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# COMPAR: A SYSTEM FOR COMPARING MULTIGROUP CROSS-SECTIONS GENERATED BY NJOY, GROUPIE, FLANGE-II, ETOG-3 AND XLACS

Jaime Anaf and E.S. Chalhoub

Technical Note - IEAv-014/87 (November 1987)
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ABSTRACT

A system consisting of the COMPAR computer program and its interfaces which was developed for comparing multigroup cross-sections generated by NJOY, GROUPIE, FLANGE-II, ETOG-3 and XLACS is presented.

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CONTENTS

## 1. INTRODUCTION

The evaluation of multigroup cross-section libraries plays a very important part in carrying out projects in the nuclear field. It is therefore necessary to validate the computer programs which calculate multigroup cross-sections on the basis of evaluated nuclear data libraries (ENDF/B-IV [1], ENDF/B-V [2], etc.). Once the validation is completed, we will have reliable programs which can be used to compare different evaluated nuclear data libraries or different situations regarding temperature, weighting spectrum, etc., for a single library. The quantity of data to be analysed in either type of study is vast, making the evaluation a difficult, monotonous and tiring task. The COMPAR system was developed to facilitate the work by automating the calculations and the formatting of the results of the comparisons, thereby allowing more time and effort to be concentrated on the study and, where necessary, correction of the models used by the various programs available in this area.

The COMPAR system comprises the COMPAR program and interface programs. The role of the interface modules is to format the results provided by the multigroup cross-section generating programs so that they can be read by COMPAR. The interfaces were developed for each of the programs under consideration. These are REDCOMP for GROUPIE [3], FLACOMP for FLANGE-II [4], ETOCOMP for ETOG3 [5] and XLACOMP for XLACS [6]. For the NJOY program [7] there is RGENDF [8] which, in addition to formatting for COMPAR, also does so for other programs. In this way, we have a modular system in which the inclusion of a new multigroup cross-section generating program requires no more than the development of a new interface module.

The COMPAR program provides tables of the different multigroup cross-sections for different purposes (programs, libraries, particular cases) and for different materials, together with percentage deviations from reference values.

The multigroup cross-sections that can be studied using the COMPAR system are those for elastic scattering, (n,γ) capture and fission. Thus, it is possible to analyse the influence of files 2 (resonances) and 3 ("background") of the evaluated nuclear data libraries.

In the following sections we shall present the COMPAR program and its interface modules. Listings for these programs are reproduced in the Appendices, as are examples of input data and the resulting tables.

## 2. THE COMPAR PROGRAM

The COMPAR program evaluates multigroup cross-sections for the elastic scattering, (n,γ) capture and fission reactions for one or more materials from various previously formatted files. The interface modules which produce the files in the COMPAR-readable format, on the basis of various multigroup cross-section generating programs, will be presented in section 3. COMPAR generates, as output, tables with the read-out values and percentage deviations from one in the files taken as reference.

The calculations performed are:

- Percentage deviation of reaction x, group g:

$$D_{x,g} = \frac{\sigma_{x,g} - \sigma^{r}_{x,g}}{\sigma^{r}_{x,g}} \times 100$$

where:

$\sigma_{x,g}$ is the cross-section for reaction x, group g; and

$\sigma^{r}_{x,g}$ is the cross-section for reaction x, group g, taken as reference.

- Mean square deviation of reaction x:

$$RMS_x = \left[ \frac{1}{NG} \sum_{g=1}^{NG} D^2_{x,g} \right]^{\frac{1}{2}}$$

where NG is the total number of energy groups under consideration; and

- Mean square deviation of reaction x weighted for the cross-section under consideration:

$$RMSP_x = \left[ \frac{\sum_{g=1}^{NG} D^2_{x,g} \times \left| \sigma^{r}_{x,g} \right|}{\sum_{g=1}^{NG} \left| \sigma^{r}_{x,g} \right|} \right]^{\frac{1}{2}}$$

This factor helps in evaluating the magnitude of the percentage deviations.

Instructions for executing the COMPAR program and dimensioning variables and other relevant observations are given in the form of comments at the beginning of the source program, which is listed in Appendix A.

Appendix B contains an example of input data (Tape 10).

No more than seven comparisons should be processed at the same time. This limit is imposed by the maximum number of characters that can be printed per line.

The tables obtained from the processing can have two formats:

(a) Comparison of two files (the results for the three reactions will be printed on one page for each material); and

(b) Comparison of three or more files (up to seven, the results being printed on one page for each reaction).

Examples of the tables are provided in Appendix C.

## 3. INTERFACE MODULES

The purpose of each of the modules is to format a multigroup library in such a way as to make it readable by COMPAR. In the source programs of each interface module the initial comments provide the instructions necessary for their execution.

### 3.1. REDCOMP

A module developed (Appendix D) for the multigroup library generated by GROUPIE [3] from the system LINEAR/RECENT/SIGMA1/GROUPIE [9,10,11,3], respectively.

### 3.2. FLACOMP

A module developed (Appendix E) for the thermal multigroup library generated by FLANGE-II [4] for the Hammer system [12].

### 3.3. ETOCOMP

A module developed (Appendix F) for the epithermal/fast multigroup library generated by ETOG-3 [5] or the Hammer [12] system.

### 3.4. XLACOMP

A module developed (Appendix G) for the multigroup library obtained on the basis of XLACS [6], the multigroup library generator for XSDRN [13].

In this case, instead of starting from the binary library supplied to XSDRN [13], it was decided to create, through XLACS, a more easily interpretable BCD copy.

There were various reasons for adopting a different procedure for this interface.

The version of XLACS [6] under consideration is not able to process at zero degrees absolute (Kelvin), since it displays an error in the PROF7 sub-routine which calculates transfer matrices in the thermal region. Furthermore, we are currently not considering scattering matrices, either thermal or fast, and the time required for these calculations is considerable. It was consequently decided to disregard this part of the program by means of an alternative routing which is activated upon assigning the value -3 to the variable IOPT(1) of the 3$ input data card [6]. The reactions are processed and recorded in a specific file which also includes information on the material under consideration, the total number of groups, the number of thermal groups, the number of isotopes, the number of reactions processed, the types of reaction and the printing options (Appendix H). From the data contained in this file, XLACOMP is able to identify the reactions that are of interest and to format them for COMPAR.

It remains to be said that XLACS separates, for capture and fission, the contribution of resonances into two portions, namely "Nordheim background" and "Infinite dilution" [6]: a certain region around each resonance is regarded as infinite dilution, while the remaining tails are considered Nordheim background. For materials which contain more than one isotope, the contribution of infinite dilution is added internally to that of "Nordheim background", but is not subsequently set to zero [?]. When identifying the reactions, the XLACOMP module also considers the number of isotopes to be added or not to the two contributions.

In this way, it is possible to get around the difficulties and to obtain the required multigroup cross-section values while minimizing the computing time.

## 4. CONCLUSIONS

A system - COMPAR - which automates the calculation and formatting of the results of comparisons needed for validating multigroup cross-section libraries was developed and is now available to users.

## 5. REFERENCES


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[12] J. Barhen, W. Rothenstein, E. Taviv, "The HAMMER Code System", NP-565, Research Project 709, Eletric Power Research Institute (1978).

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## APPENDIX A

### Listing of the COMPAR program

[Translation of COM 0 - COM 122:]

COMPAR program (Tape10, Tape11, Tape12, Tape20)

The COMPAR program compares the results of up to 7 codes with respect to the deviations of 3 cross-sections (elastic, fission and capture). The general data are read from Tape10 and the output is recorded on Tape20. The reference cross-sections are read from Tape11, while the cross-sections of the other codes to be compared are read from Tapes 12, 13, 14, 15, 16 and 17. Tape18 is used, when necessary, for drafting.

Tape10 - general data read in free format.

First card - NMAT, NCOMPAR, NG, NGT

NMAT - Number of materials to be compared
NCOMPAR - Number of codes to be compared
NG - Total number of groups
NGT - Number of thermal groups contained in NG

Second card - MAT(1), TMAT(1)

- NMAT cards will be read. Each containing the number of the material to be compared and the name, centralized within 6 positions, bounded by apostrophes.
  EX. 1057 ↑AM-243↑.

Third card - COD(1)

- NCOMPAR cards will be read, each containing the name of the code being compared. The sequence of names is the same as in Tapes 11, 12, 13, 14, 15, 16 and 17. The name of the code must be centralized within a total of 8 positions, bounded by apostrophes.
  EX1. ↑ XLACS ↑
  EX2. ↑ ETOG ↑

Tapes (11, 12, 13, 14, 15, 16 and 17)

In these files the cross-sections of each comparison will be read. When several materials are to be compared, they should preferably be taken in ascending order according to the number of the material (MAT).

First card - MAT, NG1, NGT1 (Format 3I5)

MAT - Number of the material
NG1 - Total number of groups
NGT1 - Number of thermal groups contained in NG1.

APÊNDICE A

Listagem do programa COMPAR

```
      PROGRAM COMPAR(TAPE10,TAPE11,TAPE12,TAPE20)                       COM   0
C                                                                       COM   1
C*********************************************************************** COM   2
C                                                                     * COM   3
C     O PROGRAMA COMPAR COMPARA OS RESULTADOS DE ATE 7 CODIGOS QUANTO  * COM   4
C     AOS DESVIOS DE 3 SECOES DE CHOQUE (ELASTICA, FISSAO E CAPTURA).  * COM   5
C     OS DADOS GERAIS SAO LIDOS NO TAPE10 E A SAIDA E IMPRESSA NO TA-  * COM   6
C     PE20. NO TAPE11 SERAO LIDAS AS SECOES DE CHOQUE A SEREM  USADAS  * COM   7
C     COMO REFERENCIA, SENDO LIDAS NOS TAPES 12, 13, 14, 15, 16 E  17  * COM   8
C     AS SECOES DE CHOQUE DOS OUTROS CODIGOS A SEREM COMPARADOS.       * COM   9
C     O TAPE18 E USADO, QUANDO NECESSARIO, PARA RASCUNHO.              * COM  10
C                                                                     * COM  11
C     TAPE10 - DADOS GERAIS LIDOS EM FORMATO LIVRE                     * COM  12
C                                                                     * COM  13
C          PRIMEIRO CARTAO - NMAT,NCOMPAR,NG,NGT                      * COM  14
C                    NMAT - NUMERO DE MATERIAS A SEREM COMPARADOS     * COM  15
C                 NCOMPAR - NUMERO DE CODIGOS A SEREM COMPARADOS      * COM  16
C                      NG - NUMERO TOTAL DE GRUPOS                    * COM  17
C                     NGT - NUMERO DE GRUPOS TERMICOS CONTIDOS EM NG  * COM  18
C                                                                     * COM  19
C           SEGUNDO CARTAO - MAT(I), TMAT(I)                          * COM  20
C                     - SERAO LIDOS NMAT CARTOES SENDO QUE EM CADA  UM * COM  21
C                       DEVERA CONSTAR O NUMERO DO MATERIAL A SER COM- * COM  22
C                       PARADO E O NOME, CENTRALIZADO ENTRE 6 POSICOES * COM  23
C                       DELIMITADAS POR APOSTORFOS.                   * COM  24
C                       EX. 1057 ↑AM-243↑                             * COM  25
C                                                                     * COM  26
C          TERCEIRO CARTAO - COD(I)                                   * COM  27
C                     - SERAO LIDOS NCOMPAR CARTOES. EM CADA UM   DEVE * COM  28
C                       CONSTAR O NOME DO CODIGO EM COMPARACAO. A  SE- * COM  29
C                       QUENCIA DE NOMES E A MESMA DOS TAPES 11,12, 13 * COM  30
C                       14, 15, 16 E 17. O NOME DO CODIGO DEVERA ESTAR * COM  31
C                       CENTRALIZADO ENTRE UM TOTAL DE 8 POSICOES, DE- * COM  32
C                       LIMITADAS POR APOSTORFOS.                     * COM  33
C                       EX1. ↑  XLACS ↑                               * COM  34
C                       EX2. ↑  ETOG  ↑                               * COM  35
C                                                                     * COM  36
C     TAPES (11, 12, 13, 14, 15, 16 E 17)                              * COM  37
C                                                                     * COM  38
C         NESTES ARQUIVOS SERAO LIDAS AS SECOES  DE  CHOQUE  DE  CADA * COM  39
C         COMPARACAO. QUANDO FOREM COMPARADOS VARIOS MATERIAIS, DEVEM * COM  40
C         DE PREFERENCIA, ESTAR ORDENADOS CRESCENTEMENTE PELO  NUMERO * COM  41
C         DO MATERIAL (MAT).                                          * COM  42
C                                                                     * COM  43
C         PRIMEIRO CARTAO - MAT, NG1, NGT1 (FORMATO 3I5)              * COM  44
C                     MAT - NUMERO DO MATERIAL                        * COM  45
C                     NG1 - NUMERO TOTAL DE GRUPOS                    * COM  46
C                    NGT1 - NUMERO DE GRUPOS TERMICOS CONTIDOS EM NG1 * COM  47
C                                                                     * COM  48
C         CARTOES SEGUINTES - NG1 CARTOES   (FORMATO LIVRE)           * COM  49
C                                                                     * COM  50
C                CADA CARTAO DEVERA CONTER AS SECOES DE CHOQUE DE:    * COM  51
C                                                                     * COM  52
C                     ESPALHAMENTO ELASTICO, FISSAO E CAPTURA,        * COM  53
C                                                                     * COM  54
C                PARA CADA UM DOS NG1 GRUPOS DE ENERGIA,  ESTANDO  OS * COM  55
C                GRUPOS ORDENADOS EM ENERGIAS CRESCENTES.             * COM  56
C                                                                     * COM  57
C           O ULTIMO CARTAO DE CADA UM DOS TAPES (11 A 17) DEVERA TER * COM  58
C           COMO A VARIAVEL MAT UM NUMERO INTEIRO, NEGATIVO  OU ZERO. * COM  59
C                                                                     * COM  60
C      OBSERVACOES:                                                   * COM  61
C                                                                     * COM  62
C         1 - O PROGRAMA ESTA DIMENSIONADO PARA:                      * COM  63
C               - 124 GRUPOS DE ENERGIA                               * COM  64
C               - 50 MATERIAIS A SEREM COMPARADOS                     * COM  65
C               - 7 COMPARACOES                                       * COM  66
C                                                                     * COM  67
C         2 - ALTERACOES QUE PODEM SER FACILMENTE REALIZADAS:         * COM  68
C               - NUMERO DE GRUPOS (124)                              * COM  69
C                 MODIFICAR AS MATRIZES:                              * COM  70
C                            XS(7,124,3) DO COMMON/F/ E               * COM  71
C                            ER(6,124,3) DO COMMON/G/                 * COM  72
C               - NUMERO DE MATERIAIS A SEREM COMPARADOS (50)         * COM  73
```

