JAERI-M
8247

2次元感度計算コード SENSETWO

1979年5月

山内　通則[*]・中山　光雄[**]・南　多善[**]
関　泰・飯田　浩正

日本原子力研究所
Japan Atomic Energy Research Institute

JAERI－M 8247

2次元感度計算コード SENSETWO

日本原子力研究所東海研究所核融合研究部
山内 通則*・中山 光雄**・南 多善**
関 泰・飯田 浩正

（1979年4月18日受理）

2次元遮蔽計算形状において，計算に用いられた断面積の摂動に対する反応率の感度を計算するコードSENSETWO を開発した。本コードは2次元輸送計算コードTWOTRAN－Ⅱによって計算された粒子（中性子及びガンマ線）束と随伴粒子束から1次摂動理論に基づいて感度を計算する。対象とする断面積，計算形状，原子数密度，応答関数等はTWOTRAN－Ⅱ コードからdump テープを通じて伝えられ，カードによる入力形式は非常に簡略化されている。計算結果としての感度は領域別，エネルギー群別にプリント出力する他に，単位レサジー当りの感度すなわち感度スペクトル（Sensitivity Profile）として作図することができる。また感度計算に用いる反応率は輸送計算で入力した随伴粒子源（つまり応答関数）と計算結果の粒子束とから計算するので，本コードは反応率計算コードとして用いることもできる。

*）東京芝浦電気（株）
**）富士通（株）

JAERI-M 8247

Two-Dimensional Sensitivity Calculation Code : SENSETWO

Michinori YAMAUCHI*, Mitsuo NAKAYAMA**, Kazuyoshi MINAMI**
Yasushi SEKI and Hiromasa IIDA

Division of Thermonuclear Fusion Research
Tokai Research Establishment, JAERI

(Received April 18, 1979)

A SENSETWO code for the calculation of cross section sensitivities with a two-dimensional model has been developed, on the basis of first order perturbation theory. It uses forward neutron and/or gamma-ray fluxes and adjoint fluxes obtained by two-dimensional discrete ordinates code TWOTRAN-II. The data and informations of cross sections, geometry, nuclide density, response functions, etc. are transmitted to SENSETWO by the dump magnetic tape made in TWOTRAN calculations. The required input for SENSETWO calculations is thus very simple. The SENSETWO yields as printed output the cross section sensitivities for each coarse mesh zone and for each energy group, as well as the plotted output of sensitivity profiles specified by the input. A special feature of the code is that it also calculates the reaction rate with the response function used as the adjoint source in TWOTRAN adjoint calculation and the calculated forward flux from the TWOTRAN forward calculation.

Keywords : Fusion Reactor, Cross Section Sensitivity, Two-Dimensional Calculation, Reaction Rate, Nuclear Data, Adjoint Flux, Neutron Flux, Gamma-ray Flux, Perturbation Theory, Response Function

---

*) Tokyo Shiba Electric Co. Ltd., Tokyo, Japan

**) Fujitu Ltd., Tokyo, Japan

目　　次

Contents

1. はじめに

放射線の遮蔽計算において構造材の断面積は，形状のモデル化の方法，計算理論の近似度等と共に計算結果に重大な影響を及ぼす。断面積の摂動に対する反応率の感度計算法としては摂動系と非摂動系における輸送計算結果の比較という直接計算法がわかりやすいが，計算に重要な核種を選定したい場合のように断面積の総合的な評価のためにはひとまとめにした感度計算が必要となり，炉物理の分野で発達した1次摂動理論に基づく計算法が各種の遮蔽計算に取り入れられるようになった。代表的な感度計算コードとしては米国で開発されたSWANLAKEコード[1]が有名で，多くの遮蔽計算で断面積の摂動に対する特性値（反応率）の感度解析に用いられている。しかしSWANLAKEコードは，1次元Sn計算コードANISN[2]と連動するようになっており，1次元形状しか取り扱かえない。近年計算機の性能向上と共に遮蔽計算においても2次元計算が頻繁に行われるようになり，1次元では模擬できない複雑形状における感度解析が必要になってきた。

2次元感度計算コードとしてはすでに米国でVIPコード[3]が開発されており，国内においてもROSETTA-2Dコード[4]が整備されつつある。ここでは核融合実験炉JXFRの第1次予備設計[5]で用いられたTWOTRAN-Ⅱコード[6]を2次元輸送計算の標準コードとし，その出力Dumpテープを入力データとする2次元感度解析コードSENSETWOを開発した。

本コードは2次元輸送計算に用いられた群定数に対する反応率の感度を計算する。計算に必要な群定数，Normal（あるいはForward）とAjointの粒子束，形状，原子数密度及び応答関数等はTWOTRAN-Ⅱコードのdumpテープを通じて伝えられ，カードによる入力形式は非常に簡略化されている。計算法は次章に述べる1次摂動理論に基づき，全断面積及びその成分である散乱マトリックスが全エネルギー域で一様な比の摂動を受ける場合の反応率の変化率として感度を計算する。計算結果は，上記全断面積に対する反応率の感度を領域別，エネルギー群別にプリント出力する他に，単位レサジー当りの感度すなわち感度スペクトル（Sensitivity Profile）を作図することもできる。感度計算で用いる反応率は輸送計算で入力した線源（放射線源又は応答関数）と輸送計算結果の粒子束（Adjoint又はNormal）とによりコード内で計算するので，本コードは反応率計算コードとして利用することもできる。また散乱核のルジャンドル展開次数の打ち切りに対する効果を見ることも可能である。

感度計算に用いるNormalとAdjointの粒子束の積$\phi^{*}\phi$は一種類の反応率の感度計算に対して一度計算すれば良いので，Restart FileとしてDirect Access Fileに保存される。これにより他の断面積に対する同一の反応率の感度計算は短かい入出力時間により容易に行うことができる。

以下まず本コードに関する基礎方程式を示し，コードの構成，輸送計算に関する注意事項等を述べ，最後に入力形式，出力内容等について記す。また附録として核融合実験炉の模擬形状における計算例とコードのソースプログラムを掲げる。

2. 基礎方程式

時間に独立な定常状態の系 i の，空間的位置 $\vec{r}$ における輸送方程式と随伴方程式は次の通りである。

$$\vec{\Omega}\cdot\nabla\Phi_i(\vec{r},E,\vec{\Omega})+\Sigma_{Ti}(\vec{r},E)\Phi_i(\vec{r},E,\vec{\Omega})$$
$$-\iint\Sigma_{Si}(\vec{r},E'\to E,\vec{\Omega}'\to\vec{\Omega})\Phi_i(\vec{r},E',\vec{\Omega}')\,dE'\,d\vec{\Omega}'=S(\vec{r},E,\vec{\Omega}) \quad (1)$$

$$-\vec{\Omega}\cdot\nabla\Phi_i^*(\vec{r},E,\vec{\Omega})+\Sigma_{Ti}(\vec{r},E)\Phi_i^*(\vec{r},E,\vec{\Omega})$$
$$-\iint\Sigma_{Si}(\vec{r},E\to E',\vec{\Omega}\to\vec{\Omega}')\Phi_i^*(\vec{r},E',\vec{\Omega}')\,dE'\,d\vec{\Omega}'=\Sigma_{ri}(\vec{r},E) \quad (2)$$

但し，

$\Phi(\vec{r},E,\vec{\Omega})$，$\Phi^*(\vec{r},E,\vec{\Omega})$：位置 $\vec{r}$，エネルギー E，方向 $\vec{\Omega}$ の粒子束と随伴粒子束。

$\Sigma_T(\vec{r},E)$：位置 $\vec{r}$，エネルギー E の全断面積。

$\Sigma_S(\vec{r},E'\to E,\vec{\Omega}'\to\vec{\Omega})$：位置 $\vec{r}$，エネルギーが E′ から E，方向が $\vec{\Omega}'$ から $\vec{\Omega}$ の散乱断面積。

$S(\vec{r},E,\vec{\Omega})$：位置 $\vec{r}$，エネルギー E，方向 $\vec{\Omega}$ の粒子源。

$\Sigma_r(\vec{r},E)$：位置 $\vec{r}$，エネルギー E の感度を調べようとしている応答関数。

(1), (2)式をボルツマン演算子 H_i とその随伴演算子 H_i^* によって表わすと次のようになる。

$$H_i\Phi_i(\vec{r},E,\vec{\Omega})=S(\vec{r},E,\vec{\Omega}) \quad (3)$$

$$H_i^*\Phi_i^*(\vec{r},E,\vec{\Omega})=\Sigma_{ri}(\vec{r},E) \quad (4)$$

非摂動系及び摂動系の状態をそれぞれ添字 u 及び p によって表わすと，それぞれの系における反応率 R_u 及び R_p は次のようになる。但し位置 $\vec{r}$，エネルギー E，方向 $\vec{\Omega}$ に関する記述は今後まぎらわしい場合を除いて省略する。

$$R_u=\iiint\Sigma_{ru}\Phi_u\,d\vec{r}\,dE\,d\vec{\Omega}=\iiint S\Phi_u^*\,d\vec{r}\,dE\,d\vec{\Omega} \quad (5)$$

$$R_p=\iiint\Sigma_{rp}\Phi_p\,d\vec{r}\,dE\,d\vec{\Omega}=\iiint S\Phi_p^*\,d\vec{r}\,dE\,d\vec{\Omega} \quad (6)$$

反応率，粒子束，随伴粒子束の摂動による変化量をそれぞれ ΔR，$\Delta\Phi$，$\Delta\Phi^*$ とすると，ΔR は次のように表わされる。

$$\begin{aligned}\triangle R &= R_p - R_u \\ &= \iiint (S\Phi_p^* - S\Phi_u^*)\, d\vec{r}\, dE\, d\vec{\Omega} \\ &= \iiint S\ \triangle\Phi^*\, d\vec{r}\, dE\, d\vec{\Omega} \\ &= \iiint \triangle\Phi^* H_p \Phi_p\, d\vec{r}\, dE\, d\vec{\Omega} \\ &= \iiint \Phi_p H_p^* \triangle\Phi^*\, d\vec{r}\, dE\, d\vec{\Omega} \end{aligned} \tag{7}$$

(7)式中の$H_p^* \triangle\Phi^*$ を次のように変形する。

$$\begin{aligned} H_p^* \triangle\Phi^* &= H_p^*\Phi_p^* - H_p^*\Phi_u^* \\ &= H_u^*\Phi_u^* - H_p^*\Phi_u^* + H_p^*\Phi_p^* - H_u^*\Phi_u^* \\ &= (H_u^* - H_p^*)\Phi_u^* + \Sigma_{rp} - \Sigma_{ru} \end{aligned} \tag{8}$$

(8)式を(7)式に代入して

$$\triangle R = \iiint \{\Phi_p (H_u^* - H_p^*)\Phi_u^* + (\Sigma_{rp} - \Sigma_{ru})\Phi_p\}\, d\vec{r}\, dE\, d\vec{\Omega} \tag{9}$$

随伴演算子H^* を(2)式に示された表式によって書き下すと(9)式は次のようになる。

$$\begin{aligned} \triangle R = \iiint \Big[& -\Phi_p(\vec{r}, E, \vec{\Omega})\{\Sigma_{Tp}(\vec{r}, E) - \Sigma_{Tu}(\vec{r}, E)\}\Phi_u^*(\vec{r}, E, \vec{\Omega}) \\ & + \iint \Phi_p(\vec{r}, E, \vec{\Omega})\{\Sigma_{Sp}(\vec{r}, E\to E', \vec{\Omega}\to\vec{\Omega}') \\ & \qquad - \Sigma_{Su}(\vec{r}, E\to E', \vec{\Omega}\to\vec{\Omega}')\}\Phi_u^*(\vec{r}, E', \vec{\Omega}')\, dE'\, d\vec{\Omega}' \\ & + \{\Sigma_{rp}(\vec{r}, E) - \Sigma_{ru}(\vec{r}, E)\}\Phi_p(\vec{r}, E, \vec{\Omega})\Big]\, d\vec{r}\, dE\, d\vec{\Omega} \end{aligned} \tag{10}$$

(10)式は断面積の摂動に対する反応率変化の厳密な計算式である。但しこの式の値を求めるためには摂動系における粒子束Φ_p を計算しなければならない。1次摂動理論においては断面積に与える摂動が小さいとして$\Phi_p \approx \Phi_u$と近似する。また(10)式における右辺の第3項は応答関数に与えられた摂動に対する反応率変化である。一般にこの項は，感度解析の対象とした群定数と反応率の計算に用いた応答関数とが同じ核データに基づいて作られている場合に必要とすることがあり，本コードで考慮に入れるかどうかは入力オプションに従がうようにした。

今，全断面積，散乱断面積，応答関数が全位相空間で一様な比$\triangle C$ の摂動を受けると仮定する。すなわち，

$$\begin{aligned} \triangle C &= \frac{\Sigma_{Tp}(\vec{r}, E) - \Sigma_{Tu}(\vec{r}, E)}{\Sigma_{Tu}(\vec{r}, E)} \\ &= \frac{\Sigma_{Sp}(\vec{r}, E\to E', \vec{\Omega}\to\vec{\Omega}') - \Sigma_{Su}(\vec{r}, E\to E', \vec{\Omega}\to\vec{\Omega}')}{\Sigma_{Su}(\vec{r}, E\to E', \vec{\Omega}\to\vec{\Omega}')} \end{aligned}$$

$$= \frac{\Sigma_{rp}(\vec{r},E)-\Sigma_{ru}(\vec{r},E)}{\Sigma_{ru}(\vec{r},E)} \tag{11}$$

1次摂動近似と(11)式に表わされる仮定を用いると(10)式は次のようになる。

$$\begin{aligned}\Delta R = \Delta C \iiint \{ & -\Phi_u(\vec{r},E,\vec{\Omega})\Sigma_{Tu}(\vec{r},E)\Phi_u^*(\vec{r},E,\vec{\Omega}) \\ & + \iint \Phi_u(\vec{r},E,\vec{\Omega})\Sigma_{Su}(\vec{r},E\to E',\vec{\Omega}\to\vec{\Omega}')\Phi_u^*(\vec{r},E',\vec{\Omega})\,dE'\,d\vec{\Omega}' \\ & + \Sigma_{ru}(\vec{r},E)\Phi_u(\vec{r},E,\vec{\Omega})\}\,d\vec{r}\,dE\,d\vec{\Omega}\end{aligned} \tag{12}$$

上式は断面積の摂動による反応率の変化量が，非摂動系における状態量のみによって求められることを表わしている。断面積に与える摂動はこれまで一定の大きさΔCを考えて話を進めてきたが，摂動の大きさを限りなく小さくした時の反応率変化$\delta R/\delta C$の非摂動系における反応率Rに対する割合，すなわち$\left(\frac{\delta R}{R}\right)/\delta C$が求める感度である。感度の計算式は次のようになる。但し今後非摂動系を表わす添字uは省略する。

$$\begin{aligned}\left(\frac{\delta R}{R}\right)/\delta C = \frac{1}{R}\iiint \{ & -\Phi(\vec{r},E,\vec{\Omega})\Sigma_T(\vec{r},E)\Phi^*(\vec{r},E,\vec{\Omega}) \\ & + \iint \Phi(\vec{r},E,\vec{\Omega})\Sigma_S(\vec{r},E\to E',\vec{\Omega}\to\vec{\Omega}')\Phi^*(\vec{r},E',\vec{\Omega}')\,dE'\,d\vec{\Omega}' \\ & + \Sigma_r(\vec{r},E)\Phi(\vec{r},E,\vec{\Omega})\}\,d\vec{r}\,dE\,d\vec{\Omega}\end{aligned} \tag{13}$$

巨視断面積Σ_T, Σ_S, Σ_rに対応する微視断面積をσ_T, σ_S, σ_rとし，位置$\vec{r}$の原子数密度を$\rho(\vec{r})$とする。すなわち，

$$\Sigma_T(\vec{r},E) = \sigma_T(E)\rho(\vec{r}) \tag{14}$$

$$\Sigma_S(\vec{r},E\to E',\vec{\Omega}\to\vec{\Omega}') = \sigma_S(E\to E',\vec{\Omega}\to\vec{\Omega}')\rho(\vec{r}) \tag{15}$$

$$\Sigma_r(\vec{r},E) = \sigma_r(E)\rho(\vec{r}) \tag{16}$$

また$P_1(E)$, $P_2(E)$, $P_3(E)$を次式のように定義する。

$$P_1(E) \equiv \iint \rho(\vec{r})\{-\Phi(\vec{r},E,\vec{\Omega})\sigma_T(E)\Phi^*(\vec{r},E,\vec{\Omega})\}\,d\vec{r}\,d\vec{\Omega} \tag{17}$$

$$P_2(E) \equiv \iint d\vec{r}\,d\vec{\Omega}\rho(\vec{r})\iint dE'\,d\vec{\Omega}'\Phi(\vec{r},E,\vec{\Omega})\sigma_S(E\to E',\vec{\Omega}\to\vec{\Omega}')\Phi^*(\vec{r},E',\vec{\Omega}') \tag{18}$$

$$P_3(E) \equiv \iint \rho(\vec{r})\sigma_r(E)\Phi(\vec{r},E,\vec{\Omega})\,d\vec{r}\,d\vec{\Omega} \tag{19}$$

これから先は(17)～(19)の3式の2次元計算について考える。2次元S_n計算コードTWOTRAN[6]では粒子束$\Phi(\vec{r},E,\vec{\Omega})$は関数$R_n^k(\mu,\varphi)$によって次のように展開される。

$$\Phi(\vec{r},E,\vec{\Omega}) = \sum_{n=0}^{\infty}(2n+1)\sum_{k=0}^{n}R_n^k(\mu,\varphi)\phi_n^k(\vec{r},E) \tag{20}$$

$$R_n^k(\mu,\varphi)=\left[\frac{(2-\delta_{k0})(n-k)!}{(n+k)!}\right]^{1/2}P_n^k(\mu)\cos k\varphi \tag{21}$$

但し，$\delta_{k0}=\begin{cases}1 & k=0\\ 0 & k\neq 0\end{cases}$

$P_n^k(\mu)$ ：ルジャンドルの陪関数

関数$R_n^k(\mu,\varphi)$には直交性が成り立つ。[7] すなわち，

$$\int_{-1}^{1}d\mu\int_{0}^{\pi}d\varphi\,R_n^k(\mu,\varphi)R_m^{\ell}(\mu,\varphi)=\frac{2\pi}{2n+1}\delta_{nm}\delta_{k\ell} \tag{22}$$

(17)式においてΦとΦ^*を関数R_n^kによって展開する。

$$P_1(E)=-\iint\rho(\vec{r})\left[\sum_{n=0}^{\infty}(2n+1)\sum_{k=0}^{n}R_n^k\phi_n^k\right]\sigma_T(E)\left[\sum_{m=0}^{\infty}(2m+1)\sum_{\ell=0}^{m}R_m^{\ell}\phi_m^{*\ell}\right]d\vec{r}\,d\vec{\Omega} \tag{23}$$

