 41	
XELPSC, 42	
XELPSI, 43	
XELTI2, 43	
XELTI3, 45	
XELTRK, 46	
XELTRP, 47	
XELTS2, 49	
XELTS3, 51	
XELTSW, 51	
XELVOL, 52	
XHX2D0, 245	
XHX2D1, 245	