Following cards - NG1 cards (free format)

Each card must contain the cross-sections for:

elastic scattering, fission and capture,

for each of the NG1 energy groups, the groups being ordered according to increasing energies.

The final card of each of the Tapes (11-17) must have as its variable MAT an integer, a negative number or zero.

Observations:

1 - The program is dimensioned for:

- 124 energy groups
- 50 materials to be compared
- 7 comparisons

2 - Alterations which can easily be made:

- Number of groups (124)
  Modifying the matrices:
  XS(7,124,3) of COMMON/F/ and
  ER(6,124,3) of COMMON/G/

- Number of materials to be compared (50)
  Modifying the vectors:
  TMAT(50) of CHARACTER * 6 and
  MAT(50) of COMMON/B/

3 - Number of comparisons (7)

The number was fixed at 7 so that one page would be sufficient (sub-routine SAIDA). For comparisons in excess of two, one page is used for each reaction. If the comparison should be of 2 codes, the 3 reactions will be on one single page (sub-routine SAIDA2) and the fission will appear unchanged as zero.

4 - The deviation, defined as:

(compared value - reference value)/reference value will be indicated, should the reference value be zero, as a field break (*******). The same occurs with RMS and RMSP (RMSP=RMS weighed by the cross-section of the group).

5 - Precautions that must be taken with regard to the number of groups in the libraries to be compared:

A - NG1 cannot be greater than NG from Tape10.
B - NGT1 cannot be greater than NGT from Tape10.
C - It is not possible to compare, in a single exercise, a complete structure (fast and thermal) with a purely fast and a purely thermal structure.

```
C                    MODIFICAR OS VETORES:                                  * COM  74
C                              TMAT(50) DO CHARACTER * 6 E                  * COM  75
C                              MAT(50) DO COMMON/B/                         * COM  76
C          3 - NUMERO DE COMPARACOES (7)                                    * COM  77
C              O NUMERO FOI FIXADO EM 7 PARA PODER ENTRAR EM UMA PAGI-      * COM  78
C              NA (SUBROUTINA SAIDA). PARA COMPARACOES ACIMA  DE  DUAS      * COM  79
C              UTILIZA-SE UMA PAGINA PARA CADA REACAO. CASO A COMPARA-      * COM  80
C              CAO SEJA DE 2 CODIGOS, AS 3 REACOES ESTARAO NUMA  UNICA      * COM  81
C              PAGINA (SUBROUTINA SAIDA2) E A FISSAO  APARECERA  MESMO      * COM  82
C              SENDO NULA.                                                  * COM  83
C                                                                           * COM  84
C          4 - O DESVIO, DEFINIDO COMO:                                     * COM  85
C                                                                           * COM  86
C               (VALOR COMPARADO-VALOR REFERENCIA)/VALOR REFERENCIA         * COM  87
C                                                                           * COM  88
C              SERA INDICADO, CASO O VALOR REF. SEJA NULO, COMO ESTOU-      * COM  89
C              RO DE CAMPO (*******). O MESMO ACONTECE COM RMS E  RMSP      * COM  90
C              (RMS PESADO PELA SECAO DE CHOQUE DO GRUPO).                  * COM  91
C                                                                           * COM  92
C          5 - CUIDADOS QUE DEVEM SER TOMADOS  QUANTO  AO  NUMERO  DE       * COM  93
C              GRUPOS DAS BIBLIOTECAS A SEREM COMPARADAS.                   * COM  94
C               A - NG1 NAO PODE SER SUPERIOR A NG DO TAPE10                * COM  95
C               B - NGT1 NAO PODE SER SUPERIOR A NGT DO TAPE10              * COM  96
C               C - NAO SE PODE COMPARAR, DE UMA SO VEZ, UMA ESTRUTURA      * COM  97
C                   COMPLETA (RAPIDA E TERMICA) COM UMA  ESTRUTURA  SO      * COM  98
C                   RAPIDA E UMA ESTRUTURA SO TERMICA.                      * COM  99
C                                                                           * COM 100
C       EXECUCAO VIA TERMINAL                                               * COM 101
C                                                                           * COM 102
C         * PROGRAMA FONTE                                                  * COM 103
C         GET,COMPAR                                                        * COM 104
C         * OBTER OBJETO                                                    * COM 105
C         FTN5,I=COMPAR,L=0                                                 * COM 106
C         * DADOS DE ENTRADA                                                * COM 107
C         GET,TAPE10=DADOS                                                  * COM 108
C         * BIBLIOTECAS A SEREM COMPARADAS                                  * COM 109
C         GET,TAPE11,TAPE12,TAPE13 ... ETC                                  * COM 110
C         * EXECUCAO                                                        * COM 111
C         LGO                                                               * COM 112
C         * IMPRESSAO DOS RESULTADOS                                        * COM 113
C         ROUTE,TAPE20,DC=LP,ID=01                                          * COM 114
C                                                                           * COM 115
C        PROGRAMA DESENVOLVIDO POR JAIME ANAF E E.S. CHALHOUB  COMO         * COM 116
C        PARTE DO PROJETO DE VALIDACAO DE CODIGOS QUE CALCULAM  SE-         * COM 117
C        COES DE CHOQUE MULTIGRUPO.                                         * COM 118
C                                                                           * COM 119
C                              VERSAO OUT/1987                              * COM 120
C                                                                           * COM 121
C                                                          CTA/IEAV/ENU     * COM 122
C*************************************************************************** COM 123
C                                                                            COM 124
      CHARACTER *6 TMAT(50)                                                  COM 125
      CHARACTER *8 COD(7)                                                    COM 126
      COMMON/A/ NCOMPAR                                                      COM 127
      COMMON/B/ NG,MAT(50),IMAT,NGT                                          COM 128
      COMMON/C/ NMAT                                                         COM 129
      COMMON/D/ COD, TMAT                                                    COM 130
      COMMON/E/ IFIM, N                                                      COM 131
      COMMON/F/ XS(7,124,3)                                                  COM 132
      COMMON/G/ ER(6,124,3), RMS(6,3), RMSP(6,3)                             COM 133
      COMMON/H/ TIT(3),SUBTIT(2)                                             COM 134
      COMMON/I/ NGI, NGS, IFIS, ITAPEI, ITAPES                               COM 135
      DATA TIT/8HELASTICA,8H FISSAO ,8H CAPTURA/                             COM 136
      DATA SUBTIT/7H VALOR ,7HZDESVIO/                                       COM 137
C                                                                            COM 138
C     LEITURA DOS DADOS DE ENTRADA (TAPE10)                                  COM 139
C                                                                            COM 140
      CALL ENTRADA                                                           COM 141
      DO 40 IMAT = 1, NMAT                                                   COM 142
      DO 10 N=1,NCOMPAR                                                      COM 143
C                                                                            COM 144
C     LEITURA DAS BIBLIOTECAS A SEREM COMPARADAS                             COM 145
C                                                                            COM 146
      CALL TAPE                                                              COM 147
C                                                                            COM 148
C     TESTE DE SE O MATERIAL PROCURADO FOI ENCONTRADO                        COM 149
C                                                                            COM 150
      IF(IFIM.NE.0) GO TO 40                                                 COM 151
10    CONTINUE                                                               COM 152
C                                                                            COM 153
C     TESTE DA OBSERVACOA - CUIDADOS (C) RELATADA ACIMA                      COM 154
```

EXECUTION VIA TERMINAL

```
*     Source program
GET,COMPAR
*     Attain goal
FTN5,I=COMPAR,L=0
*     Input data
GET,TAPE10=DATA
*     Libraries to be compared
GET,TAPE11,TAPE12,TAPE13 ... etc.
*     Execution
LGO
*     Printout of results
ROUTE,TAPE20,DC=LP,ID=01
```

Program developed by Jaime Anaf and E.S. Chalhoub as part of a project to validate codes for calculating multigroup cross-sections.