$\int d\vec{\Omega}=2\int_{-1}^{1}d\mu\int_{0}^{\pi}d\varphi$に注意し，(22)式の直交性を用いると(23)式は次のようになる。

$$P_1(E)=-4\pi\int\rho(\vec{r})\,\sigma_T(E)\sum_{n=0}^{\infty}(2n+1)\sum_{k=0}^{n}\phi_n^k(\vec{r},E)\phi_n^{*k}(\vec{r},E)\,d\vec{r} \tag{24}$$

(18)式において散乱核$\sigma_S(E\to E',\vec{\Omega}\to\vec{\Omega}')$は加法定理により次のように表わされる。但し$\mu_0$は$\vec{\Omega}$と$\vec{\Omega}'$の間の方向余弦である。

$$\sigma_S(E\to E',\vec{\Omega}\to\vec{\Omega}')=\frac{1}{2\pi}\sigma_S(E\to E',\mu_0)=\sum_{n=0}^{\infty}\frac{2n+1}{4\pi}P_n(\mu_0)\sigma_{Sn}(E\to E')$$

$$=\sum_{n=0}^{\infty}\frac{2n+1}{4\pi}\left\{\sum_{k=0}^{n}\frac{(2-\delta_{k0})(n-k)!}{(n+k)!}P_n^k(\mu)P_n^k(\mu')\cos k(\varphi-\varphi')\right\}\sigma_{Sn}(E\to E') \tag{25}$$

三角関数の加法定理より

$$\cos k(\varphi-\varphi')=\cos k\varphi\cos k\varphi'+\sin k\varphi\sin k\varphi' \tag{26}$$

(25)式を(18)式に代入する。この時$\Phi^*(\vec{r},E',\vec{\Omega}')$が方位角$\varphi=0$の両側で対称ならば

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\Phi^*(\vec{r},E',\vec{\Omega}')\sin k\varphi'\,d\varphi'=0 \tag{27}$$

とおくことができ，(18)式は次のようになる。

$$P_2(E)=\iint d\vec{r}\,d\vec{\Omega}\rho(\vec{r})\iint dE'\,d\vec{\Omega}'\,\Phi(\vec{r},E,\vec{\Omega})$$

$$\times\sum_{n=0}^{\infty}\frac{2n+1}{4\pi}\left\{\sum_{k=0}^{n}\frac{(2-\delta_{k0})(n-k)!}{(n+k)!}P_n^k(\mu)P_n^k(\mu')\cos k\varphi\cos k\varphi'\right\}\sigma_{Sn}(E\to E')\Phi^*(\vec{r},E',\vec{\Omega}') \tag{28}$$

和と積分の順を変えて整理すると次のようになる。

$$P_2(E)=\iint d\vec{r}\,d\vec{\Omega}\,\rho(\vec{r})\Phi(\vec{r},E,\vec{\Omega})\sum_{n=0}^{\infty}\frac{2n+1}{4\pi}\Big[\sum_{k=0}^{n}\Big\{\frac{(2-\delta_{k0})(n-k)!}{(n+k)!}\Big\}^{1/2}P_n^k(\mu)\cos k\varphi$$

$$\times\iint dE'\,d\vec{\Omega}'\ \Big\{\frac{(2-\delta_{k0})(n-k)!}{(n+k)!}\Big\}^{1/2}P_n^k(\mu')$$

$$\times\cos k\varphi\ \sigma_{Sn}(E\to E')\Phi^*(\vec{r},E',\vec{\Omega}')\Big] \quad (29)$$

(21)式により

$$P_2(E)=\int d\vec{r}\,\rho(\vec{r})\sum_{n=0}^{\infty}\frac{2n+1}{4\pi}\sum_{k=0}^{n}\int d\vec{\Omega}\,R_n^k(\mu,\varphi)\Phi(\vec{r},E,\vec{\Omega})$$

$$\times\int dE'\,\sigma_{Sn}(E\to E')\int d\vec{\Omega}'\,R_n^k(\mu',\varphi')\Phi^*(\vec{r},E',\vec{\Omega}) \quad (30)$$

又，

$$\phi_n^k(\vec{r},E)=\int_{-1}^{1}d\mu\int_0^{\pi}d\varphi\,R_n^k(\mu,\varphi)\Phi(\vec{r},E,\vec{\Omega})/2\pi \quad (31)$$

だから　$\int d\vec{\Omega}=2\int_{-1}^{1}d\mu\int_0^{\pi}d\varphi$ に注意して(30)式は次のようになる。

$$P_2(E)=4\pi\int d\vec{r}\,\rho(\vec{r})\sum_{n=0}^{\infty}(2n+1)\sum_{k=0}^{n}\phi_n^k(\vec{r},E)\int dE'\,\sigma_{Sn}(E\to E')\phi_n^{*k}(\vec{r},E') \quad (32)$$

(19)式は次のように変形する。

$$P_3(E)=\iint\rho(\vec{r})\,\sigma_r(E)R_0^0(\mu,\varphi)\Phi(\vec{r},E,\vec{\Omega})\,d\vec{r}\,d\vec{\Omega} \quad (33)$$

(31)式により

$$P_3(E)=4\pi\int\rho(\vec{r})\,\sigma_r(E)\phi_0^0(\vec{r},E)\,d\vec{r} \quad (34)$$

以上関数$P_1(E),P_2(E),P_3(E)$は(24),(32),(34)式によってTWOTRANコードの出力である粒子束から求められることを示した。次に反応Xに対する$P_1(E),P_2(E),P_3(E)$の値を$P_1^X(E),P_2^X(E),P_3^X(E)$とすると(13)式に表わされる感度$(\frac{\delta R}{R})/\delta C$は次のようになる。

$$(\frac{\delta R}{R})/\delta C=\frac{\int\{P_1^X(E)+P_2^X(E)+P_3^X(E)\}dE}{\int P_3^Y(E)\,dE}$$

$$=\begin{cases}\dfrac{\int\{P_1^X(E)+P_2^X(E)\}dE}{\int P_3^X(E)\,dE}+1.0 & (X=Y) \quad (35)\\[2ex] \dfrac{\int\{P_1^X(E)+P_2^X(E)\}dE}{\int P_3^Y(E)\,dE} & (X\neq Y) \quad (36)\end{cases}$$

前式においてXは感度解析の対象とする断面積を持つ核種，Yは応答関数が核データから作られている場合の親核種である。(35)式はXとYが同じ核種である場合応答関数の摂動による反応率の感度は1.0に等しいことを示す。(36)式はXとYが別核種，または応答関数の摂動を考慮しない場合の計算式である。

次に実際の計算における数値計算式を考察する。方程式はエネルギーに関して多群近似し，空間的位置はメッシュ分割することによって扱かう。すなわち中性子束の展開係数 $\phi_n^k(\vec{r},E)$ に対して次の量を定義する。

$$\phi_n^k(i,j,m)\cdot v(i,j)=\int_{\vec{r}<v(i,j)} d\vec{r} \int_{E<\Delta E_m} dE \quad \phi_n^k(\vec{r},E) \tag{37}$$

$\phi_n^k(i,j,m)$ はメッシュ点(i,j)の第m群の展開係数であり，v(i,j)は微小体積要素である。$\vec{r}$ の積分は体積v(i,j)内で行い，Eの積分はm群のエネルギー幅 ΔE_m 内で行う。

随伴中性子束の多群近似は次のようにして行う。

(4)式の随伴方程式を添字を省略して示すと次のようになる。

$$H^*\Phi^* = \Sigma_r \tag{38}$$

(38)式の線源項は巨視断面積の次元を持ち通常は粒子束Φ(E)を重みとして群平均される。すなわち，

$$\frac{\int_{E<\Delta E_m} \Phi(E)H^*\Phi^*(E)\,dE}{\int_{E<\Delta E_m} \Phi(E)\,dE} = \frac{\int_{E<\Delta E_m} \Sigma_r(E)\Phi(E)\,dE}{\int_{E<\Delta E_m} \Phi(E)\,dE}$$

$$= \Sigma_r^m$$

$$= (H^*\Phi^*)^m \tag{39}$$

積分はすべてm群のエネルギー範囲 ΔE_m 内で行う。Σ_r^m は第m群の応答関数であり，$(H^*\Phi^*)^m$ は随伴方程式中の第m群線源に等値される成分である。$(H^*\Phi^*)^m$ を書き下すと次のようになる。

$$(H^*\Phi^*)^m = -\vec{\Omega}\cdot\nabla\Phi^{*m}+\Sigma_T^m\Phi^{*m}-\mathrm{Sum}_{m'}\ \Sigma_S^{m\to m'}\Phi^{*m'} \tag{40}$$

(40)式を(39)式に代入して両辺に $\Phi^m=\int_{E<\Delta E_m}\Phi(E)\,dE$ をかけると

$$\int_{E<\Delta E_m}\Phi(E)H^*\Phi^*(E)\,dE=-\Phi^m\vec{\Omega}\cdot\nabla\Phi^{*m}+\Phi^m\Sigma_T^m\Phi^{*m}-\Phi^m\mathrm{Sum}_{m'}\ \Sigma_S^{m\to m'}\Phi^{*m'} \tag{41}$$

(41)式の両辺の対応する項を比較すれば次の式が導かれる。

$$\int_{E<\Delta E_m}\Phi(E)\,\Sigma_T(E)\,\Phi^*(E)\,dE=\Phi^m\Sigma_T^m\,\Phi^{*m} \tag{42}$$

$$\int_{E<\Delta E_m} \Phi(E)\int dE'\,\Sigma_S(E\to E')\Phi^*(E') = \Phi^m \underset{m'}{\mathrm{Sum}}\,\Sigma_S^{m\to m'}\,\Phi^{*m'} \tag{43}$$

(24)式の両辺をm群のエネルギー範囲で積分し，(42)式を利用すれば

$$P_1^m = -4\pi \sum_i\sum_j \rho(i,j)\sigma_T^m v(i,j) \sum_{n=0}^{\infty}(2n+1)\sum_{k=0}^{n}\phi_n^k(i,j,m)\phi_n^{*k}(i,j,m) \tag{44}$$

(32)式の両辺をm群のエネルギー範囲で積分し，(43)式を利用すれば

$$P_2^m = 4\pi \sum_i\sum_j \rho(i,j)v(i,j) \sum_{n=0}^{\infty}(2n+1)\sum_{k=0}^{n}\phi_n^k(i,j,m)\sum_{m'}\sigma_{Sn}^{m\to m'}\phi_n^{*k}(i,j,m') \tag{45}$$

(34)式の両辺をm群のエネルギー範囲で積分すれば

$$P_3^m = 4\pi \sum_i\sum_j \rho(i,j)\,v(i,j)\,\sigma_r^m\,\phi_0^0(i,j,m) \tag{46}$$

(44),(45),(46) 式が(24),(32),(34)式を多群近似した式である。反応Xに対するP_1^m, P_2^m, P_3^m の値をP_1^{Xm}, P_2^{Xm}, P_3^{Xm} とすると感度の計算式は次のようになる。

$$\left(\frac{\delta R}{R}\right)/\delta C = \frac{\sum_m (P_1^{Xm}+P_2^{Xm}+P_3^{Xm})}{\sum_m P_3^{Ym}}$$

$$= \begin{cases} \dfrac{\sum_m (P_1^{Xm}+P_2^{Xm})}{\sum_m P_3^{Xm}} + 1.0 & (X=Y) \qquad (47) \\[2ex] \dfrac{\sum_m (P_1^{Xm}+P_2^{Xm})}{\sum_m P_3^{Ym}} & (X\neq Y) \qquad (48) \end{cases}$$

(47)，(48)式は(35)，(36) 式を多群近似した式である。

群定数の配列の各成分に対して次のように感度マトリックスを定義する。

輸送計算で用いる群定数は通常〔反応の種類×エネルギー群〕のマトリックスに整理されている。ここでは，これを$\sigma_\ell(M,N)$と表わす。ℓは散乱マトリックスの展開次数である。全断面積の位置をM_Tとすると散乱マトリックスは$M \geqq M_T+1$ の位置に配列されている。次式によって計算される量$Q_\ell(M,N)$を感度マトリックスと呼ぶ。

a) $M \leqq M_T$ ($\ell=0$のみ意味がある。)の場合，

$$Q_\ell(M,N) = -\frac{4\pi}{R}\sigma_\ell(M,N)\sum_i\sum_j \rho(i,j)v(i,j) \sum_{n=0}^{ISCT}(2n+1)\sum_{k=0}^{n}\phi_n^k(i,j,N) \times \phi_n^{*k}(i,j,N) \tag{49}$$

b) $M \geqq M_T + 1$ ($\ell \leqq$ ISCT) の場合

$$Q_\ell(M,N) = \frac{4\pi}{R}\sigma_\ell(M,N)\sum_i\sum_j \rho(i,j)v(i,j)(2\ell+1)\sum_{k=0}^{\ell}\phi_\ell^k(i,j,M-M_T)\phi_\ell^{*k}(i,j,N) \quad (50)$$

ISCT ： 散乱次数　　R ：反応率

(50)式における $\sigma_\ell(M,N)$ の配列は ($M-M_T$)群から N 群への散乱マトリックスが ($M-M_T$) の位置に並ぶと仮定した。これ以外の配列の場合はそれぞれの場合に応じて ϕ_ℓ^k の群番号 ($M-M_T$) を指定してやらなければならない。

散乱核のルジャンドル級数展開の打ち切り次数の差による反応率変化は次のように計算される。

(10)式において散乱断面積のみが摂動を受けるとする。

$$\Delta R = \iiint d\vec{r}\,dE\,d\vec{\Omega}\,\rho(\vec{r})\Phi(\vec{r},E,\vec{\Omega})\iint dE'\,d\vec{\Omega}'\{\sigma_{Sp}(\vec{r},E\to E',\vec{\Omega}\to\vec{\Omega}') - \sigma_{Su}(\vec{r},E\to E',\vec{\Omega}\to\vec{\Omega}')\}\,\Phi^*(\vec{r},E',\vec{\Omega}') \quad (51)$$

非摂動系の散乱断面積 σ_{Su} として ISCT 次まで考慮した散乱核，摂動系の散乱断面積 σ_{Sp} として ($\ell-1$) ($<$ ISCT)次まで考慮した散乱核を採る。

$$\Delta R = \iiint d\vec{r}\,dE\,d\vec{\Omega}\,\rho(\vec{r})\Phi(\vec{r},E,\vec{\Omega})\iint dE'\,d\vec{\Omega}'\left\{-\sum_{n=\ell}^{ISCT}\frac{2n+1}{4\pi}P_n(\mu_0)\sigma_{Sn}(E\to E')\right\}\Phi^*(\vec{r},E',\vec{\Omega}') \quad (52)$$

(18)式と同様に変形して

$$\Delta R = -4\pi\iint d\vec{r}\,dE\,\rho(\vec{r})\sum_{n=\ell}^{ISCT}(2n+1)\sum_{k=0}^{n}\phi_n^k(\vec{r},E)\int dE'\,\sigma_{Sn}(E\to E')\,\phi_n^{*k}(\vec{r},E') \quad (53)$$

多群近似及びメッシュ分割を施せば

$$\Delta R = -4\pi\sum_m\sum_i\sum_j \rho(i,j)v(i,j)\sum_{n=\ell}^{ISCT}(2n+1)\sum_{k=0}^{n}\phi_n^k(i,j,m)\sum_{m'}\sigma_{Sn}^{m\to m'}\phi_n^{*k}(i,j,m') \quad (54)$$

すなわち，散乱次数を ISCT 次から ℓ 次におとしたために生じる m 群の反応率変化 $\left(\frac{\Delta R}{R}\right)_\ell^m$ は次のようになる。

$$\left(\frac{\Delta R}{R}\right)_\ell^m = -\frac{\sum_i\sum_j \rho(i,j)v(i,j)\sum_{n=\ell}^{ISCT}(2n+1)\sum_{k=0}^{n}\phi_n^k(i,j,m)\sum_{m'}\sigma_{Sn}^{m\to m'}\phi_n^{*k}(i,j,m')}{\sum_m\sum_i\sum_j \rho(i,j)v(i,j)\sigma_r^m\phi_0^0(i,j,m)} \quad (55)$$

3. コードの基本構成

3.1 基本仕様

本コードは，２次元輸送計算コード TWOTRAN－Ⅱで計算された粒子束と随伴粒子束を用いて炉定数ライブラリの感度解析を行うものである。プログラムはデータ入力部，計算部，出力部に大別できる。

(1) データ入力

1. カードデータの入力は，基本的にコントロールデータのみとし，データ・チェックを行う。
2. 感度解析に必要なデータ Normal flux，Adjoint flux，炉定数データおよび Response function は，TWOTRAN－Ⅱより出力される restart dump file の情報を用いる。

(2) 計算部

感度解析において計算されるものとしては，反応率，感度マトリックス，Pℓ－効果および感度スペクトルがあり，反応率をのぞいて，$\phi^*\phi$ マトリックスの計算が必要である。