Version of Oct/1987

CTA/IAEV/ENU COM 122

[Note: Rest of program listing has been left untranslated].

```
C                                                                       COM 155
      IF(NGI.NE.1.AND.NGS.NE.NG) THEN                                   COM 156
      WRITE(20,70)MAT(IMAT),ITAPEI,NGI,ITAPES,NGS                       COM 157
      STOP                                                              COM 158
      ELSE                                                              COM 159
      GO TO 20                                                          COM 160
      ENDIF                                                             COM 161
C                                                                       COM 162
C     CALCULO DOS DESVIOS                                               COM 163
C                                                                       COM 164
20    CALL ERRO                                                         COM 165
      IF(NCOMPAR.GT.2) GO TO 30                                         COM 166
C                                                                       COM 167
C     SAIDA COMPACTA PARA DUAS COMPARACOES                              COM 168
C                                                                       COM 169
      CALL SAIDA2                                                       COM 170
      GO TO 40                                                          COM 171
C                                                                       COM 172
C     SAIDA COMPLETA PARA MAIS DE DUAS COMPARCOES                       COM 173
C                                                                       COM 174
30    CALL SAIDA                                                        COM 175
40    CONTINUE                                                          COM 176
C                                                                       COM 177
C     IMPRESSAO DE AVISO SE ALGUM MATERIAL NAO FOI ENCONTRADO           COM 178
C                                                                       COM 179
      WRITE(20,80)                                                      COM 180
      REWIND 18                                                         COM 181
50    READ(18,*,END=60)I1, I2                                           COM 182
      WRITE(20,90)I1, I2                                                COM 183
      GO TO 50                                                          COM 184
60    STOP                                                              COM 185
70    FORMAT(1X,'PARA O MATERIAL ',I4,/,                                COM 186
     11X,'DEVIDO AO TAPE', I3,' NGI E IGUAL A',I3,' E',/,               COM 187
     21X,'DEVIDO AO TAPE',I3,' NGS E IGUAL A',I3,/,                     COM 188
     31X,'COMPARACAO INTERROMPIDA.',/,1X,' VER CUIDADOS (C) NAS ',      COM 189
     4'OBSERVACOES NO INICIO DO PROGRAMA FONTE')                        COM 190
80    FORMAT(1H1)                                                       COM 191
90    FORMAT(10X,'O TAPE',I3,' NAO TEM O MATERIAL DE NUMERO ',I4)       COM 192
      END                                                               COM 193


      SUBROUTINE ENTRADA                                                ENT   0
C                                                                       ENT   1
C     SUBROTINA QUE LE OS DADOS NO TAPE10                               ENT   2
C                                                                       ENT   3
      CHARACTER *6 TMAT(50)                                             ENT   4
      CHARACTER *8 COD(7)                                               ENT   5
      COMMON/A/ NCOMPAR                                                 ENT   6
      COMMON/B/ NG,MAT(50),IMAT,NGT                                     ENT   7
      COMMON/C/ NMAT                                                    ENT   8
      COMMON/D/ COD, TMAT                                               ENT   9
      COMMON/I/ NGI, NGS, IFIS, ITAPEI, ITAPES                          ENT  10
      READ(10,*)NMAT,NCOMPAR,NG,NGT                                     ENT  11
      NGI = 1                                                           ENT  12
      NGS = NG                                                          ENT  13
      DO 10 I=1,NMAT                                                    ENT  14
10    READ(10,*) MAT(I), TMAT(I)                                        ENT  15
      DO 20 I=1,NCOMPAR                                                 ENT  16
20    READ(10,*)COD(I)                                                  ENT  17
      RETURN                                                            ENT  18
      END                                                               ENT  19


      SUBROUTINE TAPE                                                   TAP   0
C                                                                       TAP   1
C     SUBROTINA QUE LE AS BIBLIOTECAS A SEREM COMPARADAS                TAP   2
C                                                                       TAP   3
      COMMON/B/ NG,MAT(50),IMAT,NGT                                     TAP   4
      COMMON/C/ NMAT                                                    TAP   5
      COMMON/E/ IFIM, N                                                 TAP   6
      COMMON/F/ XS(7,124,3)                                             TAP   7
      COMMON/I/ NGI, NGS, IFIS, ITAPEI, ITAPES                          TAP   8
      IFIM = 0                                                          TAP   9
      ITAPE = 10 + N                                                    TAP  10
      NGI1 = 1                                                          TAP  11
      NGS1 = NG                                                         TAP  12
      READ(ITAPE,100) JMAT,NG1,NGT1                                     TAP  13
C                                                                       TAP  14
C     PROCURA DO MATERIAL                                               TAP  15
```

```
C                                                                       TAP  16
      IF(JMAT.EQ.MAT(IMAT)) GO TO 30                                    TAP  17
C                                                                       TAP  18
C     SE O MATERIAL NAO ESTA EM ORDEM DO MAT A PROCURA E RECOMECADA     TAP  19
C     DO INICIO DO TAPE                                                 TAP  20
C                                                                       TAP  21
      REWIND ITAPE                                                      TAP  22
10    READ(ITAPE,100) JMAT,NG1,NGT1                                     TAP  23
C                                                                       TAP  24
C     TESTE DE FIM DE TAPE                                              TAP  25
C                                                                       TAP  26
      IF(JMAT.LE.0) GO TO 60                                            TAP  27
      IF(JMAT.EQ.MAT(IMAT)) GO TO 30                                    TAP  28
C                                                                       TAP  29
C     MATERIAL NAO E O PROCURADO, PULE PARA O PROXIMO                   TAP  30
C                                                                       TAP  31
      DO 20 I=1,NG1                                                     TAP  32
20    READ(ITAPE,*) K                                                   TAP  33
      GO TO 10                                                          TAP  34
C                                                                       TAP  35
C     MATERIAL E O PROCURADO - TESTE DE NG COM NG1 E NGT COM NGT1       TAP  36
C                                                                       TAP  37
30    IF(NG1.EQ.NG) GO TO 40                                            TAP  38
      IF(NG1.GT.NG) GO TO 70                                            TAP  39
      IF(NGT1.GT.NGT) GO TO 80                                          TAP  40
      IF(NGT1.EQ.NGT) THEN                                              TAP  41
C                                                                       TAP  42
C     DEFINACOA DOS GRUPOS QUE SERAO COMPARADOS EM FUNCAO DAS           TAP  43
C     BIBLIOTECAS LIDAS                                                 TAP  44
C                                                                       TAP  45
      NGS = NG1                                                         TAP  46
      NGS1 = NGS                                                        TAP  47
      ITAPES = ITAPE                                                    TAP  48
      GO TO 40                                                          TAP  49
      ELSE                                                              TAP  50
      NGI = NG - NG1 + 1                                                TAP  51
      NGI1 = NGI                                                        TAP  52
      ITAPEI = ITAPE                                                    TAP  53
      ENDIF                                                             TAP  54
40    DO 50 I = NGI1,NGS1                                               TAP  55
50    READ(ITAPE,*) K,(XS(N,I,J),J=1,3)                                 TAP  56
      GO TO 90                                                          TAP  57
C                                                                       TAP  58
C     MATERIAL NAO FOI ENCONTRADO                                       TAP  59
C                                                                       TAP  60
60    IFIM = 1                                                          TAP  61
      WRITE(18,110) ITAPE,MAT(IMAT)                                     TAP  62
      REWIND ITAPE                                                      TAP  63
      GO TO 90                                                          TAP  64
C                                                                       TAP  65
C     INCONSISTENCIAS CONFORME OBSERVACOES - CUIDADOS (A E B) NO        TAP  66
C     INICIO DO PROGRAMA FONTE                                          TAP  67
C                                                                       TAP  68
70    PRINT 120,ITAPE,JMAT,NG1,NG                                       TAP  69
      STOP                                                              TAP  70
80    PRINT 130,ITAPE,JMAT,NGT1,NGT                                     TAP  71
      STOP                                                              TAP  72
90    RETURN                                                            TAP  73
100   FORMAT(3I5)                                                       TAP  74
110   FORMAT(2I5)                                                       TAP  75
120   FORMAT(↑  NO TAPE ↑,I3,↑ PARA O MATERIAL NUMERO ↑,I4,/,           TAP  76
     1↑  O VALOR DE NG1 (↑,I4,↑) E MAIOR DO QUE O VALOR DE NG (↑,       TAP  77
     2I3,↑)↑,/,↑  LIDO NO TAPE10.↑,/,↑  PROGRAMA INTERROMPIDO.↑)        TAP  78
130   FORMAT(↑  NO TAPE ↑,I3,↑ PARA O MATERIAL NUMERO ↑,I4,/,           TAP  79
     1↑  O VALOR DE NGT1 (↑,I4,↑) E MAIOR DO QUE O VALOR DE NGT (↑,     TAP  80
     2I3,↑)↑,/,↑  LIDO NO TAPE10.↑,/,↑  PROGRAMA INTERROMPIDO.↑)        TAP  81
      END                                                               TAP  82


      SUBROUTINE ERRO                                                   ERR   0
C                                                                       ERR   1
C     SUBROTINA DE CALCULOS DOS DESVIOS                                 ERR   2
C                                                                       ERR   3
      COMMON/A/ NCOMPAR                                                 ERR   4
      COMMON/B/ NG,MAT(50),IMAT,NGT                                     ERR   5
      COMMON/F/ XS(7,124,3)                                             ERR   6
      COMMON/G/ ER(6,124,3), RMS(6,3), RMSP(6,3)                        ERR   7
      COMMON/I/ NGI, NGS, IFIS, ITAPEI, ITAPES                          ERR   8
      DIMENSION X(3)                                                    ERR   9
      IFIS = 0                                                          ERR  10
```

```
C
C     INICIALIZACAO
C
      DO 10 K = 1,3
      X(K) = 0.0
      DO 10 I = 1,NCOMPAR-1
      RMS(I,K) = 0.0
10    RMSP(I,K) = 0.0
      DO 40 I=NGI,NGS
C
C     SOMA DOS ABSOLUTOS DOS VALORES DE REFERENCIA PARA
C     DETERMINACAO DO RMSP
C
      X(1) = X(1) + ABS(XS(1,I,1))
      X(2) = X(2) + ABS(XS(1,I,2))
      X(3) = X(3) + ABS(XS(1,I,3))
      DO 40 J=1,NCOMPAR-1
      ER(J,I,1) = .0
      ER(J,I,2) = .0
      ER(J,I,3) = .0
C
C     TESTE DE REFERENCIA NULA PARA ESPALHAMENTO
C
      IF(XS(1,I,1).EQ.0.0) THEN
      IF(XS(J+1,I,1).EQ.0.0) GO TO 20
      ER(J,I,1) = 1.E10
      RMS(J,1)  = 1.E20
      RMSP(J,1) = 1.E20
      GO TO 20
      ELSE
      ER(J,I,1) = (XS(J+1,I,1)-XS(1,I,1))/XS(1,I,1) * 100.
      RMS(J,1) = RMS(J,1) + ER(J,I,1)**2.
      RMSP(J,1) = RMSP(J,1) + ER(J,I,1)**2.*ABS(XS(1,I,1))
      ENDIF
C
C     TESTE DE REFERENCIA NULA PARA CAPTURA
C
20    IF(XS(1,I,3).EQ.0.0) THEN
      IF(XS(J+1,I,3).EQ.0.0) GO TO 30
      ER(J,I,3) = 1.E10
      RMS(J,3)  = 1.E20
      RMSP(J,3) = 1.E20
      GO TO 30
      ELSE
      ER(J,I,3) = (XS(J+1,I,3)-XS(1,I,3))/XS(1,I,3) * 100.
      RMS(J,3) = RMS(J,3) + ER(J,I,3)**2.
      RMSP(J,3) = RMSP(J,3) + ER(J,I,3)**2.*ABS(XS(1,I,3))
      ENDIF
C
C     TESTE DE REFERENCIA NULA PARA FISSAO
C
30    IF(XS(1,I,2).EQ.0.0) THEN
      IF(XS(J+1,I,2).EQ.0.0) GO TO 40
      ER(J,I,2) = 1.E10
      RMS(J,2)  = 1.E20
      RMSP(J,2) = 1.E20
      GO TO 40
      ELSE
      ER(J,I,2) = (XS(J+1,I,2)-XS(1,I,2))/XS(1,I,2) * 100.
      RMS(J,2) = RMS(J,2) + ER(J,I,2)**2.
      RMSP(J,2) = RMSP(J,2) + ER(J,I,2)**2.*ABS(XS(1,I,2))
      ENDIF
40    CONTINUE
C
C     TESTE PARA VER SE EXISTE FISSAO NA ESTRUTURA CONSIDERADA
C     UTILIZADO NA SUBROTINA SAIDA
C
      IF(X(2).NE.0.0)IFIS = 1
C
C     CALCULO FINAL DE RMS E RMSP
C
      DO 50 I = 1,NCOMPAR-1
      DO 50 J = 1,3
      IF(X(J).EQ.0.0) GO TO 50
      RMS(I,J) = SQRT(RMS(I,J)/(NGS-NGI+1))
      IF(X(J).NE.0.0) RMSP(I,J) = SQRT(RMSP(I,J)/X(J))
50    CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SAIDA                                                  SAI   0
C                                                                       SAI   1
C     SUBROTINA PARA IMPRESSAO PARA MAIS DE DUAS COMPARACOES            SAI   2
C                                                                       SAI   3
      CHARACTER *6 TMAT(50)                                             SAI   4
      CHARACTER *8 COD(7)                                               SAI   5
      COMMON/A/ NCOMPAR                                                 SAI   6
      COMMON/B/ NG,MAT(50),IMAT,NGT                                     SAI   7
      COMMON/C/ NMAT                                                    SAI   8
      COMMON/D/ COD, TMAT                                               SAI   9
      COMMON/F/ XS(7,124,3)                                             SAI  10
      COMMON/G/ ER(6,124,3), RMS(6,3), RMSP(6,3)                        SAI  11
      COMMON/H/ TIT(3),SUBTIT(2)                                        SAI  12
      COMMON/I/ NGI, NGS, IFIS, ITAPEI, ITAPES                          SAI  13
      DO 20 I=1,3                                                       SAI  14
      IF(I.EQ.2.AND.IFIS.EQ.0) GO TO 20                                 SAI  15
      WRITE(20,50) TIT(I), TMAT(IMAT), MAT(IMAT)                        SAI  16
      WRITE(20,60)(COD(J),J=1,NCOMPAR)                                  SAI  17
      WRITE(20,70)((SUBTIT(K),K=1,2),J=1,NCOMPAR-1)                     SAI  18
      DO 10 J=NGI,NGS                                                   SAI  19
      L = NG - J + 1                                                    SAI  20
10    WRITE(20,80) J,L,XS(1,J,I),(XS(K,J,I),ER(K-1,J,I),K=2,NCOMPAR)    SAI  21
      WRITE(20,30)(RMS(J,I),J=1,NCOMPAR-1)                              SAI  22
      WRITE(20,40)(RMSP(J,I),J=1,NCOMPAR-1)                             SAI  23
20    CONTINUE                                                          SAI  24
30    FORMAT(2X,'%RMS',15X,6(12X,F7.2))                                 SAI  25
40    FORMAT(2X,'%RMSP',14X,6(12X,F7.2))                                SAI  26
50    FORMAT(1H1,'SECAO DE CHOQUE: ',A8,10X,A6,7X,'MAT = ',I4)          SAI  27
60    FORMAT(1X,'CODIGO->',2X,A8,8X,A8,11X,4(A8,11X),A8)                SAI  28
70    FORMAT(3X,'GRUPO',2X,'REFERENCIA',1X,6(2X,A7,3X,A7))              SAI  29
80    FORMAT(2I4,1PE12.4,6(1PE12.4,0PF7.1))                             SAI  30
      RETURN                                                            SAI  31
      END                                                               SAI  32
```

```
      SUBROUTINE SAIDA2                                                 SAD   0
C                                                                       SAD   1
C     SUBROTINA PARA IMPRESSAO PARA DUAS COMPARACOES                    SAD   2
C                                                                       SAD   3
      CHARACTER *6 TMAT(50)                                             SAD   4
      CHARACTER *8 COD(7)                                               SAD   5
      COMMON/A/ NCOMPAR                                                 SAD   6
      COMMON/B/ NG,MAT(50),IMAT,NGT                                     SAD   7
      COMMON/C/ NMAT                                                    SAD   8
      COMMON/D/ COD, TMAT                                               SAD   9
      COMMON/F/ XS(7,124,3)                                             SAD  10
      COMMON/G/ ER(6,124,3), RMS(6,3), RMSP(6,3)                        SAD  11
      COMMON/H/ TIT(3),SUBTIT(2)                                        SAD  12
      COMMON/I/ NGI, NGS, IFIS, ITAPEI, ITAPES                          SAD  13
      WRITE(20,40) TMAT(IMAT), MAT(IMAT)                                SAD  14
      WRITE(20,50) (TIT(I),I=1,3)                                       SAD  15
      WRITE(20,60)((COD(J),J=1,NCOMPAR),K=1,3)                          SAD  16
      WRITE(20,70)((SUBTIT(K),K=1,2),J=1,3)                             SAD  17
      DO 10 J=NGI,NGS                                                   SAD  18
      J2 = NG - J + 1                                                   SAD  19
10    WRITE(20,80)J,J2,(XS(1,J,I),XS(2,J,I),ER(1,J,I),I=1,3),J,J2       SAD  20
      WRITE(20,20)(RMS(1,I),I=1,3)                                      SAD  21
      WRITE(20,30)(RMSP(1,I),I=1,3)                                     SAD  22
20    FORMAT(2X,'%RMS',3X,3(24X,F7.2,5X))                               SAD  23
30    FORMAT(2X,'%RMSP',2X,3(24X,F7.2,5X))                              SAD  24
40    FORMAT(1H1,'MATERIAL: ',10X,A6,10X,'MAT = ',I4)                   SAD  25
50    FORMAT(1X,'SECAO DE CHOQUE: ',3X,A8,2(28X,A8))                    SAD  26
60    FORMAT(1X,'CODIGO->',2X,3(A8,8X,A8,12X))                          SAD  27
70    FORMAT(3X,'GRUPO',2X,2('REFERENCIA',3X,A7,3X,A7,6X),              SAD  28
     1'REFERENCIA',3X,A7,3X,A7,2X,'GRUPO')                              SAD  29
80    FORMAT(2I4,2(1P2E12.4,0PF7.1,5X),1P2E12.4,0PF7.1,1X,2I4)          SAD  30
      RETURN                                                            SAD  31
      END                                                               SAD  32
```

## APPENDIX B

Example of input data for the COMPAR program.

```
 3 7 83 30
 440    ↑HF-176↑
1262    ↑ U-238↑
1264    ↑PU-239↑
↑CODIGO-1↑
↑CODIGO-2↑
↑CODIGO-3↑
↑CODIGO-4↑
↑CODIGO-5↑
↑CODIGO-6↑
↑CODIGO-7↑
```

# APPENDIX C

Types of tables that can be obtained as output from the COMPAR program.

SECAO DE CHOQUE: FISSAO U-235 MAT = 1261

| CODIGO-> | | CODIGO-1 | CODIGO-2 | | CODIGO-3 | | CODIGO-4 | | CODIGO-5 | | CODIGO-6 | | CODIGO-7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRUPO | | REFERENCIA | VALOR | %DESVIO | VALOR | %DESVIO | VALOR | %DESVIO | VALOR | %DESVIO | VALOR | %DESVIO | VALOR | %DESVIO |
| 30 | 54 | 6.0078E+01 | 6.0078E+01 | .0 | 6.0078E+01 | .0 | 6.0078E+01 | .0 | 6.0078E+01 | .0 | 6.0097E+01 | .0 | 6.0239E+01 | .3 |
| 31 | 53 | 7.0335E+01 | 5.2155E+01 | -25.8 | 5.2156E+01 | -25.8 | 7.0220E+01 | -.2 | 7.0335E+01 | .0 | 7.0332E+01 | .0 | 7.0366E+01 | .0 |
| 32 | 52 | 4.1040E+01 | 8.4798E+01 | 106.6 | 8.4800E+01 | 106.6 | 4.1341E+01 | .7 | 4.1038E+01 | .0 | 4.1051E+01 | .0 | 4.1055E+01 | .0 |
| 33 | 51 | 1.4964E+01 | 1.2722E+01 | -15.0 | 1.2724E+01 | -15.0 | 1.5689E+01 | 4.8 | 1.4965E+01 | .0 | 1.4979E+01 | .1 | 1.4983E+01 | .1 |
| 34 | 50 | 1.4447E+01 | 1.3716E+01 | -5.1 | 1.3717E+01 | -5.1 | 1.5562E+01 | 7.7 | 1.4445E+01 | .0 | 1.4452E+01 | .0 | 1.4449E+01 | .0 |
| 35 | 49 | 1.4144E+01 | 1.1202E+01 | -20.8 | 1.1203E+01 | -20.8 | 1.5761E+01 | 11.4 | 1.4144E+01 | .0 | 1.4142E+01 | .0 | 1.4158E+01 | .1 |
| 36 | 48 | 3.2077E+01 | 3.5969E+01 | 12.1 | 3.5970E+01 | 12.1 | 2.1318E+01 | -33.5 | 3.2050E+01 | -.1 | 3.2090E+01 | .0 | 3.2087E+01 | .0 |
| 37 | 47 | 5.4903E+00 | 3.0042E+00 | -45.3 | 3.0050E+00 | -45.3 | 6.7299E+00 | 22.6 | 5.4887E+00 | .0 | 5.4930E+00 | .0 | 5.4931E+00 | .1 |
| 38 | 46 | 3.1006E+01 | 3.3332E+01 | 7.5 | 3.3333E+01 | 7.5 | 1.7057E+01 | -45.0 | 3.0986E+01 | -.1 | 3.1010E+01 | .0 | 3.1011E+01 | .0 |
| 39 | 45 | 1.3462E+01 | 7.5725E+00 | -43.7 | 7.5731E+00 | -43.7 | 9.5451E+00 | -29.1 | 1.3456E+01 | .0 | 1.3478E+01 | .1 | 1.3472E+01 | .1 |
| 40 | 44 | 1.0199E+02 | 1.1004E+02 | 7.9 | 1.1004E+02 | 7.9 | 1.7202E+01 | -83.1 | 1.0192E+02 | -.1 | 1.0201E+02 | .0 | 1.0203E+02 | .0 |
| 41 | 43 | 4.9480E+01 | 4.7267E+01 | -4.5 | 4.7268E+01 | -4.5 | 8.8268E+00 | -82.2 | 4.9460E+01 | -.1 | 4.9511E+01 | .0 | 4.9508E+01 | .0 |
| 42 | 42 | 3.2952E+01 | 3.8138E+01 | 15.7 | 3.8138E+01 | 15.7 | 2.8897E+00 | -91.2 | 3.2925E+01 | -.1 | 3.2950E+01 | .0 | 3.2956E+01 | .0 |
| 43 | 41 | 6.7228E+01 | 6.8754E+01 | 2.3 | 6.8755E+01 | 2.3 | 4.4948E+00 | -93.3 | 6.7175E+01 | -.1 | 6.7255E+01 | .0 | 6.7258E+01 | .0 |
| 44 | 40 | 4.5025E+01 | 4.7365E+01 | 5.2 | 4.7366E+01 | 5.2 | 2.1106E+00 | -95.3 | 4.4989E+01 | -.1 | 4.5030E+01 | .0 | 4.5036E+01 | .0 |
| 45 | 39 | 5.8640E+01 | 5.7069E+01 | -2.7 | 5.7070E+01 | -2.7 | 2.5399E+00 | -95.7 | 5.8594E+01 | -.1 | 5.8671E+01 | .1 | 5.8666E+01 | .0 |
| 46 | 38 | 3.4635E+01 | 3.4526E+01 | -.3 | 3.4527E+01 | -.3 | 1.4977E+00 | -95.7 | 3.4608E+01 | -.1 | 3.4637E+01 | .0 | 3.4648E+01 | .0 |
| 47 | 37 | 5.6488E+01 | 5.7237E+01 | 1.3 | 5.7237E+01 | 1.3 | 1.7595E+00 | -96.9 | 5.6446E+01 | -.1 | 5.6509E+01 | .0 | 5.6505E+01 | .0 |
| 48 | 36 | 2.4444E+01 | 2.4437E+01 | .0 | 2.4437E+01 | .0 | 1.0078E+00 | -95.9 | 2.4426E+01 | -.1 | 2.4451E+01 | .0 | 2.4452E+01 | .0 |
| 49 | 35 | 2.3291E+01 | 2.4042E+01 | 3.2 | 2.3550E+01 | 1.1 | 6.9023E+00 | -70.4 | 2.3289E+01 | .0 | 2.3292E+01 | .0 | 2.3358E+01 | .3 |
| 50 | 34 | 2.2864E+01 | 2.3345E+01 | 2.1 | 2.2864E+01 | .0 | 8.0378E+00 | -64.8 | 2.2864E+01 | .0 | 2.2865E+01 | .0 | 2.2926E+01 | .3 |
| 51 | 33 | 2.1280E+01 | 2.1418E+01 | .6 | 2.1280E+01 | .0 | 8.3020E+00 | -61.0 | 2.1280E+01 | .0 | 2.1280E+01 | .0 | 2.1077E+01 | -1.0 |
| 52 | 32 | 2.0842E+01 | 2.1379E+01 | 2.6 | 2.0842E+01 | .0 | 9.0864E+00 | -56.4 | 2.0842E+01 | .0 | 2.0842E+01 | .0 | 2.0930E+01 | .4 |
| 53 | 31 | 1.3691E+01 | 1.3998E+01 | 2.2 | 1.3691E+01 | .0 | 7.4554E+00 | -45.5 | 1.3691E+01 | .0 | 1.3692E+01 | .0 | 1.3721E+01 | .2 |
| 54 | 30 | 1.3209E+01 | 1.3565E+01 | 2.7 | 1.3209E+01 | .0 | 7.8201E+00 | -40.8 | 1.3210E+01 | .0 | 1.3211E+01 | .0 | 1.3279E+01 | .5 |
| 55 | 29 | 8.5200E+00 | 8.7436E+00 | 2.6 | 8.5200E+00 | .0 | 5.1881E+00 | -39.1 | 8.5206E+00 | .0 | 8.5209E+00 | .0 | 8.5570E+00 | .4 |
| 56 | 28 | 6.8845E+00 | 7.0616E+00 | 2.6 | 6.8845E+00 | .0 | 4.8837E+00 | -29.1 | 6.8861E+00 | .0 | 6.8891E+00 | .1 | 6.9161E+00 | .5 |
| 57 | 27 | 5.2048E+00 | 5.3266E+00 | 2.3 | 5.2048E+00 | .0 | 3.9918E+00 | -23.3 | 5.2049E+00 | .0 | 5.2062E+00 | .0 | 5.2102E+00 | .1 |
| 58 | 26 | 4.2387E+00 | 4.3434E+00 | 2.5 | 4.2387E+00 | .0 | 3.4423E+00 | -18.8 | 4.2385E+00 | .0 | 4.2404E+00 | .0 | 4.2480E+00 | .2 |
| 59 | 25 | 3.2713E+00 | 3.3587E+00 | 2.7 | 3.2713E+00 | .0 | 2.6322E+00 | -19.5 | 3.2717E+00 | .0 | 3.2741E+00 | .1 | 3.2829E+00 | .4 |
| 60 | 24 | 2.7136E+00 | 2.7783E+00 | 2.4 | 2.7136E+00 | .0 | 2.2889E+00 | -15.7 | 2.7130E+00 | .0 | 2.7174E+00 | .1 | 2.7197E+00 | .2 |
| 61 | 23 | 2.2506E+00 | 2.3070E+00 | 2.5 | 2.2506E+00 | .0 | 1.9940E+00 | -11.4 | 2.2506E+00 | .0 | 2.2540E+00 | .2 | 2.2565E+00 | .3 |
| 62 | 22 | 2.0273E+00 | 2.0280E+00 | .0 | 2.0273E+00 | .0 | 2.0272E+00 | .0 | 2.0273E+00 | .0 | 2.0273E+00 | .0 | 2.0283E+00 | .0 |
| 63 | 21 | 1.8406E+00 | 1.8406E+00 | .0 | 1.8406E+00 | .0 | 1.8406E+00 | .0 | 1.8406E+00 | .0 | 1.8406E+00 | .0 | 1.8400E+00 | .0 |
| 64 | 20 | 1.7148E+00 | 1.7148E+00 | .0 | 1.7148E+00 | .0 | 1.7148E+00 | .0 | 1.7148E+00 | .0 | 1.7148E+00 | .0 | 1.7146E+00 | .0 |
| 65 | 19 | 1.5830E+00 | 1.5830E+00 | .0 | 1.5830E+00 | .0 | 1.5830E+00 | .0 | 1.5830E+00 | .0 | 1.5832E+00 | .0 | 1.5855E+00 | .2 |
| 66 | 18 | 1.5148E+00 | 1.5148E+00 | .0 | 1.5148E+00 | .0 | 1.5148E+00 | .0 | 1.5148E+00 | .0 | 1.5151E+00 | .0 | 1.5202E+00 | .4 |
| 67 | 17 | 1.4310E+00 | 1.4310E+00 | .0 | 1.4310E+00 | .0 | 1.4310E+00 | .0 | 1.4310E+00 | .0 | 1.4311E+00 | .0 | 1.4335E+00 | .2 |
| 68 | 16 | 1.3398E+00 | 1.3398E+00 | .0 | 1.3398E+00 | .0 | 1.3398E+00 | .0 | 1.3398E+00 | .0 | 1.3400E+00 | .0 | 1.3429E+00 | .2 |
| 69 | 15 | 1.2985E+00 | 1.2985E+00 | .0 | 1.2985E+00 | .0 | 1.2985E+00 | .0 | 1.2985E+00 | .0 | 1.2985E+00 | .0 | 1.2971E+00 | -.1 |
| 70 | 14 | 1.2339E+00 | 1.2339E+00 | .0 | 1.2339E+00 | .0 | 1.2339E+00 | .0 | 1.2339E+00 | .0 | 1.2339E+00 | .0 | 1.2349E+00 | .1 |
| 71 | 13 | 1.1980E+00 | 1.1980E+00 | .0 | 1.1980E+00 | .0 | 1.1980E+00 | .0 | 1.1980E+00 | .0 | 1.1980E+00 | .0 | 1.1962E+00 | -.2 |
| 72 | 12 | 1.1563E+00 | 1.1563E+00 | .0 | 1.1563E+00 | .0 | 1.1563E+00 | .0 | 1.1563E+00 | .0 | 1.1563E+00 | .0 | 1.1575E+00 | .1 |
| 73 | 11 | 1.1343E+00 | 1.1343E+00 | .0 | 1.1343E+00 | .0 | 1.1343E+00 | .0 | 1.1343E+00 | .0 | 1.1343E+00 | .0 | 1.1356E+00 | .1 |
| 74 | 10 | 1.1928E+00 | 1.1928E+00 | .0 | 1.1928E+00 | .0 | 1.1928E+00 | .0 | 1.1928E+00 | .0 | 1.1928E+00 | .0 | 1.1915E+00 | -.1 |
| 75 | 9 | 1.2536E+00 | 1.2536E+00 | .0 | 1.2536E+00 | .0 | 1.2536E+00 | .0 | 1.2536E+00 | .0 | 1.2536E+00 | .0 | 1.2519E+00 | -.1 |
| 76 | 8 | 1.2550E+00 | 1.2550E+00 | .0 | 1.2550E+00 | .0 | 1.2550E+00 | .0 | 1.2550E+00 | .0 | 1.2550E+00 | .0 | 1.2535E+00 | -.1 |
| 77 | 7 | 1.2731E+00 | 1.2731E+00 | .0 | 1.2731E+00 | .0 | 1.2731E+00 | .0 | 1.2731E+00 | .0 | 1.2731E+00 | .0 | 1.2691E+00 | -.3 |
| 78 | 6 | 1.2684E+00 | 1.2684E+00 | .0 | 1.2684E+00 | .0 | 1.2684E+00 | .0 | 1.2684E+00 | .0 | 1.2685E+00 | .0 | 1.2662E+00 | -.2 |
| 79 | 5 | 1.2056E+00 | 1.2056E+00 | .0 | 1.2056E+00 | .0 | 1.2056E+00 | .0 | 1.2056E+00 | .0 | 1.2056E+00 | .0 | 1.2091E+00 | .3 |
| 80 | 4 | 1.1378E+00 | 1.1378E+00 | .0 | 1.1378E+00 | .0 | 1.1378E+00 | .0 | 1.1378E+00 | .0 | 1.1378E+00 | .0 | 1.1386E+00 | .1 |
| 81 | 3 | 1.0909E+00 | 1.0909E+00 | .0 | 1.0909E+00 | .0 | 1.0909E+00 | .0 | 1.0909E+00 | .0 | 1.0908E+00 | .0 | 1.0906E+00 | .0 |
| 82 | 2 | 1.4988E+00 | 1.4988E+00 | .0 | 1.4988E+00 | .0 | 1.4989E+00 | .0 | 1.4988E+00 | .0 | 1.4988E+00 | .0 | 1.4959E+00 | -.2 |
| 83 | 1 | 1.7853E+00 | 1.7853E+00 | .0 | 1.7853E+00 | .0 | 1.7853E+00 | .0 | 1.7853E+00 | .0 | 1.7853E+00 | .0 | 1.7808E+00 | -.3 |
| %RMS | | | | 17.92 | | 17.88 | | 44.14 | | .03 | | .04 | | .24 |
| %RMSP | | | | 24.87 | | 24.85 | | 68.68 | | .06 | | .04 | | .21 |