そこで，この計算部を反応率と$\phi^*\phi$マトリックス計算部と，感度マトリックス以後の計算部に分け，前半の結果を direct access file に保存する。

restart 時には，$\phi^*\phi$マトリックスをこのファイルより入力し，後半の計算を行うものとする。

尚，全ての計算は粗メッシュ単位に行う。

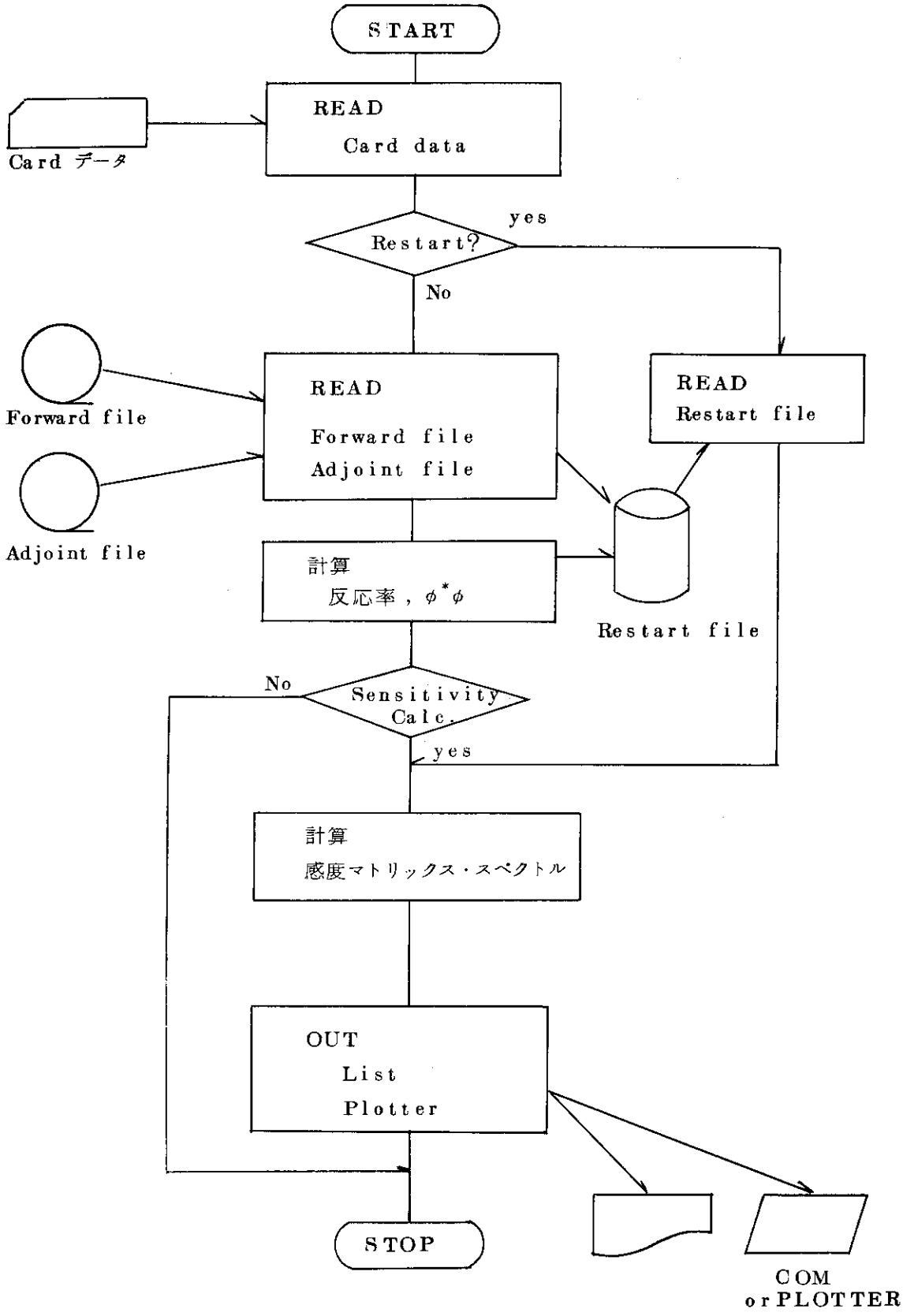
(3) 出力部

結果の出力はオプションにより選択できる。出力するものとして，粗メッシュ・マップ，Mixing Table，微視断面積，反応率，Pℓ－効果，感度マトリックスおよび，感度スペクトルがある。また感度スペクトルの作図も行う。

本コードは，モデル形状，次数等により，使用するエリアが大きく変化する為，可変ディメンジョン方式をとる。

また，$\phi^*\phi$マトリックス計算に使われるファイル（ϕ用，ϕ^*用，restart file）は，入出力時間を短縮する為に direct access file を使用する。

3.2 計算システムの流れ図



3.3 計算内容の流れ図

START

Read restart dump file for a forward case

Set integer parameters

Set address of each arrays

read following arrays

Volume	V(IT,JT)
Mixing table	MIXNUM(MS)
	MIXCOM(MS)
	MIXDEN(MS)
Material assignment	IDCS(IM,JM)
Coarse mesh boundary	IHX(IM)
	IHY(JM)

read forword flux ϕ_n^k(IT,JT,IGM) and save to a scratch disk.

read cross section array C(IHM,IGM,MT)

Read restart dump file for an adjoint case

read adjoint flux ϕ_n^{*k}(IT,JT,IGM) and save to a scratch disk

read response function Q(IT,JT,IGM) and calculate reaction rate RATE(IM,JM,IGM)

$$RATE(II,JJ,G)=\sum_{\substack{I\in II\\ J\in JJ}} V(I,J)*Q(I,J,G)*\phi_0^0(I,J,G)$$

II,JJ : Coarse mesh, I,J : fine mesh, G: energy group

To next page

From previous page

Output the reaction rate on the $\phi^*\phi$ file

$$SUM = \sum_{G} \sum_{JJ} \sum_{II} RATE(II, JJ, G)$$

Do loop for axial coarse mesh

JJ = 1, JM

Do loop for radial coarse mesh

II = 1, IM

Set $\phi^*\phi$ matrix for this coarse mesh region

$$\phi^*\phi_n(E, E') = (2n+1) \sum_{k=0}^{n} \sum_{\substack{I \in II \\ J \in JJ}} V(I,J) * \phi_n^k(I,J,E) * \phi_n^{*k}(I,J,E')$$

E′ : Sink energy group 1, 2, ⋯, IGM

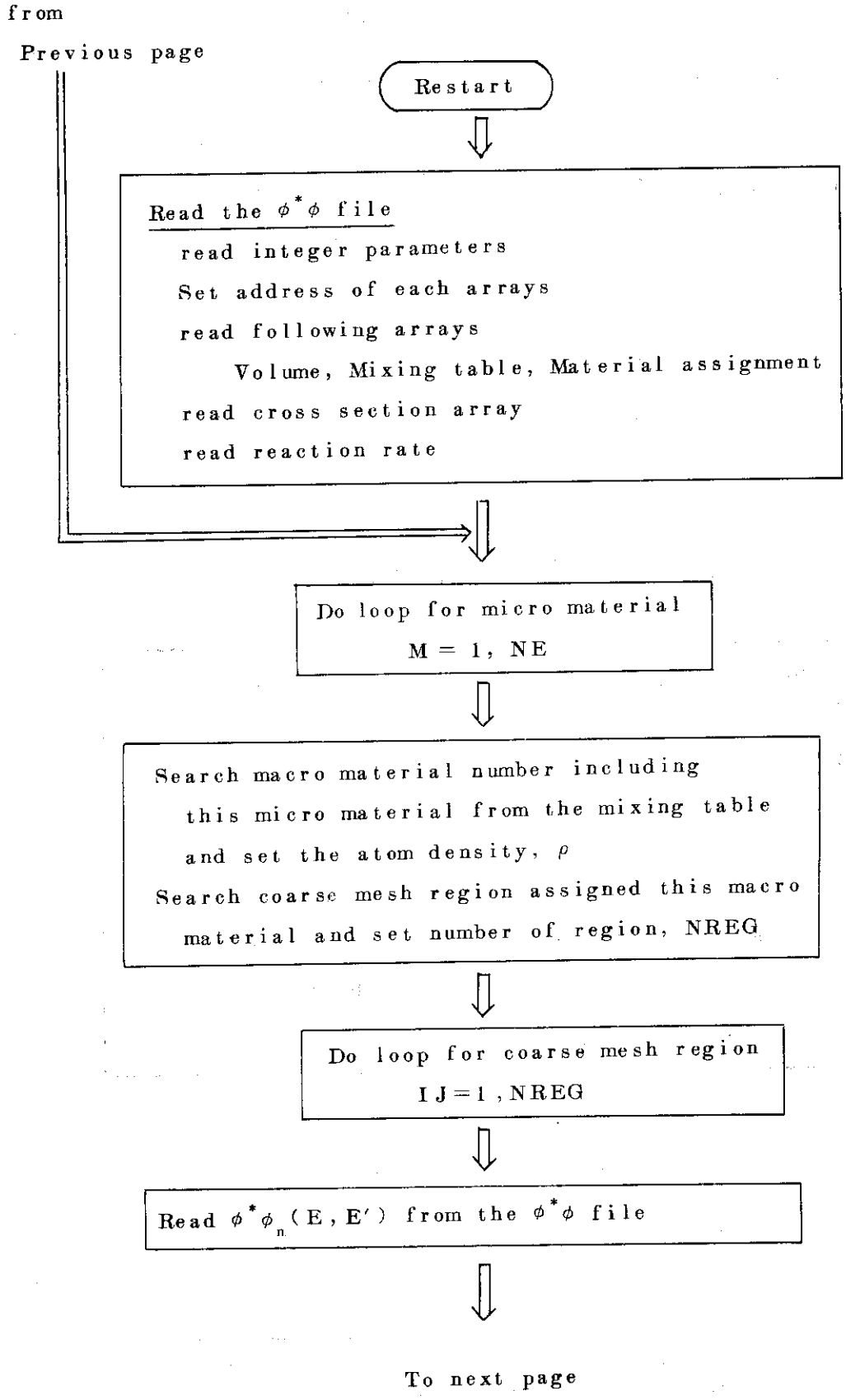
E : Source energy group E′, E′−1, ⋯, 1

Output $\phi^*\phi$ matrix on the $\phi^*\phi$ file

End of loop for radial coarsh mesh

End of loop for axial coarsh mesh

To next page


from
Previous page
Restart
Read the $\phi^*\phi$ file
read integer parameters
Set address of each arrays
read following arrays
Volume, Mixing table, Material assignment
read cross section array
read reaction rate
Do loop for micro material
M = 1, NE
Search macro material number including
this micro material from the mixing table
and set the atom density, ρ
Search coarse mesh region assigned this macro
material and set number of region, NREG
Do loop for coarse mesh region
IJ=1, NREG
Read $\phi^*\phi_n(E, E')$ from the $\phi^*\phi$ file
To next page

From previous page

⇩

Calculate sensitivity matrix, PMX

For IH=1, IHT

$$PMX(IH,E')=-\rho * C(IH,E',MP) * \sum_{n=0}^{ISCT} \phi^{*}\phi_{n}(E',E')/SUM$$

MP : micro material number

For IH=IHS, IHM

$$PMX_{n}(IH,E')=\rho * C(IH,E',MP+n) * \phi^{*}\phi_{n}(E,E')/SUM$$

of required n, print sensitivity matrix

⇩

Calculate Pℓ effect, TRUNC

$$TRUNC(\ell,E,IJ)=\sum_{n=\ell+1}^{ISCT}\sum_{E'\leftarrow E}^{IGM} PMX_{n}(IH,E')$$

⇩

Calculate sensitivity coefficient, P

$$P(E,IJ)=PMX_{n=0}(HJ,E)+\sum_{n=0}^{ISCT}\sum_{E'\leftarrow E}^{IGM} PMX_{n}(IH,E')$$

$$+RATE(I1,JJ,E)/SUM \quad (\text{if required})$$

⇩

End of loop for coarse mesh region

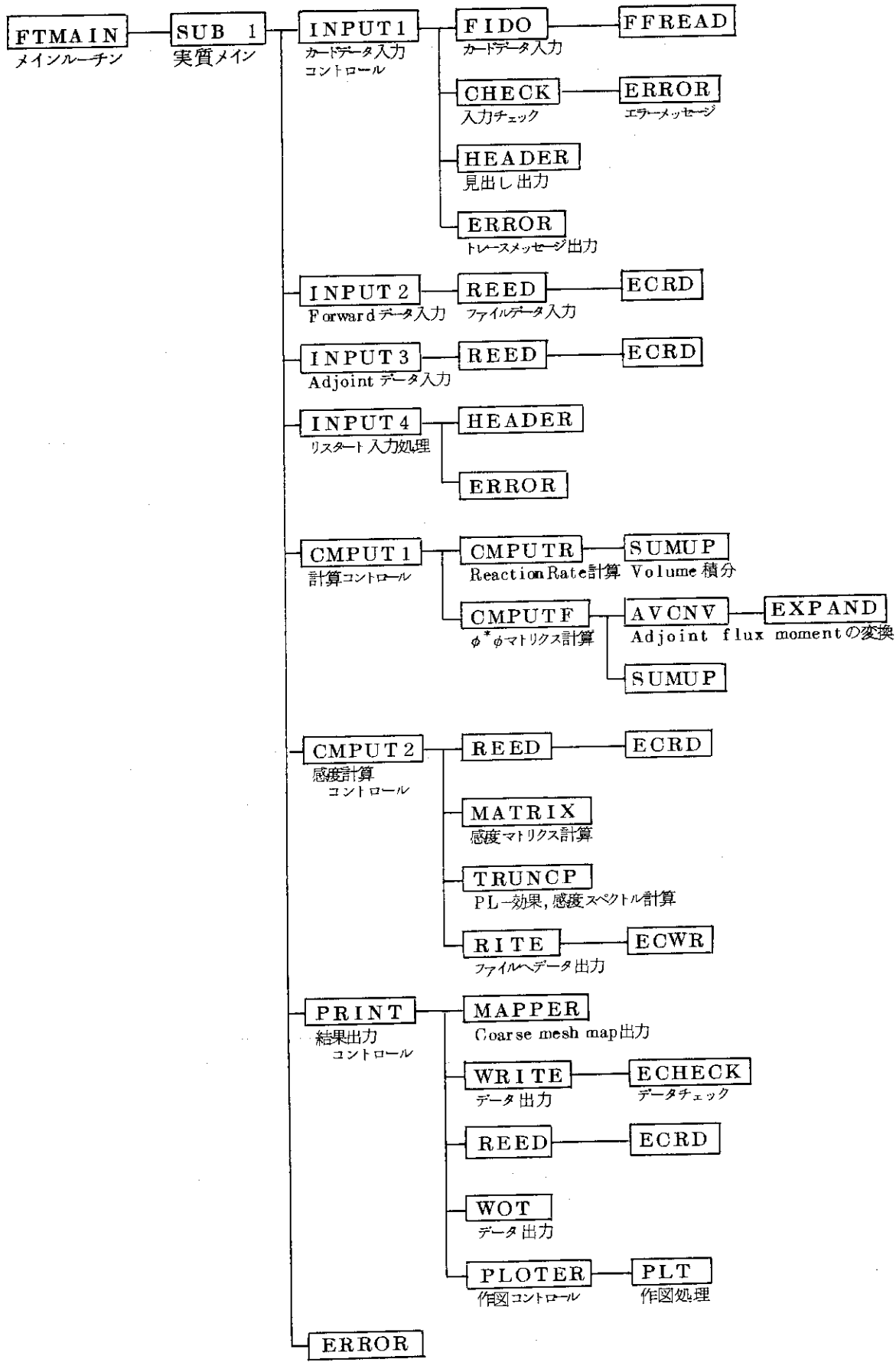
⇩

Print TRUNC(ℓ, E, IJ) and P(E, IJ)

⇩

End of loop for micro material

3.4 サブルーチンの階層構成図



4. コードの詳細設計

4.1 リスタート・ファイルの内容

リスタート・ファイルの論理レコードを以下に示す。

IB(100)	コントロールデータ
D(LWORK)	定数データ
Volume(IT,JT)	体積
Cross section (IHM,IGM,MT)	断面積
Reaction Rate(1) (IM,JM)	反応率(×IGM)
⋮	
(IGM)	
Flux matrix(1,1) (ISCT+1,IGM,IGM)	$\phi^*\phi$(×IM·JM)
⋮	
(IM,1)	
⋮	
(IM,JM)	

4.2 ダイレクトファイル・レコード数の計算
（DEFINE FILE）

F04（Restart file用）

$$f_1 = (100/LNGR)+(LWORK/LNGR)+(IT*JT/LNGR)$$
(IB) (constant data) (volume)

$$+(IHM*IGM*MT/LNGR) + (IM*JM/LNGR)*IGM$$
(cross section) (Reaction Rate)

$$+((ISCT+1)*IGM*IGM/LNGR)*IM*JM$$
(Flux matrix)

F11（Work）

$$f_2 = (IT*JT/LNG1)*NM*IGM$$
(Direct flux)

F12（Work）

$$f_3 = (IT*JT/LNG2)*NM*IGM$$
(Adjoint flux)

$$+((NQ2-NQ1+1)*IT*JT/LNG2)*IGM$$
(Adjoint source)

注1） カッコ（／）内演算は切り上げとする。

注2） f_1, f_2, f_3は必要とするレコード数。

注3） LNGR, LNG1, LNG2 は各ファイルのレコード長。

4.3 シンボル・テーブル

／COMMON名／ 変　数	内　　容	デフォルト値	I／O
／TITLE／ ITITLE(20)	タイトル	ブランク	IN
／IONO　／			
MR	カード・リーダ機番	5	
MW	L．P機番	6	
MFF	Foward　ファイル	1	
MFA	Adjoint ファイル	2	
MFC	入力処理用WORK ファイル	3	
MFR	再計算用データファイル	4	
MF1	Foward Flux　ファイル	11	
MF2	Adjoint Flux ファイル	12	
MF3	感度マトリクス・ファイル	13	
MF4	反応率変化用・ファイル	14	
MF5	感度スペクトル・ファイル	15	
／CNTRL　／			
IRR	再計算ファイル・レコード番号		
IR1	Foward Flux　ファイル・　〃		
IR2	Adjoint Flux ファイル・　〃		
／PCOND　／			
ICOND	コンディション・コード	0	
NWAR	ウォーニング・エラー・カウンター	0	
NERR	エラー・カウンター	0	

COMMON　IB(100)			
1			ダミー
2	LMAX		可変ディメンジョン最大値
3	LOPTN		入力オプションPosition(Pos.) ＝23（固定）

4	LMATE	MATE(NE)	Micro Material No.Pos. =LOPTN+11
5	LENGY	ENERGY(IGM1)	入力エネルギー Pos. =LMATE+NE
6	LIPMTV	IPTV(2,IPMTV)	作図 Coarse mesh Pos. =LENGY+IGM+1
7	LIPARM	IPARM(5)	TWOTRAN パラメータ Pos. =LIPMTV+2*IPMTV
8	LIDUSE	IDUSE(45)	TWOTRAN COMMON BLOCK FWBGN1 Pos. =LIPARM+5
9	LIA	IA(250)	TWOTRAN COMMON BLOCK IA Pos. =LIDUSE+49
10	LMIXNM	MIXNM(MS)	Mixture number Pos. =LIA+250
11	LMIXCM	MIXCM(MS)	Mixture instructions Pos. =LMIXNM+MS
12	LMIXDN	DENMIX(MS)	Mixture densities Pos. =LMIXCM+MS
13	LIDCS	IDCS(IM,JM)	Cross section zone identification numbers Pos. =LMIXDN+MS
14	LIHX	IHX(IM)	Number of radial fine-mesh intervals per coarse-mesh intervals Pos. =LIDCS+IM*JM
15	LIHY	IHY(JM)	Number of axial fine-mesh intervals per coarse-mesh intervals Pos. =LIHX+IM
16	LXR	XRAD(IM+1)	Radial coarse-mesh boundaries Pos. =LIHY+JM
17	LYR	YRAD(JM+1)	Axial coarse-mesh boundaries Pos. =LXR+IM+1
18			ダミー
19	LSUM	SUM	Sum of reaction rate Pos. =LP4+NM*MM
20	LWORK		Work area Pos. =LSUM+1