MATERIAL: U-235 MAT = 1261

| SECAO DE CHOQUE: | | ELASTICA | | | FISSAO | | | CAPTURA | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CODIGO-> | | CODIGO-1 | CODIGO-2 | | CODIGO-1 | CODIGO-2 | | CODIGO-1 | CODIGO-2 | | | |
| GRUPO | | REFERENCIA | VALOR | %DESVIO | REFERENCIA | VALOR | %DESVIO | REFERENCIA | VALOR | %DESVIO | GRUPO | |
| 30 | 54 | 1.3376E+01 | 1.3376E+01 | .0 | 6.0078E+01 | 6.0078E+01 | .0 | 5.8202E+00 | 5.8202E+00 | .0 | 30 | 54 |
| 31 | 53 | 1.2895E+01 | 1.2874E+01 | -.2 | 7.0335E+01 | 5.2155E+01 | -25.8 | 1.0774E+01 | 5.3611E+00 | -50.2 | 31 | 53 |
| 32 | 52 | 1.2907E+01 | 1.2900E+01 | -.1 | 4.1040E+01 | 8.4798E+01 | 106.6 | 1.3442E+01 | 2.6371E+01 | 96.2 | 32 | 52 |
| 33 | 51 | 1.2325E+01 | 1.2318E+01 | -.1 | 1.4964E+01 | 1.2722E+01 | -15.0 | 3.6350E+00 | 2.5516E+00 | -29.8 | 33 | 51 |
| 34 | 50 | 1.1991E+01 | 1.1984E+01 | -.1 | 1.4447E+01 | 1.3716E+01 | -5.1 | 1.2911E+01 | 1.3690E+01 | 6.0 | 34 | 50 |
| 35 | 49 | 1.1566E+01 | 1.1559E+01 | -.1 | 1.4144E+01 | 1.1202E+01 | -20.8 | 3.4394E+00 | 2.0820E+00 | -39.5 | 35 | 49 |
| 36 | 48 | 1.1360E+01 | 1.1353E+01 | -.1 | 3.2077E+01 | 3.5969E+01 | 12.1 | 1.5556E+01 | 1.6990E+01 | 9.2 | 36 | 48 |
| 37 | 47 | 1.0926E+01 | 1.0919E+01 | -.1 | 5.4903E+00 | 3.0042E+00 | -45.3 | 2.1490E+01 | 1.9896E+01 | -7.4 | 37 | 47 |
| 38 | 46 | 1.0665E+01 | 1.0657E+01 | -.1 | 3.1006E+01 | 3.3332E+01 | 7.5 | 4.8153E+01 | 4.6529E+01 | -3.4 | 38 | 46 |
| 39 | 45 | 1.0462E+01 | 1.0455E+01 | -.1 | 1.3462E+01 | 7.5725E+00 | -43.7 | 1.6176E+01 | 1.2617E+01 | -22.0 | 39 | 45 |
| 40 | 44 | 1.1905E+01 | 1.1898E+01 | -.1 | 1.0199E+02 | 1.1004E+02 | 7.9 | 3.5264E+01 | 3.8399E+01 | 8.9 | 40 | 44 |
| 41 | 43 | 1.2477E+01 | 1.2142E+01 | -2.7 | 4.9488E+01 | 4.7267E+01 | -4.5 | 7.1258E+01 | 7.2333E+01 | 1.5 | 41 | 43 |
| 42 | 42 | 1.0893E+01 | 1.0885E+01 | -.1 | 3.2952E+01 | 3.8138E+01 | 15.7 | 1.7962E+01 | 1.7620E+01 | -1.9 | 42 | 42 |
| 43 | 41 | 1.3725E+01 | 1.3714E+01 | -.1 | 6.7228E+01 | 6.8754E+01 | 2.3 | 4.5328E+01 | 4.5909E+01 | 1.3 | 43 | 41 |
| 44 | 40 | 1.1687E+01 | 1.2173E+01 | 4.2 | 4.5025E+01 | 4.7365E+01 | 5.2 | 2.0210E+01 | 2.1544E+01 | 6.6 | 44 | 40 |
| 45 | 39 | 1.3394E+01 | 1.3386E+01 | -.1 | 5.8640E+01 | 5.7069E+01 | -2.7 | 3.6394E+01 | 3.5971E+01 | -1.2 | 45 | 39 |
| 46 | 38 | 1.1983E+01 | 1.9937E+01 | 66.4 | 3.4635E+01 | 3.4526E+01 | -.3 | 1.7888E+01 | 1.7755E+01 | -.7 | 46 | 38 |
| 47 | 37 | 1.3189E+01 | 1.3581E+01 | 3.0 | 5.6488E+01 | 5.7237E+01 | 1.3 | 2.4622E+01 | 2.5368E+01 | 3.0 | 47 | 37 |
| 48 | 36 | 1.2408E+01 | 1.4040E+01 | 13.2 | 2.4444E+01 | 2.4437E+01 | .0 | 9.7688E+00 | 9.7622E+00 | -.1 | 48 | 36 |
| 49 | 35 | 1.2662E+01 | 1.2544E+01 | -.9 | 2.3291E+01 | 2.4042E+01 | 3.2 | 1.4847E+01 | 1.4591E+01 | -1.7 | 49 | 35 |
| 50 | 34 | 1.2637E+01 | 1.2496E+01 | -1.1 | 2.2864E+01 | 2.3345E+01 | 2.1 | 1.3610E+01 | 1.3194E+01 | -3.1 | 50 | 34 |
| 51 | 33 | 1.2538E+01 | 1.2406E+01 | -1.1 | 2.1280E+01 | 2.1418E+01 | .6 | 1.1199E+01 | 1.0785E+01 | -3.7 | 51 | 33 |
| 52 | 32 | 1.3015E+01 | 1.2818E+01 | -1.5 | 2.0842E+01 | 2.1379E+01 | 2.6 | 1.0197E+01 | 9.8585E+00 | -3.3 | 52 | 32 |
| 53 | 31 | 1.2297E+01 | 1.2193E+01 | -.8 | 1.3691E+01 | 1.3998E+01 | 2.2 | 5.9528E+00 | 5.7230E+00 | -3.9 | 53 | 31 |
| 54 | 30 | 1.2430E+01 | 1.2302E+01 | -1.0 | 1.3209E+01 | 1.3565E+01 | 2.7 | 4.7568E+00 | 4.5322E+00 | -4.7 | 54 | 30 |
| 55 | 29 | 1.2455E+01 | 1.2346E+01 | -.9 | 8.5200E+00 | 8.7436E+00 | 2.6 | 4.3365E+00 | 4.2092E+00 | -2.9 | 55 | 29 |
| 56 | 28 | 1.2125E+01 | 1.2041E+01 | -.7 | 6.8845E+00 | 7.0616E+00 | 2.6 | 2.6624E+00 | 2.5660E+00 | -3.6 | 56 | 28 |
| 57 | 27 | 1.1929E+01 | 1.1865E+01 | -.5 | 5.2048E+00 | 5.3266E+00 | 2.3 | 1.8977E+00 | 1.8374E+00 | -3.2 | 57 | 27 |
| 58 | 26 | 1.1805E+01 | 1.1749E+01 | -.5 | 4.2387E+00 | 4.3434E+00 | 2.5 | 1.4562E+00 | 1.4059E+00 | -3.5 | 58 | 26 |
| 59 | 25 | 1.1836E+01 | 1.1779E+01 | -.5 | 3.2713E+00 | 3.3587E+00 | 2.7 | 1.4150E+00 | 1.3837E+00 | -2.3 | 59 | 25 |
| 60 | 24 | 1.1585E+01 | 1.1541E+01 | -.4 | 2.7136E+00 | 2.7783E+00 | 2.4 | 1.1076E+00 | 1.0836E+00 | -2.2 | 60 | 24 |
| 61 | 23 | 1.1311E+01 | 1.1274E+01 | -.3 | 2.2506E+00 | 2.3070E+00 | 2.5 | 8.8779E-01 | 8.6757E-01 | -2.3 | 61 | 23 |
| 62 | 22 | 1.0977E+01 | 1.0977E+01 | .0 | 2.0273E+00 | 2.0280E+00 | .0 | 7.2196E-01 | 7.2171E-01 | .0 | 62 | 22 |
| 63 | 21 | 1.0473E+01 | 1.0473E+01 | .0 | 1.8406E+00 | 1.8406E+00 | .0 | 5.8998E-01 | 5.8998E-01 | .0 | 63 | 21 |
| 64 | 20 | 9.9203E+00 | 9.9203E+00 | .0 | 1.7148E+00 | 1.7148E+00 | .0 | 5.0588E-01 | 5.0588E-01 | .0 | 64 | 20 |
| 65 | 19 | 9.4169E+00 | 9.4169E+00 | .0 | 1.5830E+00 | 1.5830E+00 | .0 | 4.3670E-01 | 4.3670E-01 | .0 | 65 | 19 |
| 66 | 18 | 8.8804E+00 | 8.8804E+00 | .0 | 1.5148E+00 | 1.5148E+00 | .0 | 3.9082E-01 | 3.9082E-01 | .0 | 66 | 18 |
| 67 | 17 | 8.3854E+00 | 8.3854E+00 | .0 | 1.4310E+00 | 1.4310E+00 | .0 | 3.4023E-01 | 3.4023E-01 | .0 | 67 | 17 |
| 68 | 16 | 7.8730E+00 | 7.8730E+00 | .0 | 1.3398E+00 | 1.3398E+00 | .0 | 2.9612E-01 | 2.9612E-01 | .0 | 68 | 16 |
| 69 | 15 | 7.2808E+00 | 7.2808E+00 | .0 | 1.2985E+00 | 1.2985E+00 | .0 | 2.6210E-01 | 2.6210E-01 | .0 | 69 | 15 |
| 70 | 14 | 6.7318E+00 | 6.7318E+00 | .0 | 1.2339E+00 | 1.2339E+00 | .0 | 2.1624E-01 | 2.1624E-01 | .0 | 70 | 14 |
| 71 | 13 | 6.0981E+00 | 6.0981E+00 | .0 | 1.1980E+00 | 1.1980E+00 | .0 | 1.9005E-01 | 1.9005E-01 | .0 | 71 | 13 |
| 72 | 12 | 5.4837E+00 | 5.4837E+00 | .0 | 1.1563E+00 | 1.1563E+00 | .0 | 1.6233E-01 | 1.6233E-01 | .0 | 72 | 12 |
| 73 | 11 | 4.7878E+00 | 4.7878E+00 | .0 | 1.1343E+00 | 1.1343E+00 | .0 | 1.3777E-01 | 1.3777E-01 | .0 | 73 | 11 |
| 74 | 10 | 4.2711E+00 | 4.2711E+00 | .0 | 1.1928E+00 | 1.1928E+00 | .0 | 1.2112E-01 | 1.2112E-01 | .0 | 74 | 10 |
| 75 | 9 | 3.9160E+00 | 3.9160E+00 | .0 | 1.2536E+00 | 1.2536E+00 | .0 | 9.7785E-02 | 9.7785E-02 | .0 | 75 | 9 |
| 76 | 8 | 3.8862E+00 | 3.8862E+00 | .0 | 1.2550E+00 | 1.2550E+00 | .0 | 7.1980E-02 | 7.1980E-02 | .0 | 76 | 8 |
| 77 | 7 | 4.1010E+00 | 4.1010E+00 | .0 | 1.2731E+00 | 1.2731E+00 | .0 | 5.4278E-02 | 5.4278E-02 | .0 | 77 | 7 |
| 78 | 6 | 4.5110E+00 | 4.5110E+00 | .0 | 1.2684E+00 | 1.2684E+00 | .0 | 4.1969E-02 | 4.1969E-02 | .0 | 78 | 6 |
| 79 | 5 | 4.8291E+00 | 4.8291E+00 | .0 | 1.2056E+00 | 1.2056E+00 | .0 | 3.1970E-02 | 3.1970E-02 | .0 | 79 | 5 |
| 80 | 4 | 4.8960E+00 | 4.8960E+00 | .0 | 1.1378E+00 | 1.1378E+00 | .0 | 2.4101E-02 | 2.4101E-02 | .0 | 80 | 4 |
| 81 | 3 | 4.5593E+00 | 4.5693E+00 | .0 | 1.0909E+00 | 1.0909E+00 | .0 | 1.7598E-02 | 1.7598E-02 | .0 | 81 | 3 |
| 82 | 2 | 4.1254E+00 | 4.1254E+00 | .0 | 1.4988E+00 | 1.4988E+00 | .0 | 1.2853E-02 | 1.2853E-02 | .0 | 82 | 2 |
| 83 | 1 | 3.5840E+00 | 3.5840E+00 | .0 | 1.7853E+00 | 1.7853E+00 | .0 | 7.0541E-03 | 7.0541E-03 | .0 | 83 | 1 |
| %RMS | | | | 9.75 | | | 17.92 | | | 16.76 | | |
| %RMSP | | | | 10.25 | | | 24.87 | | | 18.62 | | |

## APPENDIX D

Listing of the REDCOMP interface module.

```
      PROGRAM REDCOMP(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,
     1                              TAPE1,TAPE2)
C
C     ***************************************************************
C
C     ESTE PROGRAMA REFORMATA A BIBLIOTECA PRODUZIDA  POR  GROUPIE  NO
C     FORMATO DE ENTRADA DO CODIGO COMPAR.
C
C     ARQUIVOS DE ENTRADA
C        1     - BIBLIOTECA PRODUZIDA POR GROUPIE.
C        5     - DADOS DE ENTRADA.
C     ARQUIVOS DE SAIDA
C        2     - BIBLIOTECA NO FORMATO DE ENTRADA DO CODIGO COMPAR.
C        6     - IMPRESSAO DE SAIDA -RELACAO DOS MATERIAIS PROCESSADOS.
C
C     DADOS DE ENTRADA
C       CARTAO 1          FORMATO LIVRE
C         NG              NUMERO DE GRUPOS DE ENERGIA.
C         NGT             NUMERO DE GRUPOS TERMICOS.
C
C     EXECUCAO VIA TERMINAL
C       *  PROGRAMA FONTE
C       GET,REDCOMP  OU  ATTACH,REDCOMP
C       *  PROGRAMA OBJETO
C       FTN5,I=REDCOMP,L=0
C       *  BIBLIOTECA PRODUZIDA POR GROUPIE
C       GET,TAPE1  OU  ATTACH,TAPE1
C       *  EXECUCAO
C       LGO
C       *  DADOS DE ENTRADA VIA TERMINAL - FORMATO LIVRE
C       NG NGT
C       *  BIBLIOTECA GERADA NO FORMATO DO COMPAR
C       SAVE,TAPE2
C
C     PROGRAMA DESENVOLVIDO POR  E.S.CHALHOUB  E  JAIME ANAF.
C     VERSAO OUT/87.
C
C                                                        CTA/IEAV/EMU
C     ***************************************************************
C
      DIMENSION XS(620,3),E(621),X(621),Y(621),MTI(4)
      DATA MTI/1,2,18,102/
 1000 FORMAT(66X,I4,I2,I3)
 1100 FORMAT(I11)
 1200 FORMAT(6E11.0)
 1300 FORMAT(3I5,5X,'MAT - BIBLIOTECA PRODUZIDA POR GROUPIE')
 1400 FORMAT(I5,1P3E15.4)
 1500 FORMAT(33X,I11,22X,I4)
 1600 FORMAT(3I5,5X,'MAT - ')
 1700 FORMAT(///,10X,'PROCESSAMENTO INTERROMPIDO.',/,
     1            10X,'O NUMERO DE GRUPOS DE ENERGIA',I4,',',/,
     2            10X,'ENCONTRADO NA BIBLIOTECA DO GROUPIE,',/,
     3            10X,'NAO COINCIDE COM O NUMERO DESEJADO',I4,'.')
 1800 FORMAT(///,3I5,5X,'MAT - BIBLIOTECA PRODUZIDA POR GROUPIE')
C
      IM=0
      READ(5,*    )NG,NGT
C     LER A BIBLIOTECA PRODUZIDA POR GROUPIE
      READ(1,1000)
   10 IM=IM+1
      DO 20 I=1,NG
   20 XS(I,1)=XS(I,2)=XS(I,3)=0.
      READ(1,1500,END=140)LFI,MAT
      IF(MAT.EQ.-1)GO TO 130
   30 READ(1,1000,END=140)MAT,MF
      IF(MF.NE.3)GO TO 30
      DO 70 IR1=1,4
      IR=IR1-1
      IF(IR.EQ.2.AND.LFI.EQ.0)GO TO 70
```

```
      MT1=MTI(IR1)                                                      REDC0070
   40 READ(1,1000,END=140)MAT,MF,MT                                     REDC0071
      IF(MT.GT.MT1)GO TO 70                                             REDC0072
      IF(MT.NE.MT1)GO TO 40                                             REDC0073
      IF(MT.GT.1)GO TO 50                                               REDC0074
      READ(1,1100)NG1                                                   REDC0075
      IF(NG1.NE.NG+1)GO TO 120                                          REDC0076
      READ(1,1200)(E(I),Y(I),I=1,NG1)                                   REDC0077
      GO TO 70                                                          REDC0078
   50 READ(1,1000)                                                      REDC0079
      READ(1,1100)NG1                                                   REDC0080
      READ(1,1200)(X(I),Y(I),I=1,NG1)                                   REDC0081
      J=1                                                               REDC0082
      DO 60 I=1,NG                                                      REDC0083
      IF(ABS(E(I)-X(J)).GT.1.E-06)GO TO 60                              REDC0084
      XS(I,IR)=Y(J)                                                     REDC0085
      J=J+1                                                             REDC0086
   60 CONTINUE                                                          REDC0087
   70 CONTINUE                                                          REDC0088
   80 READ(1,1000)IFIM                                                  REDC0089
      IF(IFIM.GT.0)GO TO 80                                             REDC0090
C     GERAR A BIBLIOTECA PARA COMPAR                                    REDC0091
      IF(IM.GT.1)GO TO 90                                               REDC0092
      WRITE(2,1300)MAT,NG,NGT                                           REDC0093
      WRITE(6,1800)MAT,NG,NGT                                           REDC0094
      GO TO 100                                                         REDC0095
   90 WRITE(2,1600)MAT,NG,NGT                                           REDC0096
      WRITE(6,1600)MAT,NG,NGT                                           REDC0097
  100 DO 110 I=1,NG                                                     REDC0098
  110 WRITE(2,1400)I,(XS(I,IR),IR=1,3)                                  REDC0099
      GO TO 10                                                          REDC0100
C     ERRO ENCONTRADO NA BIBLIOTECA DE ENTRADA                          REDC0101
  120 NGG=NG1-1                                                         REDC0102
      WRITE(6,1700)NGG,NG                                               REDC0103
      GO TO 140                                                         REDC0104
C     TERMINO DA GERACAO DA BIBLIOTECA PARA COMPAR                      REDC0105
  130 WRITE(2,1600)MAT                                                  REDC0106
      WRITE(6,1600)MAT                                                  REDC0107
  140 STOP                                                              REDC0108
      END                                                               REDC0109
```