21			ダミー
22			ダミー
23	NORDM		Number of LCM records
24			ダミー
25			ダミー
26	LAST		Length of common block
27	LASTEC		Length of LCM
28	LTSO		Length of the source-to-the group block
29	LTFX		Length of the flux block for a group
30	LTXS		Length of the cross-section block for a group
31	LTQS		Length of the Q-source block for a group
32			ダミー
33			ダミー
34	ISCT		Scattering order
35	ISCS		=ISCT+1
36	IGM		Number of groups
37	IGM1		=IGM+1
38	IM		Number of radial coarse-mesh intervals
39	JM		Number of axial coarse-mesh intervals
40	MT		Total number of materials
41	MS		Number of mixture instructions
42	IHT		Position in table of total cross section
43	IHS		Position in table of self-scatter cross section
44	IHM		Cross section table length
45	IMC		Number of material coarse-mesh interval in radial direction
46	JMC		Number of material coarse-mesh intervals in the axial direction
47	NM		((ISCT+1)*(ISCT+2))/2
48	NMQ		((IQAN+1)*(IQAN+2))/2
49	IT		Total number of radial fine-mesh
50	JT		Total number of axial fine-mesh
51	LIHXT	IHX(IM)	Number of radial fine-mesh intervals per coarse-mesh intervals Pos.of TWOTRAN-Ⅱ

52	LIHYT	IHY(JM)	Number of axial fine-mesh intervals per coarse-mesh intervals Pos. of TWOTRAN-Ⅱ
53	LA5	A5(IIP)	Volume = A5*YH
54	LDC	IDCS(IC)	Cross-section zone identification numbers Pos. of TWOTRAN-Ⅱ
55	LYH	YH(JT)	Material mesh axial fine-mesh spacing
56	LMN	MIXNUM(MS)	Mixture number Pos. of TWOTRAN-Ⅱ
57	LMC	MIXCOM(MS)	Mixture instructions Pos. of TWOTRAN-Ⅱ
58	LMD	MIXDEN(MS)	Mixture densities Pos. of TWOTRAN-Ⅱ
59	LXRAD	XRAD(I)	Radial coarse-mesh boundaries Pos. of TWOTRAN-Ⅱ
60	LYRAD	YRAD(J)	Axial coarse-mesh boundaries Pos. of TWOTRAN-Ⅱ
61	MM		(ISN*(ISN+2))/2
62			ダミー
63	LNGR		Record length of Restart file
64	LNG1		Record length of direct flux file
65	LNG2		Record length of Adjoint flux file
66	KIB		Record number of IB
67	KD		Record number of D(LWORK)
68	KVL		Record number of volume
69	KCR		Record number of cross-section
70	KRT		Record number of reaction rate
71	KFL		Record number of flux matrix
72	NFL		=(IT*JT/LNGR)+1
73	NRT		=(IM*JM/LNGR)+1
74	KFF		Record number of direct flux
75	NFF		=(IT*JT/LNG1)+1
76			ダミー
77	KFA		Record number of adjoint flux
78	NFA		=(IT*JT/LNG2)+1
79	KQS		Record number of adjoint source
80	NQS		=((NQ2-NQ1+1)*IT*JT/LNG2)+1
81			ダミー
82			ダミー
83	NQ1		First order of required source
84	NQ2		Final order of required source

85			ダミー
86	LW	WGT(MM)	Direction weights Pos. =LYR+JM+1
87	LP1	P1(NM,MM)	Spherical harmonic function for in-down sweep Pos. =LW+MM
88	LP2	P2(NM,MM)	Spherical harmonic function for out-down sweep Pos. =LP1+NM*MM
89	LP3	P3(NM,MM)	Spherical harmonic function for in-up sweep =LP2+NM*MM
90	LP4	P4(NM,MM)	Spherical harmonic function for out-up sweep =LP3+NM*MM
91 ～ 100			ダミー

4.4 プログラム・シート

プログラム中のサブルーチンとその機能を以下に示す。

FTMAIN（メインルーチン）

(1) 可変ディメンジョンの領域指定

(2) I/O 機番の指定

(3) ダイレクト アクセス ファイルの指定

SUB1（メインコントロール）

(1) メインコントロールルーチン

(2) 可変ディメンジョンの大きさの出力

(3) WORK エリアセクト

INPUT1（カードデータ入力コントロール）

(1) カードデータ入力コントロール

(2) 定数データのセット

FIDO（一般入力ルーチン）

(1) 任意FORMATのデータ入力

FFREAD（カードデータ入力とチェック）

(1) カードデータ入力及びFORMATチェック

CHECK（入力データ（カード）チェック）

(1) オプションデータチェック

(2) Material number チェック

(3) Energy structure チェック

HEADER（見出し出力）

(1) 見出しの出力

(2) 入力データの出力

INPUT2（TWOTRAN-Ⅱ direct file data 入力）

(1) Set Mixing table, Material assignment, Coarse-mesh boundaries, volume, Direct flux and Cross section from TWOTRAN-Ⅱ direct file.

REED（Binary data入力処理）

(1) Binary data入力処理

ECRD（データ転送）

(1) LCM transfer to core replacement routine

INPUT3（TWOTRAN-Ⅱ adjoint file data 入力）

(1) Set Adjoint flux and Response function
from TWOTRAN-Ⅱ adjoint file

CMPUT1（Reaction Rate と $\phi^*\phi$ マトリクス計算コントロール）

(1) Reaction Rate 計算用work area セット

(2) $\phi^*\phi$ マトリクス計算用work area セット

CMPUTR（Reaction Rate 計算）

(1) 各coarse-mesh毎にvolume, ϕ, Response function 入力

(2) $RATE(I,J,G) = \sum_{I,J} vQ\ \phi$

(3) RATE をRestart file に出力

SUMUP（積分ルーチン）

$$SUM(n) = \sum_{k=0}^{n} \sum_{\substack{I\in II \\ J\in JJ}} V(I,J)\cdot A_n^k(I,J)\cdot B_n^k(I,J)$$

CMPUTF（$\phi^*\phi$ マトリクス計算コントロール）

(1) 各coarse mesh毎にvolume, ϕ, ϕ^* を入力

(2) Adjoint flux(ϕ^*)のangle 変換（AVCONV）

(3) $\phi^*\phi_n(I,J,m) = (2n-1)\sum_{I,J} v\cdot\phi^*\ \phi$

(4) $\phi^*\phi_n$ をRestart file に出力

ACONV（Adjoint flux moments の変換）

(1) Adjoint flux ϕ^* のangle 逆転変換

EXPAND（Angle 変換ルーチン）

(1) Adjoint flux(T1) を，係数（P1, P2, W）で変換する。

INPUT4（再計算用データ入力処理）

(1) 再計算用定数データ入力

(2) 定数データ・アドレスを再セット

(3) 見出し出力ルーチンコール

CMPUT2（感度マトリクス，感度係数計算コントロール）

(1) Cross section sets 入力

(2) 感度マトリクス，PL−effect，感度スペクトル計算コントロール

(3) 計算結果のファイルへの出力

MATRIX（感度マトリクス計算）

(1) 感度マトリクス計算

$$PMX_n(IH, E') = \pm \rho \cdot C(IH, E', MP) \sum_n \phi^* \phi_n (E, E') / SUM$$

（SUM= sum of reaction rate）

TRUNCP（感度解析）

(1) PL−effect 計算

(2) 感度係数計算

RITE（Binary data 出力処理）

(1) Binary data出力処理

ECWR（データ転送）

(1) Core to LCM transfer replacement routine

PRINT（データ出力ルーチン）

(1) 出力するもの

1. Coarse mesh map
2. Mixing table
3. Cross section
4. Reaction rate
5. PL−effect
6. Sensitivity matrix
7. Sensitivity spectra

MAPPER（Material map 出力）

(1) Material map を出力

WRITE（出力ルーチン）

(1) 固定FORMATで3次元データ出力

ECHECK（出力データチェック）

(1) Check to see if all entries are zero

WOT（出力ルーチン）

(1) 固定FORMATで3次元データ出力

PLOTER（作図コントロール）

(1) プロッターのOPEN/CLOSE

(2) 作図展開長，きざみ幅指定

(3) プロッタールーチンコントロール（PLT）

PLT（作図ルーチン）

(1) 感度スペクトルの作図ルーチン

ERROR（エラーメッセージ出力）

(1) エラー種別を分け，メッセージを出力する。

5. TWOTRAN－Ⅱ コードによる輸送計算に関する注意事項

本コードにて微視的断面積に対する感度解析を行うためは，TWOTRAN －Ⅱ への断面積の入力は微視的断面積を用い，mixing テーブルの指定によりTWOTRAN－Ⅱコードにて巨視的断面積を作成しなければならない。mixing テーブルの入力は次の形式で行う必要がある。

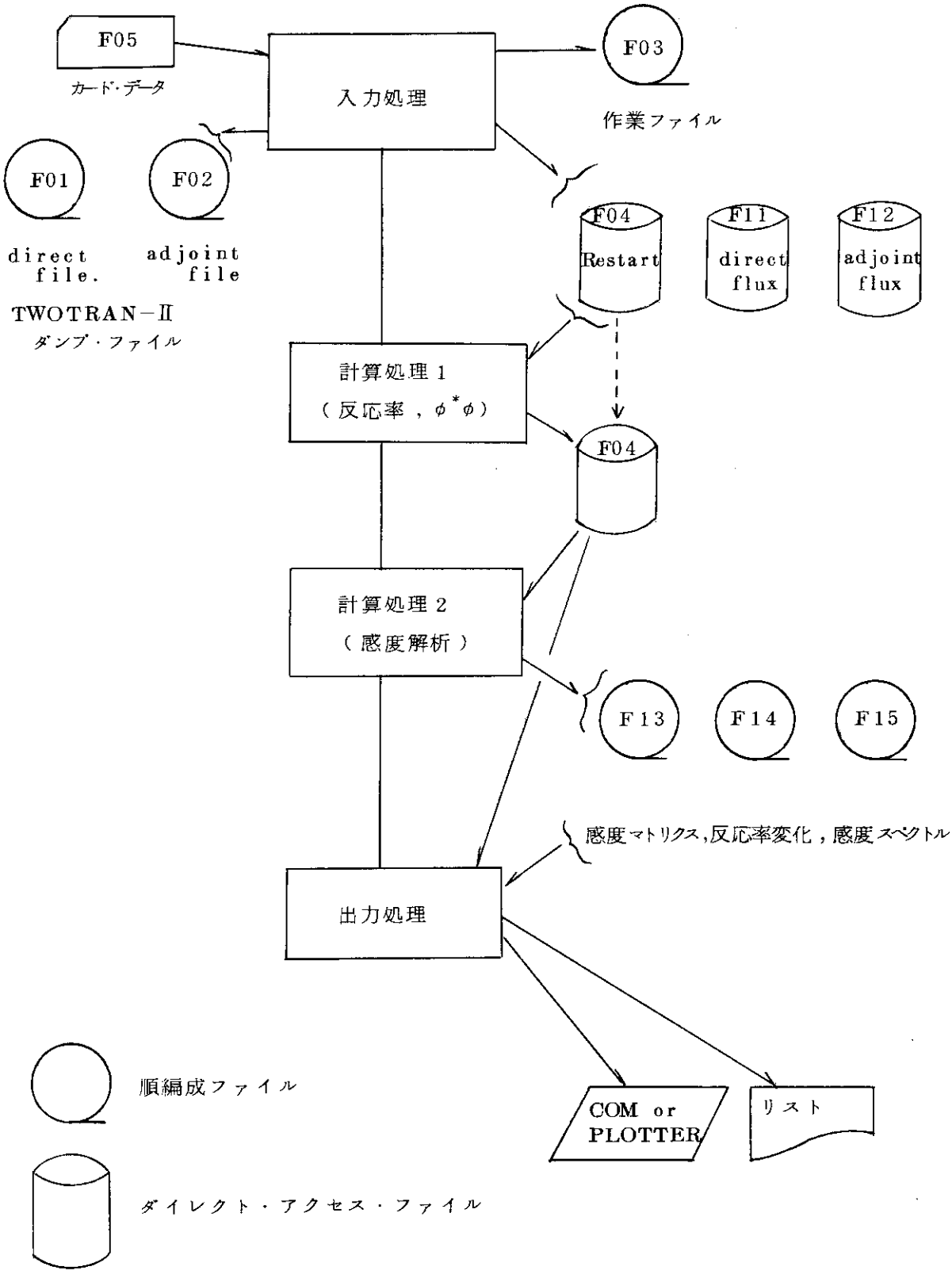
MIXNUM	MIXCOM	MIXDEN
46	0	0.0
46	1	0.0478
46	20	0.0333

その他の形式で入力すると本コードでは正しく処理されない。

本コードではmixing テーブルのMIXCOMで入力した物質番号を入力データで指定すると，この物質について感度解析が行われる。

本コードでは rebalance coars mesh と material coarse mesh が同一であると仮定しているのでTWOTRAN－Ⅱ の入力データでの control integer の IMC，JMC のオプションは使用できない。

6. 機 器 構 成


F05
カード・データ
入力処理
F03
作業ファイル
F01
F02
direct file.
adjoint file
TWOTRAN－Ⅱ
ダンプ・ファイル
F04
Restart
F11
direct flux
F12
adjoint flux
計算処理 1
（反応率，φ*φ）
F04
計算処理 2
（感度解析）
F13
F14
F15
感度マトリクス,反応率変化，感度スペクトル
出力処理
順編成ファイル
COM or PLOTTER
リスト
ダイレクト・アクセス・ファイル

7. 入 力 方 法

枝	変 数 名	説 明	備 考
1	ITITLE(20)	タイトル	20A4
2		1$ array コントロール オプション	Iタイプ
	NE	計算する核種の数	
	IGM	エネルギー群数 ＝TWOTRAN－Ⅱで使用される エネルギー群数	
	MATR	応答関数に対する物質番号	
	IRESP	検出器に対する物質番号 ＝0 考慮しない。 ＝1 考慮する。 ＝2 両方を計算する。	
	ITAPE	再計算・オプション ＝0 全部計算する。 ＝1 先に計算された $\phi^*\phi$ を使用する。 ＝2 $\phi^*\phi$ までを計算する。	
	IPCRS	微視断面積の出力オプション ＝0 出力せず。 ＝1 出力する。	
	IPPL	感度マトリクスにおける，Pℓ－ 効果の 出力オプション ＝0 出力せず。 ＝1 出力する。	

No.	変数名	説明	備考
	IPMTX	感度マトリクスの出力オプション ＝0　出力せず。 ＝1　スカラー断面積部分のみの出力 ＝2　スカラーと散乱マトリクス （各々のP_ℓ成分とそれらの和） ＝3　スカラーと散乱マトリクス （P_ℓ成分の和）	
	IPLOT	感度スペクトルの作図オプション ＝0　作図せず。 ＝1　作図する。	
	IPLTZ	各粗メッシュ領域毎の感度スペクトルの作図オプション ＝0　作図せず。 ＝1　作図する。	
	IPMTV	出力する感度マトリクスと，作図する感度スペクトルの粗メッシュ領域数 ＝−1 全粗メッシュ領域 ＝0　ナシ ＝n　4＄array で入力する領域数 T：1＄array の終り。	
3	MATE(NE)	2＄ array 計算する核種に対する物質番号 ＝NE個の入力 T：2＄ arrayの終り。	Iタイプ
4	ENGY(IGM+1)	3* array エネルギー構造 ＝IGM＋1個の入力 T：3 * array の終り。	Eタイプ
5	IPTV (2,IPMTV)	4＄ array 考慮する粗メッシュ領域群 （i，j）の組で入力。 IPMTV＝n（＞0）の時のみ必要 T：4＄ arrayの終り。	Iタイプ

8. 出 力 内 容

プリント出力の内容は以下の通りである。

1) カード・イメージでの入力データ
2) FIDO ルーチンでの読み込み個数のチェック
3) 見出し及びコントロール・データ
4) TWOTRAN−Ⅱ コードにおける主パラメータ
5) TWOTRAN−Ⅱ で計算したモデルの粗メッシュマップ
6) 元素の混合比
7) TWOTRAN−Ⅱ の計算で用いた断面積（IRCRS＝1 の時出力）
8) 反応率の空間分布及び全空間積分量

以下の内容は感度計算の対象とする核種毎に出力される。

9) 散乱核のルジャンドル級数展開次数の打ち切りの差に対する反応率の変化率
10) 入力データで指定された粗メッシュ領域における感度マトリックス（IPMTV＝−1のときは全粗メッシュ領域に対して出力）
11) 対象とする断面積の核種が存在するすべての粗メッシュ領域についての感度係数

以上のプリント内容の他に領域別に（IPLZ＝1），または全領域について（IPLOT＝1）作図された感度スペクトルがプロッター出力される。

9. 使用法とジョブ制御文

9.1 使用法

1) 可変ディメンジョン

TWOTRAN－Ⅱで作成されたrestart dump fileデータは，散乱次数，モデル形状等により，データ・サイズが変化する。本コードは，この変化に対応する様，使用するデータ・サイズを可変とし，その大きさはMAINルーチンで指定する。

ex.)

```
COMMON  IB(100), D(100000)
LMAX=100000
~~~~~~線部を変更する。
```

2) ダイレクト・アクセス・ファイル

ダイレクト・アクセス・ファイルの使用するレコード数は，3.3節で求められる。これらの結果より，レコード長とレコード数をMAINルーチンで変更する。

ex.)

```
LNGR=900
DEFINE  FILE  4(200, 900, u, IRR)
 ———線部レコード長
 ~~~~~線部レコード数  を変更する。
```

以上の変更が生じたときは，MAINソースを変更し，次の様にJCLを追加する。

1) ソース・カードを変更するとき

```
¥HFORT
```

```
┌──────────┐
│ MAINソース │
└──────────┘
```

```
¥HLIEDRUN ·····          ,EDIT=YES
                           追 加
```

2) ソース・ファイルを変更する時

```
¥HFORT   SFNAME = J2372.SENCE1 ,  ELM=FTMAIN
                  ソース ファイル名
¥HLIEDRUN ·····        ,EDIT = YES
                           追 加
```

この様にＪＣＬを変更する。

9.2 ジョブ制御文

＜1＞　ＩＴＡＰＥ＝０の時（作図時ＣＯＭ使用）

```
¥NO                                                          T.n／ ①
                                                             C.3／
                                                             W.m／ ②
                                                             P.0／
                                                             C35   ③
¥GJOB.....
¥HLIEDRUN  RFNAME=J2372.SENCERB1,GRFD=ON,                    ／
                   登録RB名
                                                                   ④
           COMLIB=CALL                                             ⑤
¥GCOM35
¥TAPE      F01, ファイル名(Direct), OLD, ボリウム通番
¥TAPE      F02, ファイル名(Adjoint), OLD, ボリウム通番
¥DISK      F03
¥DISKTN    F04, ファイル名(Restart)
¥DISK      F11
    ≀
¥DISK      F15
¥DATA
```

データ

```
¥JEND
```

注）　①　n：n≧5，　②　m：出力オプションにより異なる。

④　必らず必要（ＰＬＯＴＴＥＲを使用時は"ＰＬＴＬＩＢ＝ＣＡＬＬ"に変更）

③，⑤　作図しない時は不必要。

＜2＞　ＩＴＡＰＥ＝１の時（作図時ＣＯＭ使用）

```
¥NO                                                    T.n ／     ①
                                                       C.3 ／
                                                       W.m ／     ②
                                                       P.0 ／
                                                       C35 ／     ③
¥GJOB ·····
¥HLIEDRUN   RFNAME=J2372.SENCERB1,GRFD=ON              ／
            COMLIB=CALL
¥GCOM35                                                           ④
¥DISK    F03
¥DISKTO  F04,  Restart ファイル名
¥DISK    F13
¥DISK    F14
¥DISK    F15
¥DATA
```

データ

```
¥JEND
```

注）　①　n：n≧1（処理内容により異なる）

②　m：m≧1（出力オプションにより異なる）

③，④　作図しない時不要

＜3＞　ＩＴＡＰＥ＝２の時（作図せず）

```
¥NO                                                    T.n ／  ①
                                                       C.3 ／
                                                       W.m ／  ②
                                                       P.0 ／
¥GJOB ……
¥HLIEDRUN   RFNAME=J2372.SENCERB1,GRFD=ON,          ／
            COMLIB=CALL
¥TAPE       F01,Direct ファイル名,OLD,ボリウム通番
¥TAPE       F02,Adjoint ファイル名,OLD,ボリウム通番

¥DISK       F03
¥DISKTN     F04,Restart ファイル名
¥DISK       F11
¥DISK       F12
¥DATA

            データ

¥JEND
```

注）①　n：n≧5

②　m：m≧0（出力オプションにより異なる）

参考文献

1) D.E. Bartine et al. ; " SWANLAKE, A Computer Code Utilizing ANISN Radiation Transport Calculations for Cross Section Sensitivity Analysis", ORNL-TM-3809(1973).

2) W.W. Engle Jr. ; " A Users Manual for ANISN, A One Dimensional Discrete Ordinates Code with Anisotropic Scattering," K-1693, Computing Technology Center, Union Carbide Corporation(1967).

3) R.L.Childs et al. ; " Perturbation Theory and Sensitivity Analysis for Two-Dimensional Shielding Calculations," Trans.Am. Nucl. Soc. 21, 543 (1975).

4) 川合将義，他；「遮蔽感度解析コードシステムの開発」昭和54年度日本原子力学会年会 F 37.

5) 迫　淳，他；核融合実験炉第1次予備設計　JAERI-M 7300(1977).

6) K.D.Lathrop and F.W. Brinkley;"TWOTRAN-Ⅱ, An Interfaced Exportable Version of the TWOTRAN Code for Two-Dimensional Transport", LA-4848-MS(1973).

7) СМИРНОВ, В.И.;「高等数学教程」Ⅲ巻二部（第二分冊），共立出版（翻訳）.

8) Y.Seki,M.Yamauchi and H.Iida; " Applicability of a Two Dimensional Sensitivity Calculation Code;SENSETWO," submitted to J. Nucl. Sci. Technol.

9) 迫　淳，他；核融合実験炉第1次予備設計（中間報告書），JAERI-M 6670(1976).

付録1　入出力例

ＳＥＮＳＥＴＷＯコードの適用性評価を行いその妥当性は確認してある[8]。その評価に使用した例題の一部を入出力例として以下に示す。

計算の対象とした体系は原研の核融合実験炉の第１次予備設計の中間報告書[9]に示されたものである。使用した２次元計算モデルをＦｉｇ．Ａ．１に示す。図に示されたＬｉ$_2$Ｏ ブロック領域におけるトリチウム生成反応，つまり ^{6}Ｌｉ(ｎ，α)ｔ 反応に対する炭素と鉄の全断面積の感度を計算した。

以下にまず入力リスト，出力リストの一部とプロッタ出力の一部を示す。

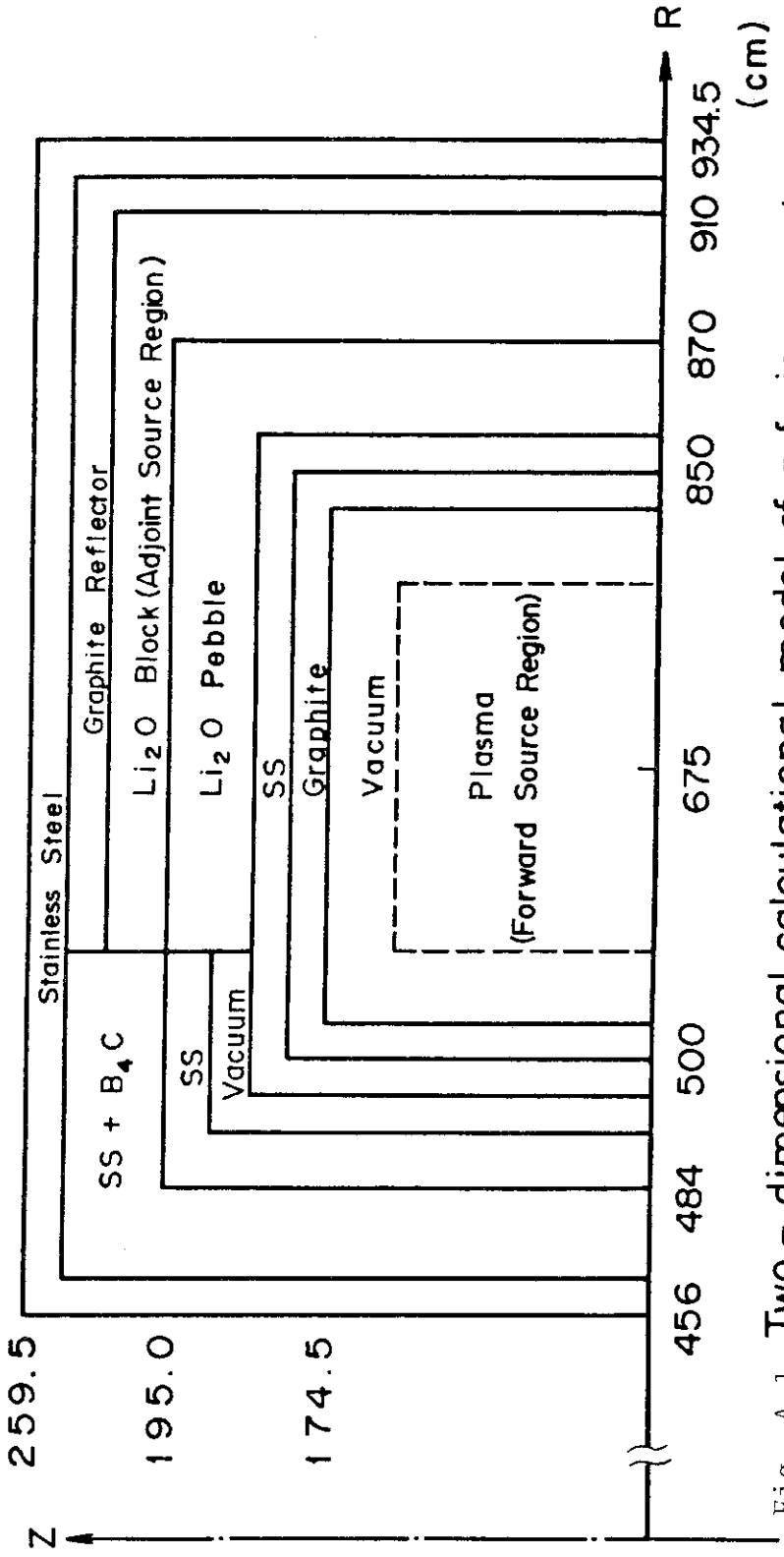


Fig. A.1 Two-dimensional calculational model of a fusion reactor

INPUT DATA LIST ← カード・イメージ・データ リスト

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
1   SENSITIVITY ANALYSIS TEST ( P2 ) ← タイトル                          SEN00100
2   1**                                                                  SEN00200
3         2    =  NE                                                     SEN00300
4         7    =  IGM                                                    SEN00400
5         1    =  MATR                                                   SEN00500
6         0    =  IRESP                                                  SEN00600
7         0    =  ITAPE                                                  SEN00700
8         0    =  IPCRS                                                  SEN00800
9         1    =  IPPL                                                   SEN00900
10        2    =  IPMTX                                                  SEN01000
11        1    =  IPLOT                                                  SEN01100
12        1    =  IPLTZ                                                  SEN01200
13        10   =  IPMTV                                                  SEN01300
14  T                                                                    SEN01400
15  2**                                                                  SEN01500
16        13  } 注目する物質番号 (NE 他), この域分は炭素と鉄            SEN01600
17        43  }                                                          SEN01700
18  T                                                                    SEN01800
19  3**                          エネルギー群構造 (IGM+1個, 降順)       SEN01900
20        1.5E7     1.372E7   7.32E6   2.5E6     2.83E5    4.65E3       SEN02000
21        2.15E1    1.0E-3                                             SEN02100
22  T                                                                    SEN02200
23  4**              注目する粗メッシュ領域群 (R, Z の組 < IPMTV 組)     SEN02300
24     3  1  5  1  6  1  13  1  14  1  15  1  8  8  9  6  8  7  9  7    SEN02400
25  T                                                                    SEN02500
```

```
1* ARRAY     11 ENTRIES READ
 T
2* ARRAY      2 ENTRIES READ
 T
3* ARRAY      6 ENTRIES READ
 T
4* ARRAY     20 ENTRIES READ
 T
```

FIDO ルーナ、個数チェックリスト

```
*****************************************************
*                                                   *
*                                                   *
*          S E N S I T I V I T Y   A N A L Y S I S  *
*                                                   *
*                                                   *
*                  O F   T W O T R A N - I I        *
*                                                   *
*                                                   *
*****************************************************
```

見出し及びコントロール
データ・リスト

DATA 79-04-16

C A S E = SENSITIVITY ANALYSIS TEST (P2) SEN00100

```
  2  NE      NUMBER OF MICRO CROSS SECTION SETS
  7  IGM     NUMBER OF ENERGY GROUPS
  1  MATR    MATERIAL NUMBER FOR THE RESPONSE FUNCTION
  0  IRESP   0/1/2  EFFECT OF CROSS SECTION CHANGE OF DETECTOR
                    NOT CONSIDER / CONSIDER / BOTH

  0  ITAPE   0/1/2  RESTART OPTION   TOTAL / RESTART / ONLY FLUX MATRIX

  0  IPCRS   0/1  PRINT OF MICRO CROSS SECTION   NO / YES
  1  IPPL    0/1  PRINT OF PL EFFECT FOR SENSITIVITY MATRIX   NO / YES
  2  IPMTX   0/1/2/3  PRINT OF SENSITIVITY MATRIX
                    NO / ONLY SCALAR CROSS SECTION
                    / SCALAR + SCATTERING MATRIX (FOR EACH PL COMPONENT AND SUM)
                    / SCALAR + SCATTERING MATRIX (SUM OF PL COMPONENT)
  1  IPLOT   0/1  PLOT OF SENSITIVITY SPECTRA   NO / YES
  1  IPLTZ   0/1  PLOT OF SENSITIVITY SPECTRA FOR EACH COARSE MESH REGION   NO / YES
 10  IPMTV   =1/0/N  PRINT OF SENSITIVITY MATRIX AND PLOT OF SENSITIVITY SPECTRA
                    ALL COARSE MESH / NO / REQUIRED MESH
```

```
MATERIAL NUMBER OF MICRO CROSS SECTION SET
   13   43

ENERGY STRUCTURE
  1.5000E+07  1.3720E+07  7.3280E+06  2.9000E+06  2.8300E+05  4.6500E+03  2.1500E+01  1.0000E-03

PRINT SENSITIVITY MATRIX FOR REQUIRED COARSE MESH
(  3,  1)  (  5,  1)  (  6,  1)  ( 13,  1)  ( 14,  1)  ( 15,  1)  (  8,  6)  (  9,  6)
(  8,  7)  (  9,  7)  (
```

TWOTRAN-IIコードにおける主パラメータ・リスト

```
THIS CASE WAS PROCESSED BY THE TWOTRAN-II CODE OF  04/24/73
JXFF FLUX CALCULATION FOR SENSITIVITY STUDY

  0 ITH     0/1 DIRECT/ADJOINT
  2 ISCT    0/N ISOTROPIC/NTH ORDER ANISOTROPIC
  8 ISN     SN ORDER ( +/- BUILT-IN/STANDARD INTERFACE FILE )
  7 IGM     NO. GROUPS
 15 IM      NO. COARSE MESH R INTERVALS
  8 JM      NO. COARSE MESH Z INTERVALS
0 0 1 0     LEFT,RIGHT,BOTTOM,TOP BOUNDARY CONDITION 0/1/2/3 VACUUM/REFLECTIVE/WHITE/PERODIC
  0 IEVT    0/1/2/3/4  Q/K/ALPHA/C/DELTA  CALCULATION
  1 ISTART  -5/-4/-3/-2/-1/ /1/2/3/4/5 STARTING OPTIONS ( MINUS FOR ISOTROPIC COMPONENT ONLY ) SEE MANUAL FOR DETAILS

 90 MT      TOTAL NO. OF MATERIALS
192 MS      NO. OF MIXTURE INSTRUCTIONS
  3 IHT     ROW OF TOTAL CROSS SECTION
  4 IHS     ROW OF SELF SCATTER CROSS SECTION
 10 IHM     LAST ROW OF CROSS SECTION TABLE
  3 IQOPT   0/1/2/3/4/5 NONE/SAME AS ISTART FOR SOURCE DISTRIBUTION
  0 IQAN    0/N  ISOTROPIC/NTH ORDER ANISOTROPIC SOURCE
0 0 0       IQR/IQB/IQT RIGHT,BOTTOM,TOP BOUNDARY SOURCE ( 0/1 NO/YES )
  0 IPVT    0/1/2 NONE/K/ALPHA  PARAMETRIC EIGENVALUE TYPE
 99 IITL    MAX NO. INNER ITERATIONS
  0 IXM     0/1 NO/YES MODIFY R RADII (IEVT=4 ONLY)

  0 IYM     0/1 NO/YES MODIFY Z RADII (IEVT=4 ONLY)
  2 IGEOM   1/2/3 (X,Y)/(R,Z)/(R,T) GEOMETRY
  0 IEDOPT  0/1/2/3/4=NONE/  EDIT OPTIONS SEE MANUAL FOR DETAILS
  0 ISDF    0/1 NO/YES INPUT FINE MESH DENSITY FACTORS
  0 IANG    -1/0/1 PRINT AND STORE/NO/STORE ANGULAR FLUX
 15 IMC     NO. OF HORIZON. MAT.MESH INTERVALS (IF.NE.0, REBAL.MESH.NE.MAT.MESH WHICH IS EDIT MESH)
  8 JMC     NO. OF VERTICAL MAT.MESH INTERVALS

0.0         EV       EIGENVALUE GUESS
0.0         EVM      EIGENVALUE MODIFIER
0.0         PV       PARAMETRIC EIGENVALUE
1.000E-02   XLAL     SEARCH LAMBDA LOWER LIMIT
5.000E-01   XLAH     SEARCH LAMBDA UPPER LIMIT
1.000E-03   XLAX     FINE MESH SEARCH PRECISION

1.000E-03   EPS      CONVRGENCE PRECISION
1.000E+00   NORM     NORMALIZATION  AMPLITUDE
1.000E+00   POD      PARAMETER OSCILLATION DAMPER
0.0         BHGT     TOTAL BUCKLING HEIGHT IN CM FOR (X,Y) AND (R,T) ONLY


  MAX. AREA IS                     136000
  PARAMETER AREA IS                  1359
  MAX. WORK AREA IS                 67402
  MAX. UNIT OF I/O AREA IS          28571
  REMAINING AREA IS                 42596
```

```
****************************************************REBALANCE MAP*******************************************************

   Z                                     MATERIALS BY BROAD ZONE, ORIGIN AT LOWER LEFT.
 ROW   M                                 M IS NUMBER OF FINE INTERVALS/BROAD ROW(COLUMN).
259.5000  000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
  8    1  0 -67 * -67 * -67 * -67 * -67 * -67 * -67 * -67 * -67 * -67 * -67 * -67 * -67 * -67 * -67 0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
255.0000  0*****************************************************************************************0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
  7    5  0 -67 * -85 * -85 * -85 * -85 * -85 * -85 * -61 * -61 * -61 * -61 * -61 * -61 * -61 * -67 0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
235.0000  0*****************************************************************************************0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
  6   10  0 -67 * -85 * -85 * -85 * -85 * -85 * -85 * -79 * -79 * -79 * -79 * -79 * -79 * -61 * -67 0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
195.0000  0*****************************************************************************************0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
  5    3  0 -67 * -85 * -67 * -67 * -67 * -67 * -67 * -73 * -73 * -73 * -73 * -73 * -79 * -61 * -67 0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
181.0000  0*****************************************************************************************0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
  4    2  0 -67 * -85 * -67 * -55 * -55 * -55 * -55 * -73 * -73 * -73 * -73 * -73 * -79 * -61 * -67 0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
176.0000  0*****************************************************************************************0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
  3    1  0 -67 * -85 * -67 * -55 * -67 * -67 * -67 * -67 * -67 * -67 * -67 * -73 * -79 * -61 * -67 0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
175.0000  0*****************************************************************************************0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
  2    1  0 -67 * -85 * -67 * -55 * -67 * -61 * -61 * -61 * -61 * -61 * -67 * -73 * -79 * -61 * -67 0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
174.5000  0*****************************************************************************************0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
  1    7  0 -67 * -85 * -67 * -55 * -67 * -61 * -55 * -55 * -55 * -61 * -67 * -73 * -79 * -61 * -67 0
          0    *     *     *     *     *     *     *     *     *     *     *     *     *     *     0
0.0       0111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
  R    456.  460.  484.  494.  499.  500.  500.  525.  525.  849.  850.  851.  870.  910.  930.  934.
        0     0     0     0     0     0  5000     0     0  5000     0     0     0     0     0  5000