## APPENDIX E

Listing of the FLACOMP interface module.

```
      PROGRAM FLACOMP(OUTPUT,TAPE6=OUTPUT,TAPE1,TAPE2)
C
C     ************************************************************
C
C     ESTE PROGRAMA REFORMATA  A BIBLIOTECA  PRODUZIDA  POR  FLANGE NO
C     FORMATO DE ENTRADA DO CODIGO COMPAR.
C
C     ARQUIVOS DE ENTRADA
C        1     - BIBLIOTECA DO FLANGE.
C     ARQUIVOS DE SAIDA
C        2     - BIBLIOTECA NO FORMATO DE ENTRADA DO CODIGO COMPAR.
C        6     - IMPRESSAO DE SAIDA -RELACAO DOS MATERIAIS PROCESSADOS.
C
C     EXECUCAO VIA TERMINAL
C       *  PROGRAMA FONTE
C       GET FLACOMP  OU  ATTACH,FLACOMP
C       *  PROGRAMA OBJETO
C       FTN5,I=FLACOMP,L=0
C       *  BIBLIOTECA PRODUZIDA POR FLANGE
C       GET,TAPE1  OU  ATTACH,TAPE1
C       *  EXECUCAO
C       LGO
C       *  BIBLIOTECA GERADA NO FORMATO DO COMPAR
C       SAVE,TAPE2
C
C     PROGRAMA DESENVOLVIDO POR  E.S.CHALHOUB  E  JAIME ANAF.
C     VERSAO OUT/87.
C
C                                                        CTA/IEAV/ENU
C     ************************************************************
C
      CHARACTER*1 REAC(4),REAC1
      CHARACTER*8 REACT(3),FID,FID1
      DIMENSION XS(30,3),JR(3)
      DATA REAC/'S','F','A','K'/
      DATA REACT/'ESP.ELAS','  FISSAO','ABSORCAO'/
 1000 FORMAT(68X,A8,I4)
 1100 FORMAT(4X,I3,A1,E12.0,48X,A8)
 1200 FORMAT(8X,5E12.0)
 1300 FORMAT(3I5,5X,'MAT - BIBLIOTECA PRODUZIDA POR FLANGE')
 1400 FORMAT(3I5,5X,'MAT - ')
 1500 FORMAT(I5,1P3E15.4)
 1600 FORMAT(///,10X,'PROCESSAMENTO INTERROMPIDO.')
 1700 FORMAT(10X,'BIBLIOTECA DO FLANGE, MAT ',I4,',',/,
     1        10X,'NAO POSSUI A REACAO : ',)
 1800 FORMAT(32X,A8)
 1900 FORMAT(/,10X,'ADVERTENCIA.')
 2100 FORMAT(///,3I5,5X,'MAT - BIBLIOTECA PRODUZIDA POR FLANGE')
C
      IM=0
C     LER A BIBLIOTECA PRODUZIDA POR FLANGE
   10 IM=IM+1
      DO 20 I=1,30
   20 XS(I,1)=XS(I,2)=XS(I,3)=0.
      DO 30 IR=1,3
   30 JR(IR)=0
   40 READ(1,1000,END=150)FID,MAT
      IF(IM.GT.1.AND.FID.EQ.FID1)GO TO 40
   50 READ(1,1100,ERR=70,END=70)NG1,REAC1,T,FID1
      IF(REAC1.EQ.REAC(4))GO TO 70
      DO 60 IR=1,3
   60 IF(REAC1.EQ.REAC(IR))GO TO 80
      GO TO 50
   70 IF(JR(1).EQ.0.OR.JR(3).EQ.0)GO TO 140
      WRITE(6,1900)
      WRITE(6,1700)MAT
      WRITE(6,1800)REACT(2)
      WRITE(6,1500)
      BACKSPACE 1
```

```
      GO TO 90                                                          FLAC0070
   80 JR(IR)=1                                                          FLAC0071
      NG=NG1                                                            FLAC0072
      READ(1,1200)(XS(I,IR),I=1,NG)                                     FLAC0073
      IF(JR(1).EQ.0.OR.JR(2).EQ.0.OR.JR(3).EQ.0)GO TO 50                FLAC0074
   90 DO 100 I=1,NG                                                     FLAC0075
  100 XS(I,3)=XS(I,3)-XS(I,2)                                           FLAC0076
C     GERAR A BIBLIOTECA PARA COMPAR                                    FLAC0077
      IF(IM.GT.1)GO TO 110                                              FLAC0078
      WRITE(2,1300)MAT,NG,NG                                            FLAC0079
      WRITE(6,2100)MAT,NG,NG                                            FLAC0080
      GO TO 120                                                         FLAC0081
  110 WRITE(2,1400)MAT,NG,NG                                            FLAC0082
      WRITE(6,1400)MAT,NG,NG                                            FLAC0083
  120 DO 130 I=1,NG                                                     FLAC0084
  130 WRITE(2,1500)I,(XS(I,IR),IR=1,3)                                  FLAC0085
      GO TO 10                                                          FLAC0086
C     ERRO ENCONTRADO NA BIBLIOTECA DE ENTRADA                          FLAC0087
  140 WRITE(6,1600)                                                     FLAC0088
      WRITE(6,1700)MAT                                                  FLAC0089
      IF(JR(1).EQ.0)WRITE(6,1800)REACT(1)                               FLAC0090
      IF(JR(3).EQ.0)WRITE(6,1800)REACT(3)                               FLAC0091
      GO TO 160                                                         FLAC0092
C     TERMINO DA GERACAO DA BIBLIOTECA PARA COMPAR                      FLAC0093
  150 MAT=-1                                                            FLAC0094
      WRITE(2,1400)MAT                                                  FLAC0095
      WRITE(6,1400)MAT                                                  FLAC0096
  160 STOP                                                              FLAC0097
      END                                                               FLAC0098
```

## APPENDIX F

Listing of the ETOCOMP interface module.

```
      PROGRAM ETOCOMP(OUTPUT,TAPE6=OUTPUT,TAPE1,TAPE2)                  ETOC0001
C                                                                       ETOC0002
C     ***************************************************************   ETOC0003
C                                                                       ETOC0004
C     ESTE PROGRAMA REFORMATA  A  BIBLIOTECA  PRODUZIDA  POR  ETOG  NO  ETOC0005
C     FORMATO DE ENTRADA DO CODIGO COMPAR.                              ETOC0006
C                                                                       ETOC0007
C     ARQUIVOS DE ENTRADA                                               ETOC0008
C        1    - BIBLIOTECA DO ETOG.                                     ETOC0009
C     ARQUIVOS DE SAIDA                                                 ETOC0010
C        2    - BIBLIOTECA NO FORMATO DE ENTRADA DO CODIGO COMPAR.      ETOC0011
C        6    - IMPRESSAO DE SAIDA -RELACAO DOS MATERIAIS PROCESSADOS.  ETOC0012
C                                                                       ETOC0013
C     EXECUCAO VIA TERMINAL                                             ETOC0014
C       *  PROGRAMA FONTE                                               ETOC0015
C       GET,ETCOMP  OU  ATTACH,ETCOMP                                   ETOC0016
C       *  PROGRAMA OBJETO                                              ETOC0017
C       FTN5,I=ETCOMP,L=0                                               ETOC0018
C       *  BIBLIOTECA PRODUZIDA POR ETOG                                ETOC0019
C       GET,TAPE1  OU  ATTACH,TAPE1                                     ETOC0020
C       *  EXECUCAO                                                     ETOC0021
C       LGO                                                             ETOC0022
C       *  BIBLIOTECA GERADA NO FORMATO DO COMPAR                       ETOC0023
C       SAVE,TAPE2                                                      ETOC0024
C                                                                       ETOC0025
C     PROGRAMA DESENVOLVIDO POR  E.S.CHALHOUB  E  JAIME ANAF.           ETOC0026
C     VERSAO OUT/87.                                                    ETOC0027
C                                                                       ETOC0028
C                                                          CTA/IEAV/ENU ETOC0029
C     ***************************************************************   ETOC0030
C                                                                       ETOC0031
      DIMENSION ZS(124,3),XS(124,3)                                     ETOC0032
 1000 FORMAT(44X,I4)                                                    ETOC0033
 1100 FORMAT(I1,I3,4X,2F8.3,8X,F8.3)                                    ETOC0034
 1200 FORMAT(3I5,5X,'MAT - BIBLIOTECA PRODUZIDA POR ETOG')              ETOC0035
 1300 FORMAT(3I5,5X,'MAT - ')                                           ETOC0036
 1400 FORMAT(I5,1P3E15.4)                                               ETOC0037
 1500 FORMAT(///,3I5,5X,'MAT - BIBLIOTECA PRODUZIDA POR ETOG')          ETOC0038
C                                                                       ETOC0039
      IM=0                                                              ETOC0040
      NGT=0                                                             ETOC0041
C     LER A BIBLIOTECA PRODUZIDA POR ETOG                               ETOC0042
   10 IM=IM+1                                                           ETOC0043
      READ(1,1000,END=100)MAT                                           ETOC0044
   20 READ(1,1100)IFIM,I,E,C,F                                          ETOC0045
      IF(IFIM.GT.1)GO TO 30                                             ETOC0046
      NG=I                                                              ETOC0047
      ZS(I,1)=E                                                         ETOC0048
      ZS(I,2)=F                                                         ETOC0049
      ZS(I,3)=C                                                         ETOC0050
      GO TO 20                                                          ETOC0051
   30 NG1=NG+1                                                          ETOC0052
      DO 40 I=1,NG                                                      ETOC0053
      J=NG1-I                                                           ETOC0054
      XS(J,1)=ZS(I,1)                                                   ETOC0055
      XS(J,2)=ZS(I,2)                                                   ETOC0056
      XS(J,3)=ZS(I,3)                                                   ETOC0057
   40 CONTINUE                                                          ETOC0058
      IF(IFIM.EQ.9)GO TO 60                                             ETOC0059
   50 READ(1,1100)IFIM                                                  ETOC0060
      IF(IFIM.NE.9)GO TO 50                                             ETOC0061
C     GERAR A BIBLIOTECA PARA COMPAR                                    ETOC0062
   60 CONTINUE                                                          ETOC0063
      IF(IM.GT.1)GO TO 70                                               ETOC0064
      WRITE(2,1200)MAT,NG,NGT                                           ETOC0065
      WRITE(6,1500)MAT,NG,NGT                                           ETOC0066
      GO TO 80                                                          ETOC0067
   70 WRITE(2,1300)MAT,NG,NGT                                           ETOC0068
      WRITE(6,1300)MAT,NG,NGT                                           ETOC0069
```

```
   80 DO 90 I=1,NG                                                      ETOC0070
      WRITE(2,1400)I,(XS(I,IR),IR=1,3)                                  ETOC0071
   90 CONTINUE                                                          ETOC0072
      GO TO 10                                                          ETOC0073
C     TERMINO DA GERACAO DA BIBLIOTECA PARA COMPAR                      ETOC0074
  100 MAT=-1                                                            ETOC0075
      WRITE(2,1300)MAT                                                  ETOC0076
      WRITE(6,1300)MAT                                                  ETOC0077
      STOP                                                              ETOC0078
      END                                                               ETOC0079
```