  M           1     6     4     1     1     1     1    12     1     1     1     5    10     5     1
COLUMN        1     2     3     4     5     6     7     8     9    10    11    12    13    14    15
```

TWOTRAN-IIで計算したモデルの雑メッシュ・マップ

	MIXTURE NUMBER	MIXTURE COMMAND	MATERIAL ATOMIC DENCITY
1	55	0	0.0
2	55	14	1.0000000E-11
3	56	0	0.0
4	56	20	1.0000000E-11
5	57	0	0.0
6	57	21	1.0000000E-11
7	58	0	0.0
8	58	22	1.0000000E-11
9	59	0	0.0
10	59	23	1.0000000E-11
11	60	0	0.0
12	60	24	1.0000000E-11
13	61	0	0.0
14	61	13	8.3740000E-02
15	62	0	0.0
16	62	14	8.3740000E-02
17	63	0	0.0
18	63	15	8.3740000E-02
19	64	0	0.0
20	64	16	8.3740000E-02
21	65	0	0.0
22	65	17	8.3740000E-02
23	66	0	0.0
24	66	18	8.3740000E-02
25	67	0	0.0
26	67	25	1.2550000E-03
27	67	31	1.5750000E-02
28	67	37	9.8480000E-03
29	67	43	5.9090000E-02
30	68	0	0.0
31	68	26	1.2550000E-03
32	68	32	1.5750000E-02
33	68	38	9.8480000E-03
34	68	44	5.9090000E-02
35	69	0	0.0
36	69	27	1.2550000E-03
37	69	33	1.5750000E-02
38	69	39	9.8480000E-03
39	69	45	5.9090000E-02
40	70	0	0.0
41	70	28	1.2550000E-03
42	70	34	1.5750000E-02
43	70	40	9.8480000E-03
44	70	46	5.9090000E-02
45	71	0	0.0
46	71	29	1.2550000E-03
47	71	35	1.5750000E-02
48	71	41	9.8480000E-03
49	71	47	5.9090000E-02
50	72	0	0.0
51	72	30	1.2550000E-03
52	72	36	1.5750000E-02
53	72	42	9.8480000E-03
54	72	48	5.9090000E-02
55	73	0	0.0
56	73	1	1.2280000E-03
57	73	7	1.5320000E-02
58	73	19	8.2749999E-03
59	73	25	1.1300000E-04
60	73	31	1.4180000E-03
61	73	37	8.8630000E-04
62	73	43	5.3190000E-03
63	74	0	0.0
64	74	2	1.2280000E-03
65	74	8	1.5320000E-02
66	74	20	8.2749999E-03
67	74	26	1.1300000E-04
68	74	32	1.4180000E-03
69	74	38	8.8630000E-04
70	74	44	5.3190000E-03
71	75	0	0.0
72	75	3	1.2280000E-03
73	75	9	1.5320000E-02
74	75	21	8.2749999E-03
75	75	27	1.1300000E-04
76	75	33	1.4180000E-03
77	75	39	8.8630000E-04
78	75	45	5.3190000E-03
79	76	0	0.0
80	76	4	1.2280000E-03
81	76	10	1.5320000E-02
82	76	22	8.2749999E-03
83	76	28	1.1300000E-04
84	76	34	1.4180000E-03
85	76	40	8.8630000E-04
86	76	46	5.3190000E-03
87	77	0	0.0
88	77	5	1.2280000E-03
89	77	11	1.5320000E-02
90	77	23	8.2749999E-03
91	77	29	1.1300000E-04
92	77	35	1.4180000E-03
93	77	41	8.8630000E-04
94	77	47	5.3190000E-03
95	78	0	0.0
96	78	6	1.2280000E-03
97	78	12	1.5320000E-02
98	78	24	8.2749999E-03
99	78	30	1.1300000E-04
100	78	36	1.4180000E-03
101	78	42	8.8630000E-04
102	78	48	5.3190000E-03
103	79	0	0.0
104	79	1	3.6850000E-03
105	79	7	4.5980000E-02
106	79	19	2.4830000E-02
107	79	25	2.1340000E-04
108	79	31	2.6740000E-03
109	79	37	1.6740000E-03
110	79	43	1.0050000E-02
111	80	0	0.0
112	80	2	3.6850000E-03
113	80	8	4.5980000E-02
114	80	20	2.4830000E-02
115	80	26	2.1340000E-04
116	80	32	2.6740000E-03
117	80	38	1.6740000E-03
118	80	44	1.0050000E-02
119	81	0	0.0
120	81	3	3.6850000E-03
121	81	9	4.5980000E-02
122	81	21	2.4830000E-02
123	81	27	2.1340000E-04
124	81	33	2.6740000E-03
125	81	39	1.6740000E-03
126	81	45	1.0050000E-02
127	82	0	0.0
128	82	4	3.6850000E-03

(× 10^{-24})

元素の混合比

(Mixing Table)

129	82	10	4.5980000E-02
130	82	22	2.4830000E-02
131	82	28	2.1340000E-04
132	82	34	2.6780000E-03
133	82	40	1.6740000E-03
134	82	46	1.0050000E-02
135	83	0	0.0
136	83	5	3.6850000E-03
137	83	11	4.5980000E-02
138	83	23	2.4830000E-02
139	83	29	2.1340000E-04
140	83	35	2.6780000E-03
141	83	41	1.6740000E-03
142	83	47	1.0050000E-02
143	84	0	0.0
144	84	6	3.6850000E-03
145	84	12	4.5980000E-02
146	84	24	2.4830000E-02
147	84	30	2.1340000E-04
148	84	36	2.6780000E-03
149	84	42	1.6740000E-03
150	84	48	1.0050000E-02
151	85	0	0.0
152	85	13	1.1850000E-02
153	85	25	5.0200000E-04
154	85	31	6.3000000E-03
155	85	37	3.9390000E-03
156	85	43	2.3640000E-02
157	85	49	3.7640000E-02
158	86	0	0.0
159	86	14	1.1850000E-02
160	86	26	5.0200000E-04
161	86	32	6.3000000E-03
162	86	38	3.9390000E-03
163	86	44	2.3640000E-02
164	86	50	3.7640000E-02
165	87	0	0.0
166	87	15	1.1850000E-02
167	87	27	5.0200000E-04
168	87	33	6.3000000E-03
169	87	39	3.9390000E-03
170	87	45	2.3640000E-02
171	87	51	3.7640000E-02
172	88	0	0.0
173	88	16	1.1850000E-02
174	88	28	5.0200000E-04
175	88	34	6.3000000E-03
176	88	40	3.9390000E-03
177	88	46	2.3640000E-02
178	88	52	3.7640000E-02
179	89	0	0.0
180	89	17	1.1850000E-02
181	89	29	5.0200000E-04
182	89	35	6.3000000E-03
183	89	41	3.9390000E-03
184	89	47	2.3640000E-02
185	89	53	3.7640000E-02
186	90	0	0.0
187	90	18	1.1850000E-02
188	90	30	5.0200000E-04
189	90	36	6.3000000E-03
190	90	42	3.9390000E-03
191	90	48	2.3640000E-02
192	90	54	3.7640000E-02

REACTION RATE FOR EACH GROUP AND COARSE MESH ←反応率リスト

REACTION RATE ENERGY GR. 1 ←エネルギー群番号

R MESH	1 R MESH	2 R MESH	3 R MESH	4 R MESH	5 R MESH	6 R MESH	7 R MESH	8
Z MESH								
1 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5 0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.053961E-12	
6 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
7 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
8 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

R MESH	9 R MESH	10 R MESH	11 R MESH	12 R MESH	13 R MESH	14 R MESH	15
1 0.0	0.0	0.0	0.0	9.184688E-13	0.0	0.0	
2 0.0	0.0	0.0	0.0	1.877278E-15	0.0	0.0	
3 0.0	0.0	0.0	0.0	3.736284E-15	0.0	0.0	
4 0.0	0.0	0.0	0.0	1.749931E-14	0.0	0.0	
5 0.0	0.0	0.0	0.0	2.883002E-14	0.0	0.0	
6 6.969343E-14	1.290307E-15	2.564730E-15	3.702855E-14	1.598232E-14	0.0	0.0	
7 0.0	0.0	0.0	0.0	0.0	0.0	0.0	
8 0.0	0.0	0.0	0.0	0.0	0.0	0.0	

REACTION RATE ENERGY GR. 2

R MESH	1 R MESH	2 R MESH	3 R MESH	4 R MESH	5 R MESH	6 R MESH	7 R MESH	8
1 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5 0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.064013E-12	
6 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
7 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
8 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

R MESH	9 R MESH	10 R MESH	11 R MESH	12 R MESH	13 R MESH	14 R MESH	15
1 0.0	0.0	0.0	0.0	1.764605E-12	0.0	0.0	
2 0.0	0.0	0.0	0.0	3.474183E-15	0.0	0.0	
3 0.0	0.0	0.0	0.0	6.841680E-15	0.0	0.0	
4 0.0	0.0	0.0	0.0	3.196766E-14	0.0	0.0	
5 0.0	0.0	0.0	0.0	5.554931E-14	0.0	0.0	
6 1.461483E-13	2.700293E-15	5.342213E-15	8.396372E-14	4.881256E-14	0.0	0.0	
7 0.0	0.0	0.0	0.0	0.0	0.0	0.0	
8 0.0	0.0	0.0	0.0	0.0	0.0	0.0	

REACTION RATE ENERGY GR. 3

R MESH	1 R MESH	2 R MESH	3 R MESH	4 R MESH	5 R MESH	6 R MESH	7 R MESH	8
1 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
6 0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.479552E-12	
7 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	R MESH 9	R MESH 10	R MESH 11	R MESH 12	R MESH 13	R MESH 14	R MESH 15
1	0.0	0.0	0.0	0.0	4.603290E-12	0.0	0.0
2	0.0	0.0	0.0	0.0	8.977594E-15	0.0	0.0
3	0.0	0.0	0.0	0.0	1.770055E-14	0.0	0.0
4	0.0	0.0	0.0	0.0	8.277174E-14	0.0	0.0
5	0.0	0.0	0.0	0.0	1.728030E-13	0.0	0.0
6	3.936440E-13	7.272954E-15	1.439551E-14	2.244345E-13	1.316571E-13	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

REACTION RATE ENERGY GR. 4

	R MESH 1	R MESH 2	R MESH 3	R MESH 4	R MESH 5	R MESH 6	R MESH 7	R MESH 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.163318E-10
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	R MESH 9	R MESH 10	R MESH 11	R MESH 12	R MESH 13	R MESH 14	R MESH 15
1	0.0	0.0	0.0	0.0	9.542175E-11	0.0	0.0
2	0.0	0.0	0.0	0.0	1.849911E-13	0.0	0.0
3	0.0	0.0	0.0	0.0	3.650327E-13	0.0	0.0
4	0.0	0.0	0.0	0.0	1.711851E-12	0.0	0.0
5	0.0	0.0	0.0	0.0	3.652521E-12	0.0	0.0
6	8.648001E-12	1.577675E-13	3.142480E-13	4.841627E-12	2.884516E-12	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

REACTION RATE ENERGY GR. 5

	R MESH 1	R MESH 2	R MESH 3	R MESH 4	R MESH 5	R MESH 6	R MESH 7	R MESH 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.041510E-09
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	R MESH 9	R MESH 10	R MESH 11	R MESH 12	R MESH 13	R MESH 14	R MESH 15
1	0.0	0.0	0.0	8.389685E-10	0.0	0.0	
2	0.0	0.0	0.0	1.673649E-12	0.0	0.0	
3	0.0	0.0	0.0	3.307669E-12	0.0	0.0	
4	0.0	0.0	0.0	1.571190E-11	0.0	0.0	
5	0.0	0.0	0.0	3.572460E-11	0.0	0.0	
6	8.144000E-11	1.509857E-12	2.982126E-12	4.777974E-11	3.721644E-11	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

REACTION RATE ENERGY GR. 6

	R MESH 1	R MESH 2	R MESH 3	R MESH 4	R MESH 5	R MESH 6	R MESH 7	R MESH 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.987481E-09
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	R MESH 9	R MESH 10	R MESH 11	R MESH 12	R MESH 13	R MESH 14	R MESH 15
1	0.0	0.0	0.0	0.0	2.402655E-09	0.0	0.0
2	0.0	0.0	0.0	0.0	4.803408E-12	0.0	0.0
3	0.0	0.0	0.0	0.0	9.496945E-12	0.0	0.0
4	0.0	0.0	0.0	0.0	4.520997E-11	0.0	0.0
5	0.0	0.0	0.0	0.0	1.040550E-10	0.0	0.0
6	2.365127E-10	4.379938E-12	8.643992E-12	1.390869E-10	1.265673E-10	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

REACTION RATE ENERGY GR. 7

	R MESH 1	R MESH 2	R MESH 3	R MESH 4	R MESH 5	R MESH 6	R MESH 7	R MESH 8
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.104099E-10
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	R MESH 9	R MESH 10	R MESH 11	R MESH 12	R MESH 13	R MESH 14	R MESH 15
1	0.0	0.0	0.0	9.049841E-11	0.0	0.0	
2	0.0	0.0	0.0	1.757949E-13	0.0	0.0	
3	0.0	0.0	0.0	3.474743E-13	0.0	0.0	
4	0.0	0.0	0.0	1.652612E-12	0.0	0.0	
5	0.0	0.0	0.0	3.810169E-12	0.0	0.0	
6	8.502493E-12	1.568133E-13	3.081942E-13	4.952307E-12	6.604489E-12	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*** SUM OF REACTION RATE = 8.65b16E-09 ***

全反応率

```
**********************************************************************************************

                    SENSITIVITY ANALYSIS FOR MATERIAL NUMBER =    13

**********************************************************************************************

*** 1.  ANALYSIS OF PL EFFECT  ***
        ( PL-ORDER N MEANS THE EFFECT FOR CALCULATING BY THE P-(N-1) CROSS SECTION SETS )

**   PL-EFFECT FOR EACH GROUP   **

PL-ORDER  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
       1  1.92747E-04 -6.14554E-04 -1.49551E-04 -4.03307E-04 -6.80088E-04 -3.51565E-04  4.82155E-05
       2  6.03820E-06  6.92434E-05  7.65484E-06 -8.94944E-06 -5.74466E-08  7.39600E-09 -1.48640E-09

**   PL-EFFECT FOR EACH COARSE MESH   **

PL-ORDER   ( 2, 1)       ( 6, 1)       (10, 1)       (14, 1)       ( 2, 2)       ( 6, 2)       ( 7, 2)       ( 8, 2)
       1 -3.25354E-04 -9.11901E-04  6.43196E-04 -9.40666E-04 -4.87726E-07 -3.18002E-06 -1.19908E-04  9.67026E-04
       2  3.52991E-05  9.42171E-05 -3.15885E-04 -1.52178E-05  6.73036E-08  8.58113E-07  2.80895E-05  2.29434E-04

PL-ORDER   ( 9, 2)       (10, 2)       (14, 2)       ( 2, 3)       (14, 3)       ( 2, 4)       (14, 4)       ( 2, 5)
       1  1.34287E-04  3.18240E-06 -1.73579E-05 -9.44424E-07 -3.42669E-06 -3.95900E-06 -1.61842E-05 -4.47818E-06
       2 -2.51249E-05 -5.98186E-07 -2.46453E-08  1.32650E-07 -4.79067E-08  5.84096E-07 -2.14848E-07  7.04316E-07

PL-ORDER   (14, 5)       ( 2, 6)       ( 3, 6)       ( 4, 6)       ( 5, 6)       ( 6, 6)       ( 7, 6)       (14, 6)
       1 -3.59697E-05 -3.74480E-07 -1.58279E-06 -1.33046E-06 -2.64227E-07 -1.17107E-07 -4.00307E-05 -4.08857E-05
       2 -3.61953E-07  9.23174E-09  1.83164E-07  9.43323E-08  1.26201E-08  6.22065E-09  1.05220E-06  1.02506E-07

PL-ORDER   ( 2, 7)       ( 3, 7)       ( 4, 7)       ( 5, 7)       ( 6, 7)       ( 7, 7)       ( 8, 7)       ( 9, 7)
       1 -7.89842E-11 -2.21032E-10 -2.42878E-10 -5.85571E-11 -2.76118E-11 -3.03774E-07 -1.08710E-03 -7.53538E-05
       2  2.34977E-11  2.21087E-11  1.26793E-11  7.52177E-12  6.74794E-12  9.84685E-09 -1.56691E-05 -1.16982E-06

PL-ORDER   (10, 7)       (11, 7)       (12, 7)       (13, 7)       (14, 7)
       1 -1.36005E-06 -2.76657E-06 -4.27107E-05 -3.71408E-05 -6.41564E-06
       2 -2.05694E-08 -4.00445E-08 -5.14490E-07  6.33608E-08  1.02050E-07
```

物質番号１３に対する感度計算結果

P_2 効果

TWOTRAN-Ⅱで計算したＩＳＣＴ次（P_2）の結果に対してP_0，P_1で計算したときの反応率の変化率（$\Delta R/R$）

```
*** 2.  SENSITIVITY MATRIX  ***
        ( FOR EACH COARSE MESH )

**   SCALAR + SCATTERING MATRIX (FOR EACH PL EFFECT)   **

 COARSE MESH =  (  3,  1)

 SCATTERING ORDER =   0

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
       1  0.0          0.0           0.0           0.0           0.0           0.0           0.0
      POSITION    2 THRU POSITION   1G SAME AS ABOVE

 SCATTERING ORDER =   1

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
       1  0.0          0.0           0.0           0.0           0.0           0.0           0.0
      POSITION    2 THRU POSITION   1G SAME AS ABOVE

 SCATTERING ORDER =   2

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
       1  0.0          0.0           0.0           0.0           0.0           0.0           0.0
      POSITION    2 THRU POSITION   1G SAME AS ABOVE

 COARSE MESH =  (  5,  1)

 SCATTERING ORDER =   0

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
       1  0.0          0.0           0.0           0.0           0.0           0.0           0.0
      POSITION    2 THRU POSITION   1G SAME AS ABOVE

 SCATTERING ORDER =   1

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
       1  0.0          0.0           0.0           0.0           0.0           0.0           0.0
      POSITION    2 THRU POSITION   1G SAME AS ABOVE

 SCATTERING ORDER =   2

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
       1  0.0          0.0           0.0           0.0           0.0           0.0           0.0
      POSITION    2 THRU POSITION   1G SAME AS ABOVE

 COARSE MESH =  (  6,  1)

 SCATTERING ORDER =   0

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
       1 -1.26051E-03 -1.85[illegible]E-04 -3.84503E-07  0.0           0.0          -1.12319E-07 -1.94714E-09
       2  0.0           0.0           0.0           0.0           0.0           0.0           0.0
```

4 $ ARRAY で指定した粗メッシュのみ出力
（ＩPMTY＝－１のときは全粗メッシュを出力）

粗メッシュ領域（Ｒメッシュ番号3，Ｚメッシュ番号１）での断面積テーブルの各成分に対する感度（その領域に注目する物質が含まれないときは全て0.0となる。）

```
      3 -1.19738E-02 -1.87466E-03 -3.29895E-03 -5.46212E-02 -1.00053E-01 -3.33813E-02 -5.73613E-05
      4  4.93477E-03  1.12372E-03  2.47391E-03  4.83234E-02  9.73962E-02  3.34541E-02  5.62571E-05
      5  0.0          4.93744E-03  5.72709E-04  9.40571E-04  5.26481E-03  2.39982E-03  1.06049E-05
      6  0.0          0.0          7.47859E-04  1.55924E-04  4.64431E-06  0.0          0.0
      7  0.0          0.0          0.0          1.76539E-03  6.35712E-06  4.75274E-06  0.0
      8  0.0          0.0          0.0          0.0          8.50499E-05  1.25561E-09  6.75492E-11
      9  0.0          0.0          0.0          0.0          0.0          1.78435E-08  0.0
     10  0.0          0.0          0.0          0.0          0.0          0.0          0.0

 SCATTERING ORDER =  1

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION     3 SAME AS ABOVE
      4 -9.09604E-04 -4.59264E-05 -2.32156E-03  1.31508E-04 -1.98105E-05  5.53066E-06  6.49589E-08
      5  0.0          -1.47934E-04  1.96524E-06  1.10118E-05 -1.39024E-05  2.20346E-06 -1.02426E-08
      6  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     7 THRU POSITION    10 SAME AS ABOVE


 SCATTERING ORDER =  2

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION     3 SAME AS ABOVE
      4  8.41132E-05  3.29576E-06  1.89799E-06  6.48479E-08  5.15158E-08 -6.73262E-09 -7.94291E-11
      5  0.0          6.31403E-06  7.45767E-08  3.79253E-07  3.91237E-08 -1.04777E-08  4.41979E-11
      6  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION     7 THRU POSITION    10 SAME AS ABOVE


 COARSE MESH =  ( 13,  1)

 SCATTERING ORDER =  0

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION    10 SAME AS ABOVE


 SCATTERING ORDER =  1

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION    10 SAME AS ABOVE


 SCATTERING ORDER =  2

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION    10 SAME AS ABOVE


 COARSE MESH =  ( 14,  1)

 SCATTERING ORDER =  0

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1 -5.03131E-05 -2.54184E-04 -6.83606E-07  0.0           0.0          -4.25034E-06 -4.36644E-06
      2  0.0           0.0           0.0           0.0           0.0           0.0           0.0
      3 -4.77935E-04 -2.52296E-03 -5.46509E-03 -5.83976E-02 -5.99265E-01 -1.27077E+00 -1.28632E-01
      4  2.56818E-04  1.53216E-03  4.57895E-03  5.39122E-02  5.86098E-01  1.27199E+00  1.28278E-01
      5  0.0          2.94059E-04  1.10876E-03  1.8708RE-03  6.73259E-03  2.09839E-02  3.31205E-03
      6  0.0          0.0          5.28637E-05  3.24518E-04  1.06041E-05  0.0          0.0
      7  0.0          0.0          0.0          1.35769E-04  1.51770E-05  1.57275E-07  0.0
      8  0.0          0.0          0.0          0.0          7.41930E-06  4.35256E-09  1.85105E-09
      9  0.0          0.0          0.0          0.0          0.0          2.26388E-09  0.0
     10  0.0          0.0          0.0          0.0          0.0          0.0          0.0

 SCATTERING ORDER =  1

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION     3 SAME AS ABOVE
      4 -8.55944E-05 -2.35908E-04 -8.42189E-05 -1.89999E-04 -3.12551E-04 -1.44128E-04  1.97088E-05
      5  0.0          -1.23234E-05  8.76713E-06  3.20386E-05  2.25836E-05  5.43826E-05  1.79666E-06
      6  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     7 THRU POSITION    10 SAME AS ABOVE


 SCATTERING ORDER =  2

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION     3 SAME AS ABOVE
      4 -6.81332E-07 -7.58903E-06 -4.68710E-06 -9.01532E-07 -1.67663E-07  4.45346E-08  1.33433E-10
      5  0.0          -3.20588E-07 -4.13375E-07 -6.02670E-07  8.48096E-08  1.65763E-08 -6.07375E-10
      6  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     7 THRU POSITION    10 SAME AS ABOVE


 COARSE MESH =  ( 15,  1)

 SCATTERING ORDER =  0

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION    10 SAME AS ABOVE


 SCATTERING ORDER =  1

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION    10 SAME AS ABOVE


 SCATTERING ORDER =  2

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION    10 SAME AS ABOVE


 COARSE MESH =  (  8,  6)

 SCATTERING ORDER =  0

POSITION  GROUP  1      GROUP  2      GROUP  3      GROUP  4      GROUP  5      GROUP  6      GROUP  7
      1  0.0           0.0           0.0           0.0           0.0           0.0           0.0
     POSITION     2 THRU POSITION    10 SAME AS ABOVE


 SCATTERING ORDER =  1
```

```
POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION   10 SAME AS ABOVE

 SCATTERING ORDER =  2

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION   10 SAME AS ABOVE

 COARSE MESH =  ( 9,  6)

 SCATTERING ORDER =  0

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION   10 SAME AS ABOVE

 SCATTERING ORDER =  1

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION   10 SAME AS ABOVE

 SCATTERING ORDER =  2

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION   10 SAME AS ABOVE

 COARSE MESH =  ( 8,  7)

 SCATTERING ORDER =  0

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1 -5.69323E-05 -2.65974E-04 -7.84401E-07  0.0          0.0         -4.92683E-06 -5.05222E-06
     2  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     3 -5.40412E-04 -2.63406E-03 -8.59630E-03 -6.62948E-02 -6.94594E-01 -1.47303E+00 -1.48835E-01
     4  2.89913E-04  2.05726E-03  5.14937E-03  6.12096E-02  6.79430E-01  1.47461E+00  1.48433E-01
     5  0.0          3.31143E-04  1.24524E-03  2.10655E-03  7.66059E-03  2.44294E-02  3.85875E-03
     6  0.0          0.0          5.96632E-05  3.64902E-04  1.19983E-05  0.0          0.0
     7  0.0          0.0          0.0          1.53420E-04  1.71472E-05  1.78741E-07  0.0
     8  0.0          0.0          0.0          0.0          8.42428E-06  4.94085E-09  2.11719E-09
     9  0.0          0.0          0.0          0.0          0.0          2.58325E-09  0.0
    10  0.0          0.0          0.0          0.0          0.0          0.0          0.0

 SCATTERING ORDER =  1

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION    3 SAME AS ABOVE
     4 -9.65741E-05 -2.44205E-04 -9.47829E-05 -2.17620E-04 -3.69823E-04 -1.76711E-04  2.23507E-05
     5  0.0         -1.34787E-03  9.82436E-06  3.61918E-03  2.60503E-05  6.49442E-05  2.22542E-06
     6  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    7 THRU POSITION   10 SAME AS ABOVE

 SCATTERING ORDER =  2

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION    3 SAME AS ABOVE
     4 -4.65946E-07 -7.77449E-06 -4.98005E-06 -9.81052E-07 -1.82644E-07  5.27119E-08  7.07681E-11
     5  0.0         -3.34178E-05 -4.43023E-07 -6.41525E-07  9.23763E-08  1.43395E-08 -7.87489E-10
     6  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    7 THRU POSITION   10 SAME AS ABOVE

 COARSE MESH =  ( 9,  7)

 SCATTERING ORDER =  0

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1 -3.57965E-06 -1.96257E-05 -5.16287E-06  0.0          0.0         -3.59716E-07 -3.65804E-07
     2  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     3 -3.40039E-05 -1.44443E-04 -4.42956E-04 -4.58633E-03 -5.08062E-02 -1.07548E-01 -1.07763E-02
     4  1.82559E-05  1.37584E-04  3.48106E-04  4.23536E-03  4.98625E-02  1.07655E-01  1.07469E-02
     5  0.0          2.04478E-05  8.30412E-05  1.41126E-04  5.28745E-04  1.77674E-03  2.80132E-04
     6  0.0          0.0          3.74500E-06  2.42551E-05  7.99691E-07  0.0          0.0
     7  0.0          0.0          0.0          9.59801E-06  1.13407E-06  1.16438E-08  0.0
     8  0.0          0.0          0.0          0.0          5.24378E-07  3.24745E-10  1.39277E-10
     9  0.0          0.0          0.0          0.0          0.0          1.59739E-10  0.0
    10  0.0          0.0          0.0          0.0          0.0          0.0          0.0

 SCATTERING ORDER =  1

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION    3 SAME AS ABOVE
     4 -6.08450E-06 -1.74134E-05 -6.43919E-06 -1.50923E-05 -2.66631E-05 -1.24491E-05  1.63215E-06
     5  0.0         -8.74438E-05  6.60550E-07  2.43102E-06  1.76556E-06  4.64155E-06  1.57117E-07
     6  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    7 THRU POSITION   10 SAME AS ABOVE