## APPENDIX G

Listing of the XLACOMP interface module.

```
      PROGRAM XLACOMP(OUTPUT,TAPE6=OUTPUT,TAPE1,TAPE2)
C
C     ************************************************************
C
C     ESTE PROGRAMA REFORMATA O TAPE 20 PRODUZIDO POR XLACS NO FORMATO
C     DE ENTRADA DO CODIGO COMPAR.
C
C     ARQUIVOS DE ENTRADA
C        1     - BIBLIOTECA PRODUZIDA POR XLACS.
C     ARQUIVOS DE SAIDA
C        2     - BIBLIOTECA NO FORMATO DE ENTRADA DO CODIGO COMPAR.
C        6     - IMPRESSAO DE SAIDA -RELACAO DOS MATERIAIS PROCESSADOS.
C
C     EXECUCAO VIA TERMINAL
C       *  PROGRAMA FONTE
C       GET,XLACOMP
C       *  PROGRAMA OBJETO
C       FTN5,I=XLACOMP,L=0
C       *  TAPE 20 PRODUZIDO POR XLACS
C       GET,TAPE1  OU  ATTACH,TAPE1
C       *  EXECUCAO
C       LGO
C       *  BIBLIOTECA GERADA NO FORMATO DO COMPAR
C       SAVE,TAPE2
C
C     PROGRAMA DESENVOLVIDO POR  JAIME ANAF  E  E.S. CHALHOUB.
C     VERSAO OUT/87.
C
C                                                        CTA/IEAV/ENU
C     ************************************************************
C
      DIMENSION X1(84,14),X(84,3),NTIT(14),NUM(5),NISM(50),MATM(50)
      READ(1,*)IOPT,NNUC,NG,NGT
      IF(IOPT.EQ.3)GO TO 20
      DO 10 I=1,NNUC
10    READ(1,*)NISM(I),MATM(I)
      DO 220 L=1,NNUC
      NIS=NISM(L)
      MAT=MATM(L)
      GO TO 30
20    READ(1,*,END=230) NIS,MAT
30    READ(1,*)NR
      READ(1,*)(NTIT(I),I=1,NR)
      DO 40 I=1,NG
      READ(1,*)IDUM, (X1(I,J),J=1,NR)
      DO 40 J=1,3
40    X(I,J) = 0.0
      NUM(1) = 2
      NUM(2) = 0
      NUM(3) = 0
      NUM(4) = 0
      NUM(5) = 0
      DO 50 I1 = 3,NR
      IF(NTIT(I1).NE.18) GO TO 50
      NUM(2) = I1
      J1 = I1
      GO TO 60
50    CONTINUE
60    IF(NUM(2).NE.0) THEN
      DO 70 I2=J1,NR
      IF(NTIT(I2).EQ.101) NUM(3) = I2
      IF(NTIT(I2).EQ.1021)NUM(4) = I2
70    IF(NTIT(I2).EQ.1022)NUM(5) = I2
      GO TO 130
      ELSE
      DO 80 I3=3,NR
80    IF(NTIT(I3).EQ.102) NUM(3)=I3
      ENDIF
      IF(NUM(3).NE.0) THEN
```

```
      DO 90 I4=NUM(3),NR                                                XLA  69
      IF(NTIT(I4).EQ.1021) NUM(4)=I4                                    XLA  70
90    IF(NTIT(I4).EQ.1022) NUM(5)=I4                                    XLA  71
      GO TO 130                                                         XLA  72
      ELSE                                                              XLA  73
      DO 100 I5=3,NR                                                    XLA  74
100   IF(NTIT(I5).EQ.101) NUM(3)=I5                                     XLA  75
      ENDIF                                                             XLA  76
      IF(NUM(3).NE.0) THEN                                              XLA  77
      DO 110 I6=NUM(3),NR                                               XLA  78
      IF(NTIT(I6).EQ.1021) NUM(4)=I6                                    XLA  79
110   IF(NTIT(I6).EQ.1022) NUM(5)=I6                                    XLA  80
      GO TO 130                                                         XLA  81
      ELSE                                                              XLA  82
      DO 120 I7=3,NR                                                    XLA  83
      IF(NTIT(I7).EQ.27) NUM(3)=I7                                      XLA  84
      IF(NTIT(I7).EQ.1021)NUM(4)=I7                                     XLA  85
120   IF(NTIT(I7).EQ.1022)NUM(5)=I7                                     XLA  86
      ENDIF                                                             XLA  87
130   IF(NUM(2).EQ.0) THEN                                              XLA  88
      IF(NUM(4).EQ.0) THEN                                              XLA  89
      DO 140 I=1,NG                                                     XLA  90
      X(I,1) = X1(I,2)                                                  XLA  91
140   X(I,3) = X1(I,NUM(3))                                             XLA  92
      ELSE                                                              XLA  93
      DO 150 I=1,NG                                                     XLA  94
      X(I,1) = X1(I,2)                                                  XLA  95
      IF(NIS.EQ.1) X(I,3) = X1(I,NUM(4))                                XLA  96
150   X(I,3) = X1(I,NUM(3)) + X(I,3)                                    XLA  97
      ENDIF                                                             XLA  98
      ELSE                                                              XLA  99
      IF(NUM(5).EQ.0) THEN                                              XLA 100
      DO 160 I=1,NG                                                     XLA 101
      X(I,1) = X1(I,2)                                                  XLA 102
      X(I,2) = X1(I,NUM(2))                                             XLA 103
      IF(NIS.EQ.1) X(I,3) = X1(I,NUM(4))                                XLA 104
160   X(I,3) = X1(I,NUM(3)) + X(I,3)                                    XLA 105
      ELSE                                                              XLA 106
      DO 170 I=1,NG                                                     XLA 107
      X(I,1) = X1(I,2)                                                  XLA 108
      X(I,2) = X1(I,NUM(2)) + X1(I,NUM(5))                              XLA 109
      IF(NIS.EQ.1) X(I,3) = X1(I,NUM(4))                                XLA 110
170   X(I,3) = X1(I,NUM(3)) + X(I,3)                                    XLA 111
      ENDIF                                                             XLA 112
      ENDIF                                                             XLA 113
      WRITE(2,180) MAT, NG, NGT                                         XLA 114
180   FORMAT(3I5,2X,'XLACS - ESPALHAMENTO, FISSAO E CAPTURA(N,GAMA)')   XLA 115
      DO 190 I=1,NG                                                     XLA 116
      K = NG + 1 - I                                                    XLA 117
190   WRITE(2,200) I,(X(K,J),J=1,3)                                     XLA 118
200   FORMAT(I5,3(1PE15.4))                                             XLA 119
      WRITE(6,210)MAT, NG, NGT                                          XLA 120
210   FORMAT(  /,3I5,5X,'MAT - BIBLIOTECA PRODUZIDA POR XLACS')         XLA 121
      IF(IOPT.EQ.3) GO TO 20                                            XLA 122
220   CONTINUE                                                          XLA 123
230   WRITE(2,240)                                                      XLA 124
240   FORMAT(1X,'-1')                                                   XLA 125
      WRITE(6,250)                                                      XLA 126
250   FORMAT(  /,'   -1',15X,'MAT - FIM DE PROCESSAMENTO')              XLA 127
      STOP                                                              XLA 128
      END                                                               XLA 129
```

APPENDIX H

This Appendix contains partial listings of sub-routines

L1ST
RESN
RESS
XLACS

of the XLACS program, modified through the addition of the instructions indicated by an asterisk in column 76, which make it possible to generate the TAPE20 file, as required for the XLACOMP interface module.

The additional instructions in sub-routines L1ST, RESN and RESS are intended solely for writing in the TAPE20 file. Line XLA 253 was introduced into the XLACS sub-routine for writing data. The purpose of lines XLA 116 to XLA 118, XLA 331, XLA 361 and XLA 368 is to activate, or not, the alternative routing mentioned in Section 3.4.

```
      SUBROUTINE L1ST(A,N1D,MAXG1,IO6,IDR,ID19)                         L1S    0
      DIMENSION A(MAXG1,1),HEAD(3,8),IDR(19),NTIT(14)                   L1S    1
C *** LIST ONE DIMENSIONAL ARRAYS                                       L1S    2
                                        .
                                        .
                                        .
      IF(L1.LE.MAXG)GO TO 4                                             L1S   37
      N1=N2+1                                                           L1S   38
      IF(N1.LE.N1D)GO TO 1                                              L1S   39
      WRITE(20,301)N1D                                                  L1S*  40
  301 FORMAT(2I4)                                                       L1S*  41
      DO 302 I=1,N1D                                                    L1S*  42
  302 NTIT(I) = IFIX(A(1,I))                                            L1S*  43
      WRITE(20,303)(NTIT(I),I=1,N1D)                                    L1S*  44
  303 FORMAT(9X,9(5X,I4,5X),/,5X,9(5X,I4,5X))                           L1S*  45
      DO 402 J=2,MAXG1                                                  L1S*  46
      K= J - 1                                                          L1S*  47
  402 WRITE(20,304)K,(A(J,I),I=1,N1D)                                   L1S*  48
  304 FORMAT(I4,9(1PE14.5),/,9(E14.5))                                  L1S*  49
      RETURN                                                            L1S   50
      END                                                               L1S   51


      SUBROUTINE RESN(NNN)                                              RES    0
      COMMON/DATA/D(1),LA1,LA2,LA3,LA4,LA5,LA6,LA7,LA8,LA9,LDM0(10),    RES    1
    1 LX,LY,LB,LNBT,LJNT,LJMT,LJAT,LJTT,LJLT,LA,LDM2(10),               RES    2
                                        .
                                        .
                                        .
      IF(LRP.GT.0)GO TO 4                                               RES   33
      INIS=1                                                            RES   34
      IXSR=1                                                            RES   35
      WRITE(20,40)INIS,MATNO                                            RES*  36
   40 FORMAT(2X,I2,2X,I4)                                               RES*  37
      GO TO 999                                                         RES   38
    4 NPAS=0                                                            RES   39
    2 NP=101                                                            RES   40
                                        .
                                        .
                                        .
                                        .
                                        .
      END                                                               RES  178
```

```
      SUBROUTINE RESS(NREF,AP,NER,ABN,SPIR,ZAI,LRU,I1,EL,EH,EBDRY,NLSR,  RES    0
     1 NRS,I2,I4,DATA,E,C,CBKG,FBKG,CDIL,FDIL,A1,A2,A3,NDOD,EE,CC,       RES    1
     2 UBDRY,AWRI,NUMRES)                                               RES    2
                                        .
                                        .
                                        .
      DO 30 I=LLFW,LOOO                                                 RES   77
30    LFWX=LFWX+D(I)                                                    RES   78
      EHIR=0.0                                                          RES   79
      ELOR=1.0E+50                                                      RES   80
      WRITE(20,40)NIS,MATNO                                             RES*  81
40    FORMAT(2X,I2,2X,I4)                                               RES*  82
      DO 340 I=1,NIS                                                    RES   83
      LLRR=LLRR+LRU(1,I)                                                RES   84
                                        .
                                        .
                                        .
      END                                                               RES 333



      SUBROUTINE XLACS(LLIM)                                            XLA    0
       INTEGER TIT                                                      XLA    1
      COMMON/DATA/D(1),LA1,LA2,LA3,LA4,LA5,LA6,LA7,LA8,LA9,LDMO(10),    XLA    2
                                        .
                                        .
                                        .
C*****READ DATA BLOCK 1      1S   2S   3S                               XLA 111
C                                                                       XLA 112
      WRITE(IO6,200)                                                    XLA 113
  200 FORMAT(20(/))                                                     XLA 114
      CALL FIDO(2,J3,IO5,IO6)                                           XLA 115
      IOPT1 = IOPT(1)                                                   XLA*116
      IOPT(1) = IABS(IOPT(1))                                           XLA*117
      IF(IOPT1.LT.0)IOPT(2) = 3                                         XLA*118
      IF(NPE.EQ.0) NPE=20                                               XLA 119
      IF(NPEP.EQ.0) NPEP=40                                             XLA 120
      IF(NGMA.EQ.0)NGMA=11                                              XLA 121
                                        .
                                        .
                                        .
   30 MATOLD=LLIM                                                       XLA 251
      CALL OUT1(D(LEGRP),D(LUGRP),D(LX),D(LY))                          XLA 252
      WRITE(20,*)IOPT(1),NNUC,MAXG,NEG                                  XLA*253
      IF(NNUC.GT.0)GO TO 35                                             XLA 254
      NNNN=1                                                            XLA 255
                                        .
                                        .
                                        .
      CALL CLOCK(TO)                                                    XLA 330
      IF(IOPT1.LT.0)GO TO 9                                             XLA*331
      NEGS=NEG                                                          XLA 332
      REWIND ITPS                                                       XLA 333
      IF(NEG.EQ.1)NEG=0                                                 XLA 334
      WRITE(IO6,205)                                                    XLA 335
  205 FORMAT(1H1,//,† *****  ELASTIC MATRICES CALCULATION  ******†)     XLA 336
      IF(ABS(AWR-1.0).GT.0.1)GO TO 6                                    XLA 337
      CALL HYDR                                                         XLA 338
      CALL CLOCK(TO)                                                    XLA 339
      GO TO 7                                                           XLA 340
    6 IF(NEG.LT.MAXG)CALL ELAS                                          XLA 341
      CALL CLOCK(TO)                                                    XLA 342
    7 LC=LPMX+MAXG*MAXG1/2                                              XLA 343
      LZAI=LC+MAXG*LOR1                                                 XLA 344
C *** CHECK DIMENSIONS                                                  XLA 345
      CALL DRAG(D(LDMO(1)),NNNN,D(LPMX),MAXG-NEG,LOR1,D(LC),            XLA 346
     *   ITPS,MAXG,IO8)                                                 XLA 347
      NEG=NEGS                                                          XLA 348
C *** INELASTIC/N2N/FISSION SPECTRUM CALCULATIONS-----FILE 5 PROCESSING XLA 349
      WRITE(IO6,206)                                                    XLA 350
  206 FORMAT(1H1,//,† *****  INELASTIC, N2N, FISSION SPECTRUM †,        XLA 351
     *†CALCULATIONS  ******†)                                           XLA 352
      CALL INELAS(4,D(LDMO(1)),NNNN,D(LX),D(LY),D(LMBT),D(LJMT))        XLA 353
      CALL CLOCK(TO)                                                    XLA 354
      IF(NTEMP*NEG.LE.1) GO TO 9                                        XLA 355
      WRITE(IO6,207)                                                    XLA 356
  207 FORMAT(1H1,//,† *****  THERMAL CALCULATION  ******†)              XLA 357
      CALL FLANGE(D(LT),D(LDMO(1)),NNNN)                                XLA 358
      CALL CLOCK(TO)                                                    XLA 359
```

```
    9 CONTINUE                                                          XLA 360
      IF(IOPT1.LT.0)GO TO 1000                                          XLA*361
    8 IF(NDNP.GT.0)NNUC=NNUC+1                                          XLA 362
      LAST=LZETA-1                                                      XLA 363
      CALL CLEAR(LXS,LAST)                                              XLA 364
      IF(NDNP.GT.0)CALL DDSE(D(LXS),IO8,D(LDMO(1)),D(LX),D(LV),D(LNBT),  XLA 365
     * D(LJNT),D(LEGRP),MAXG,NNUC)                                      XLA 366
      CALL XSDRNT                                                       XLA 367
 1000 CONTINUE                                                          XLA*368
      WRITE(IO6,208)                                                    XLA 369
  208 FORMAT(1H1,//,1X,80(1H*),/1X,'YOU HAVE COME TO END OF A PERILOUS F XLA 370
     1LIGHT THROUGH THAT MAGNIFICENT',/1X,'PROGRAM....X L A C S.....I TR XLA 371
     2UST IT HAS BEEN MOVING PERFORMANCE',/1X,'SEE YOU ON THE NEXT TIME  XLA 372
     3THROUGH',/1X,80(1H*))                                             XLA 373
      RETURN                                                            XLA 374
      END                                                               XLA 375
```