 SCATTERING ORDER =  2

POSITION  GROUP 1      GROUP 2      GROUP 3      GROUP 4      GROUP 5      GROUP 6      GROUP 7
     1  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    2 THRU POSITION    3 SAME AS ABOVE
     4 -4.09012E-08 -5.75190E-07 -3.74971E-07 -7.43560E-08 -1.54455E-08  4.26815E-09  1.30986E-10
     5  0.0         -2.21734E-06 -3.18752E-08 -4.82539E-08  7.14763E-09  1.68728E-09 -9.08679E-11
     6  0.0          0.0          0.0          0.0          0.0          0.0          0.0
     POSITION    7 THRU POSITION   10 SAME AS ABOVE
```

== SCALAR + SCATTERING MATRIX (SUM OF PL EFFECT) ==

COARSE MESH = (3, 1)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POSITION	2 THRU POSITION	10 SAME AS ABOVE					

COARSE MESH = (5, 1)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POSITION	2 THRU POSITION	10 SAME AS ABOVE					

COARSE MESH = (6, 1)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	-1.26051E-03	-1.86869E-04	-3.84509E-07	0.0	0.0	-1.12319E-07	-1.94714E-09
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	-1.19738E-02	-1.87468E-03	-3.29895E-03	-5.46212E-02	-1.00053E-01	-3.35813E-02	-5.73613E-05
4	4.10928E-03	1.08059E-03	2.45259E-03	4.84550E-02	9.73765E-02	3.34597E-02	5.63219E-05
5	0.0	4.79622E-03	5.74740E-04	9.51962E-04	5.25095E-03	2.40201E-03	1.05967E-05
6	0.0	0.0	7.47454E-04	1.55924E-04	4.64431E-06	0.0	0.0
7	0.0	0.0	0.0	1.78539E-03	6.35712E-06	4.75274E-08	0.0
8	0.0	0.0	0.0	0.0	8.50499E-05	1.25561E-09	6.75492E-11
9	0.0	0.0	0.0	0.0	0.0	1.78435E-08	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0

COARSE MESH = (13, 1)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POSITION	2 THRU POSITION	10 SAME AS ABOVE					

COARSE MESH = (14, 1)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	-5.03131E-05	-2.54184E-04	-8.83606E-07	0.0	0.0	-4.25034E-06	-4.36644E-06
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	-4.77935E-04	-2.52296E-03	-3.86509E-03	-5.83976E-02	-5.99265E-01	-1.27077E+00	-1.28632E-01
4	1.70542E-04	1.58466E-03	4.49004E-03	5.37213E-02	5.85785E-01	1.27185E+00	1.28297E-01
5	0.0	2.81415E-04	1.11712E-03	1.90232E-03	6.75526E-03	2.10383E-02	3.31385E-03
6	0.0	0.0	5.28637E-05	3.24518E-04	1.06041E-05	0.0	0.0
7	0.0	0.0	0.0	1.35769E-04	1.51770E-05	1.57275E-07	0.0
8	0.0	0.0	0.0	0.0	7.41930E-06	4.35256E-09	1.85105E-09
9	0.0	0.0	0.0	0.0	0.0	2.26388E-09	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0

COARSE MESH = (15, 1)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POSITION	2 THRU POSITION	10 SAME AS ABOVE					

COARSE MESH = (8, 6)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POSITION	2 THRU POSITION	10 SAME AS ABOVE					

COARSE MESH = (9, 6)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POSITION	2 THRU POSITION	10 SAME AS ABOVE					

COARSE MESH = (8, 7)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	-5.69323E-05	-2.85924E-04	-7.68901E-07	0.0	0.0	-4.92683E-06	-5.05222E-06
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	-5.40812E-04	-2.83800E-03	-6.59690E-03	-6.62948E-02	-6.94594E-01	-1.47303E+00	-1.48835E-01
4	1.92851E-04	1.78528E-03	5.04960E-03	6.09916E-02	6.79060E-01	1.47443E+00	1.48955E-01
5	0.0	3.17607E-04	1.25457E-03	2.14210E-03	7.70673E-03	2.44944E-02	3.86098E-03
6	0.0	0.0	5.96632E-05	3.64902E-04	1.19963E-05	0.0	0.0
7	0.0	0.0	0.0	1.53420E-04	1.71472E-05	1.78741E-07	0.0
8	0.0	0.0	0.0	0.0	8.42428E-06	4.94085E-09	2.11719E-09
9	0.0	0.0	0.0	0.0	0.0	2.58325E-09	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0

COARSE MESH = (9, 7)

POSITION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7
1	-3.57965E-06	-1.90257E-05	-5.16287E-08	0.0	0.0	-3.59716E-07	-3.65804E-07
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	-3.40039E-05	-1.88843E-04	-4.42956E-04	-4.58633E-03	-5.08062E-02	-1.07548E-01	-1.07763E-02
4	1.21305E-05	1.19095E-04	3.39311E-04	4.22019E-03	4.96659E-02	1.07643E-01	1.07485E-02
5	0.0	1.99913E-05	8.36699E-05	1.43509E-04	5.30538E-04	1.78138E-03	2.80289E-04
6	0.0	0.0	3.74500E-06	2.42551E-05	7.99691E-07	0.0	0.0
7	0.0	0.0	0.0	9.59801E-06	1.13407E-06	1.18438E-08	0.0
8	0.0	0.0	0.0	0.0	5.24378E-07	3.24745E-10	1.39277E-10
9	0.0	0.0	0.0	0.0	0.0	1.59739E-10	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0

注目している物質が含まれる全ての粗メッシュ領域の感度が出力される。

*** 3. SENSITIVITY COEFFICIENTS ***
(FOR EACH COARSE MESH AND SUM OF ENERGY GROUP AND VOLUME)

-- NOT CONSIDER THE EFFECT OF DETECTOR CROSS SECTION CHANGE --

GROUP	(2, 1)	(6, 1)	(10, 1)	(14, 1)	(2, 2)	(6, 2)	(7, 2)	(8, 2)
1	9,19827E-05	-4,50013E-04	-5,41809E-03	1,70077E-04	1,08969E-07	6,62804E-07	-6,11423E-05	-8,49696E-03
2	1,43216E-05	-5,70403E-05	-5,24251E-04	5,22521E-04	2,25966E-08	1,09147E-07	-4,48604E-06	-5,69760E-04
3	4,34582E-05	1,10293E-04	-1,37116E-03	5,38031E-04	6,43941E-08	4,70500E-07	1,65905E-05	2,42293E-05
4	3,58877E-04	-9,15264E-04	-8,10314E-04	2,07889E-03	6,82940E-07	1,93973E-07	-3,08396E-05	-7,33767E-04
5	9,60687E-05	-2,74839E-04	-9,28055E-04	7,55917E-03	1,64301E-07	1,42347E-07	-3,48382E-05	-1,28321E-03
6	2,20931E-06	-1,11031E-04	-9,89120E-05	4,39093E-03	4,16408E-09	-8,52651E-08	-8,27841E-06	-5,76767E-05
7	7,66832E-11	-1,03935E-06	-3,93674E-07	-3,34803E-04	2,07061E-13	-2,60595E-09	-7,36259E-08	-1,40917E-08
SUM OF ENERGY								
1	6,06918E-04	-1,69493E-03	-7,79373E-03	1,49248E-02	1,04738E-06	1,49090E-06	-1,23068E-04	-1,11172E-02

GROUP	(9, 2)	(10, 2)	(14, 2)	(2, 3)	(14, 3)	(2, 4)	(14, 4)	(2, 5)
1	-7,68914E-04	-1,62090E-03	3,04674E-07	2,09580E-07	6,02349E-07	8,24996E-07	2,80799E-04	7,86399E-07
2	-6,67419E-05	-1,38788E-04	9,51120E-07	4,30266E-08	1,87626E-06	1,84993E-07	8,81110E-06	2,13974E-07
3	-5,70485E-06	-1,59598E-05	9,70716E-07	1,24030E-07	1,91379E-06	5,12706E-07	9,01710E-06	5,40660E-07
4	-1,46703E-04	-3,91175E-06	3,75664E-06	1,33067E-06	7,39453E-06	5,70505E-06	3,49574E-05	6,80444E-06
5	-1,59528E-04	-3,53681E-06	1,39521E-05	3,14388E-07	2,75375E-05	1,27117E-06	1,30641E-04	1,06387E-06
6	-1,99410E-05	-8,40289E-07	8,11613E-06	7,70371E-09	1,60357E-05	3,02898E-08	7,61896E-05	2,27075E-08
7	-3,10911E-08	-4,13323E-09	-6,13782E-07	3,62853E-13	-1,21020E-06	1,35742E-12	-5,74708E-06	1,03902E-12
SUM OF ENERGY								
1	-1,16756E-03	-2,60495E-05	2,74376E-05	2,02940E-06	5,41700E-05	8,52920E-06	2,56677E-04	9,43145E-06

GROUP	(14, 5)	(2, 6)	(3, 6)	(4, 6)	(5, 6)	(6, 6)	(7, 6)	(14, 6)
1	5,69221E-06	4,23921E-08	1,74526E-07	1,43900E-07	2,11062E-08	8,71450E-09	9,32636E-06	4,85820E-06
2	1,91623E-05	2,34194E-08	3,88689E-08	1,28035E-08	-1,59890E-09	-2,21180E-09	4,38799E-06	1,91267E-05
3	1,98343E-05	3,76667E-08	1,26829E-07	7,83169E-08	1,33233E-08	5,86729E-09	6,80281E-06	2,09869E-05
4	7,74401E-05	4,23273E-07	2,96688E-06	2,78062E-06	6,45049E-07	3,08668E-07	7,59464E-07	8,37455E-05
5	2,97983E-04	6,46576E-09	2,72169E-07	1,69570E-07	2,69025E-08	1,12464E-08	1,91268E-05	3,69080E-04
6	1,75320E-04	5,34098E-12	5,34211E-09	5,08887E-09	7,52463E-10	1,44702E-10	1,26773E-06	2,48317E-04
7	-1,34498E-05	3,79807E-16	5,55795E-13	1,12250E-12	1,07749E-13	3,24895E-15	3,55958E-10	-2,15002E-05
SUM OF ENERGY								
1	5,82181E-04	5,33222E-07	3,58459E-06	3,19030E-06	7,05135E-07	3,32429E-07	4,16715E-05	7,24614E-04

GROUP	(2, 7)	(3, 7)	(4, 7)	(5, 7)	(6, 7)	(7, 7)	(8, 7)	(9, 7)
1	1,65220E-11	8,47079E-11	1,30434E-10	3,75528E-11	1,73094E-11	5,80684E-08	1,91156E-04	1,19854E-05
2	2,51098E-12	1,91867E-12	-2,79630E-11	-2,17941E-11	-1,57051E-11	1,20406E-07	5,83909E-04	3,93114E-05
3	1,17337E-12	7,48385E-13	6,12740E-13	1,71315E-13	1,01679E-13	1,07677E-07	6,06988E-04	4,06759E-05
4	1,06721E-12	2,60321E-13	-1,78377E-13	-1,12640E-13	-8,96192E-14	4,65385E-08	2,40351E-03	1,64405E-04
5	3,48719E-18	3,36441E-16	2,71131E-18	1,33351E-18	8,42766E-19	9,54398E-08	8,96050E-03	6,41050E-04
6	9,80708E-27	6,25819E-28	3,34207E-28	1,39378E-28	1,86610E-29	2,54119E-08	5,26932E-03	3,75222E-04
7	7,05549E-42	5,02779E-50	8,04874E-51	7,45297E-51	1,89669E-50	7,19462E-11	-3,79685E-04	-2,78133E-05
SUM OF ENERGY								
1	2,12735E-11	8,76352E-11	1,02905E-10	1,58174E-11	1,61639E-12	4,53614E-07	1,76357E-02	1,24484E-03

GROUP	(10, 7)	(11, 7)	(12, 7)	(13, 7)	(14, 7)
1	2,17965E-07	4,33465E-07	6,51782E-06	4,28226E-06	2,53112E-07
2	7,14522E-07	1,41503E-06	2,20819E-05	1,71359E-05	1,12512E-06
3	7,36492E-07	1,45518E-06	2,28822E-05	1,87274E-05	1,52148E-06
4	2,96070E-06	5,83337E-06	9,16852E-05	7,55599E-05	5,35789E-06
5	1,15780E-05	2,29645E-05	3,66451E-04	3,40968E-04	2,68343E-05
6	6,77491E-06	1,35122E-05	2,15569E-04	2,28034E-04	6,79465E-05
7	-5,16011E-07	-1,04286E-06	-1,61093E-05	-1,97369E-05	5,89259E-06
SUM OF ENERGY					
1	2,24665E-05	4,45708E-05	7,09098E-04	6,64971E-04	1,08931E-04

GROUP	TOTAL 1
1	-1,47076E-02
2	3,39493E-05
3	1,46762E-03
4	2,77622E-03
5	1,62034E-02
6	1,07981E-02
7	-8,17893E-04

体系全体の物質の感度

** SUM OF ENERGY AND VOLUME = 1.57539E-02 **

-- SENSITIVITY COEFFICIENT PER LETHARGY -- *Sensitivity Profile*

GROUP	(2, 1)	(6, 1)	(10, 1)	(14, 1)	(2, 2)	(6, 2)	(7, 2)	(8, 2)
1	1,03125E-03	-5,04524E-03	-6,07439E-02	1,90678E-03	1,22168E-06	7,43091E-06	-6,85486E-04	-9,52621E-02
2	2,28360E-05	-9,09514E-05	-8,35923E-04	8,33165E-04	3,60305E-08	1,74037E-07	-7,15303E-06	-9,08489E-04
3	4,04108E-05	1,02559E-04	-1,27501E-03	5,00302E-04	5,98786E-08	4,37507E-07	1,54271E-05	2,25302E-05
4	1,64728E-04	-4,20116E-04	-3,71943E-04	9,54234E-04	3,13477E-07	8,90358E-08	-1,41557E-05	-3,36807E-04
5	2,33825E-05	-6,68939E-05	-2,25882E-04	1,83985E-03	3,99697E-08	3,46462E-08	-8,47536E-06	-3,12325E-04
6	4,10914E-07	-2,06510E-05	-1,83969E-05	8,16678E-04	7,78207E-10	-1,58586E-08	-1,53972E-06	-1,07278E-05
7	7,68692E-12	-1,04187E-07	-3,94633E-06	-3,35615E-05	2,07563E-14	-2,61227E-10	-7,38044E-09	-1,41259E-09

GROUP	(9, 2)	(10, 2)	(14, 2)	(2, 3)	(14, 3)	(2, 4)	(14, 4)	(2, 5)
1	-8,62054E-03	-1,81725E-02	3,41580E-06	2,34967E-06	6,75312E-06	9,24929E-06	3,14812E-05	8,81657E-06
2	-1,06421E-04	-2,21298E-04	1,51657E-06	6,86064E-08	2,99172E-06	2,94973E-07	1,40494E-05	3,41183E-07
3	-5,30480E-06	-1,48406E-05	9,02645E-07	1,15332E-07	1,77959E-06	4,76753E-07	8,38479E-06	5,02189E-07
4	-6,73381E-05	-1,79554E-06	1,72436E-06	6,10793E-07	3,39417E-06	2,61868E-06	1,60458E-05	3,12331E-06
5	-3,88279E-05	-8,60836E-07	3,39584E-06	7,65198E-08	6,70730E-06	3,09393E-07	3,17971E-05	2,58940E-07
6	-3,70887E-06	-1,56287E-07	1,50954E-06	1,43283E-09	2,98252E-06	5,63366E-09	1,41707E-05	4,22343E-09
7	-3,11665E-09	-4,14325E-10	-6,15270E-08	3,63733E-14	-1,21314E-07	1,36071E-13	-5,76101E-07	1,04154E-13

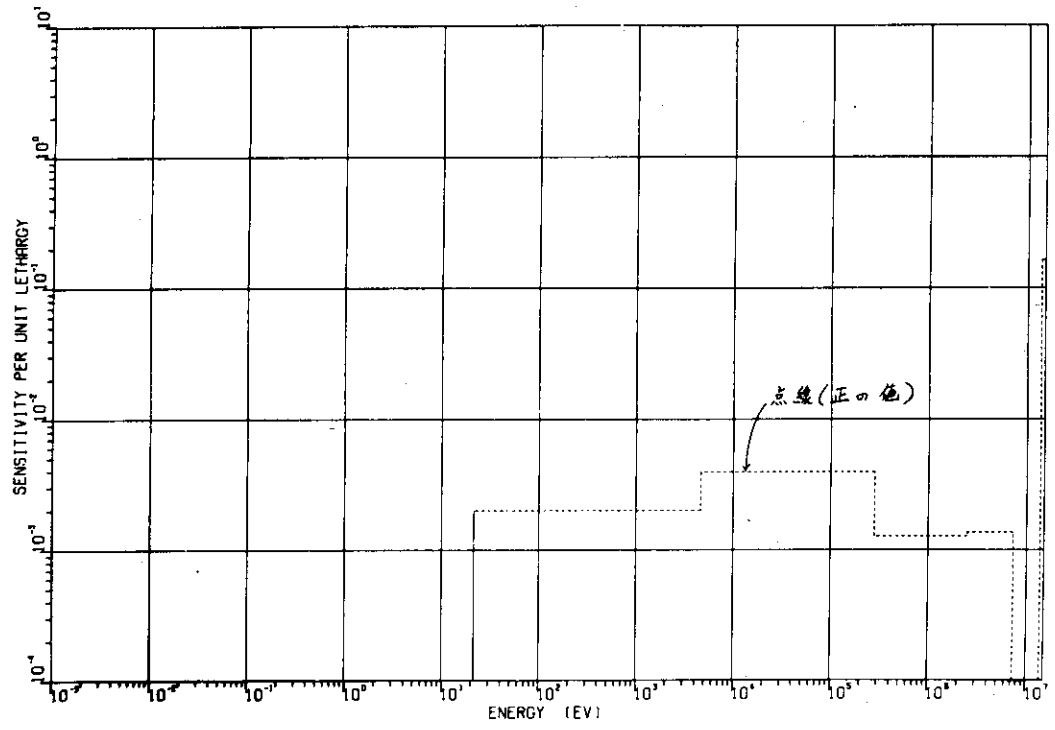
GROUP	(14, 5)	(2, 6)	(3, 6)	(4, 6)	(5, 6)	(6, 6)	(7, 6)	(14, 6)
1	6,60594E-05	4,75271E-07	1,95667E-06	1,61331E-06	2,36628E-07	9,77010E-08	1,04561E-04	5,44668E-05
2	3,05544E-05	3,73425E-06	6,19766E-06	2,04153E-06	-2,54946E-09	-3,52674E-09	6,99669E-06	3,04977E-05
3	1,84434E-05	3,50254E-06	1,17935E-07	7,28250E-08	1,23690E-08	5,45585E-09	6,32577E-06	1,95152E-05
4	3,55458E-05	1,94287E-07	1,36183E-06	1,27634E-06	2,96084E-07	1,41682E-07	3,48602E-07	3,84400E-05
5	7,25269E-05	1,57372E-09	6,62393E-08	4,12721E-08	6,45054E-09	2,73730E-09	4,65534E-06	8,98315E-05
6	3,26081E-05	9,93380E-13	9,93591E-10	9,46491E-10	1,34956E-10	2,69134E-11	2,35787E-07	4,61850E-05
7	-1,34824E-06	3,80728E-19	5,57143E-14	1,12522E-13	1,08010E-14	3,25683E-16	3,56821E-11	-2,15523E-06

GROUP	(2, 7)	(3, 7)	(4, 7)	(5, 7)	(6, 7)	(7, 7)	(8, 7)	(9, 7)
1	1,85233E-10	9,49687E-10	1,46233E-09	4,21017E-10	1,94062E-10	6,51024E-07	2,14311E-03	1,34372E-04
2	4,00379E-12	3,05934E-12	-4,45872E-11	-3,47509E-11	-2,50419E-11	1,91989E-07	9,31049E-04	6,26824E-05
3	1,09109E-12	6,95905E-13	5,69773E-13	1,59301E-13	9,45488E-14	1,00126E-07	5,64424E-04	3,78235E-05
4	4,89859E-13	1,19490E-13	-8,18771E-14	-5,17028E-14	-4,11361E-14	2,13617E-08	1,10324E-03	7,56634E-05
5	8,48759E-19	8,18476E-19	6,59914E-19	3,24568E-19	2,05123E-19	7,32294E-08	2,18092E-03	1,56027E-04
6	1,82404E-27	1,16397E-28	6,21598E-29	2,59233E-29	3,47080E-30	4,72641E-09	9,80052E-04	6,97884E-05
7	7,07260E-43	5,03998E-51	8,08826E-52	7,47104E-52	1,90129E-51	7,21207E-12	-3,80606E-05	-2,78807E-06

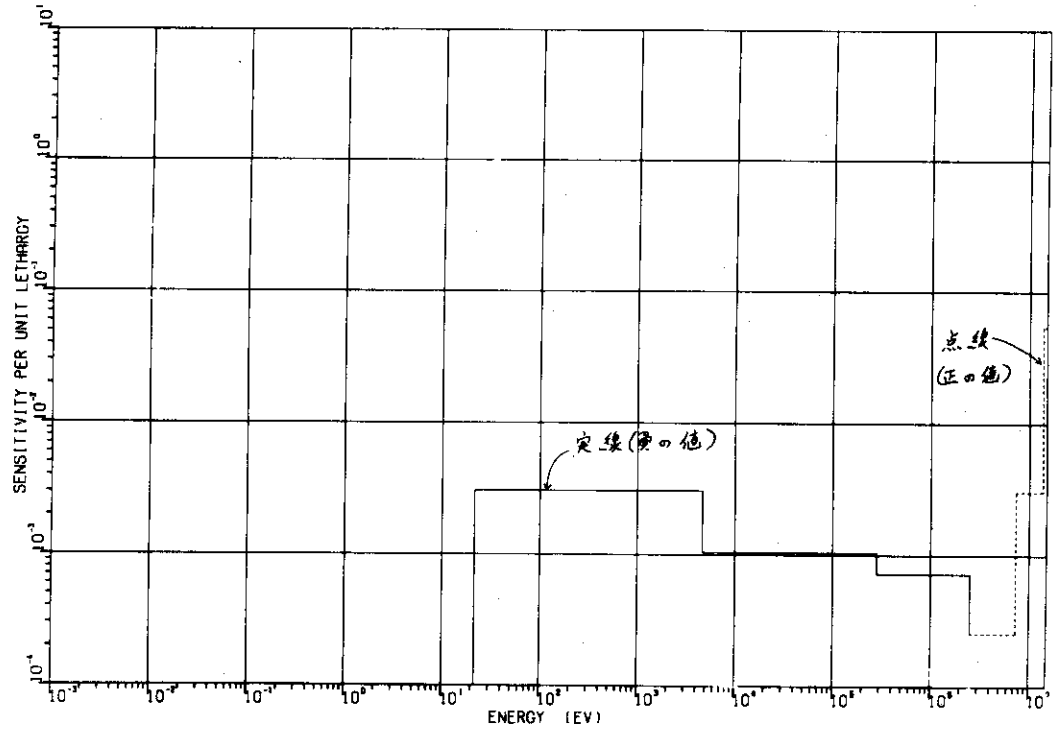
GROUP	(10, 7)	(11, 7)	(12, 7)	(13, 7)	(14, 7)
1	2,44368E-06	4,85971E-06	7,30733E-05	4,80098E-05	2,83772E-06
2	1,13931E-06	2,25628E-06	3,52098E-05	2,73233E-05	1,79402E-06
3	6,84846E-07	1,35314E-06	2,12777E-05	1,74142E-05	1,41479E-06
4	1,35899E-06	2,67758E-06	4,20845E-05	3,46828E-05	2,45933E-06
5	2,81799E-06	5,58940E-06	8,91916E-05	8,29894E-05	6,53129E-06
6	1,26008E-06	2,51315E-06	4,00979E-05	4,24126E-05	1,26375E-05
7	-5,17262E-08	-1,04538E-07	-1,61454E-06	-1,97848E-06	5,90688E-07

以下同様に物質４３の感度が出力されるが，ここでは省略する。

SENSITIVITY ANALYSIS TEST (P2)
MATNO=13 ZONE=TOTAL TYPE=SUM IN VOLUME



SENSITIVITY ANALYSIS TEST (P2)
MATNO=43 ZONE=(8,6) TYPE=FOR EACH COARSE



付録2　プログラムソースリスト

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE   1

ISN   ST-NO                SOURCE PROGRAM                                                    SEQUENCE
  1         SUBROUTINE ACONV(F,W,P1,P2,P3,P4,MI,IR,MJ,JR,NM,MM,ISCT)                       ACC00010
                                                    -- 1.4.2.1 --                          ACC00020
C                                                                                          ACC00030
C     AJOINT FLUX MOMENTS ARE RE-CALCULATED TO INVERSE THE ANGULAR ORDER,                  ACC00040
C           F    AJOINT FLUX MOMENT                                                        ACC00050
C           *    *EIGHT                                                                    ACC00060
C           P1   ORTHOGONAL POLYNOMIALS  (-ETA,-NU)                                        ACC00070
C           P2   ORTHOGONAL POLYNOMIALS  (-ETA,+NU)                                        ACC00080
C           P3   ORTHOGONAL POLYNOMIALS  (+ETA,-NU)                                        ACC00090
C           P4   ORTHOGONAL POLYNOMIALS  (+ETA,+NU)                                        ACC00100
C                                                                                          ACC00110
  2         DIMENSION F(NM,MI,MJ),W(MM),P1(NM,MM),P2(NM,MM),P3(NM,MM),                     ACC00120
     *            P4(NM,MM)                                                               ACC00130
  3         DIMENSION T1(50),T2(50),T3(50)                                                 ACC00140
C                                                                                          ACC00150
  4         DO 300 J=1,JR                                                                  ACC00160
  5         DO 300 I=1,IR                                                                  ACC00170
  6         DO 100 N=1,NM                                                                  ACC00180
  7         T1(N)=F(N,I,J)                                                                 ACC00190
  8     100 T3(N)=0.0                                                                      ACC00200
  9         CALL EXPAND(P1,P4,T1,T2,T3,W,NM,MM,ISCT+1)                                     ACC00210
 10         CALL EXPAND(P2,P3,T1,T2,T3,W,NM,MM,ISCT+1)                                     ACC00220
 11         CALL EXPAND(P3,P2,T1,T2,T3,W,NM,MM,ISCT+1)                                     ACC00230
 12         CALL EXPAND(P4,P1,T1,T2,T3,W,NM,MM,ISCT+1)                                     ACC00240
 13         DO 200 N=1,NM                                                                  ACC00250
 14     200 F(N,I,J)=T3(N)                                                                 ACC00260
 15     300 CONTINUE                                                                       ACC00270
 16         RETURN                                                                         ACC00280
 17         END
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE   2

ISN   ST-NO                SOURCE PROGRAM                                                    SEQUENCE
  1         SUBROUTINE  CHECK                                                              CHE00010
C*****************************************************************************           *CHE00020
C     CHECK                        -- 1.1.2 --                                           CHE00030
C                                                                                         *CHE00040
C                                                                                         *CHE00050
C       1. SUBROUTINE                                                                     *CHE00060
C            (1) CHECK OPTION DATAS                                                       *CHE00070
C            (2) CHECK MATERIAL NUMBER OF MICRO CROSS SECTION SETS                        *CHE00080
C            (3) CHECK ENERGY STRUCTURE                                                   *CHE00090
C                                                                                         *CHE00100
C       2. INPUT                                                                          *CHE00110
C            (1) OPTIONS                                                                  *CHE00120
C            (2) MCS          MATERIAL NUMBERS                                            *CHE00130
C            (3) ENERGY       ENERGY STRUCTURE                                            *CHE00140
C                                                                                         *CHE00150
C       3. OUTPUT                                                                         *CHE00160
C            (1) KER          RETURN CODE                                                 *CHE00170
C                                                                                         *CHE00180
C       4. CALLED BY      ( INPUT1 )                                                      *CHE00190
C       5. CALLS          ( ERROR  )                                                     *CHE00200
C*****************************************************************************           CHE00210
     1     ( NE, IGM, MART, IRESP, ITAPE, IPCRS, IPPL, IPMTX, IPMTV,                     CHE00220
     2       IPLOT, IPLTZ, MCS, ENERGY, IGM1, KER )                                      CHE00230
  2       DIMENSION  MCS(NE), ENERGY(IGM1)                                              CHE00240
  3       COMMON /PCOND / ICOND, NWAR, NERR                                             CHE00250
C                                                                                       CHE00260
  4       KER = 0                                                                       CHE00270
C                                                                                       CHE00280
C******** CHECK OPTIONS                                                                 CHE00290
C                                                                                       CHE00300
  5       IF( NE   .LE.0 .OR. NE   .GT.20 )                                             CHE00310
     *CALL ERROR(1,10,'CHECK- 1 ** NE ) 0 OR NE ) 20          ')                         CHE00320
  6       IF( IGM  .LE.0 )   CALL ERROR(2, 5,'CHECK- 2 ** IGM ) 1 ')                   CHE00330
  7       IF( MART .LE.0 )   CALL ERROR(1, 5,'CHECK- 3 ** MART ) 1')                   CHE00340
  8       IF( IRESP.LT.0 .OR. IRESP.GT.2 )                                              CHE00350
     *CALL ERROR(1,10,'CHECK- 4 ** NOT IRESP  0/1/2 (0 SET)    ')                       CHE00360
  9       IF( IRESP.LT.0 .OR. IRESP.GT.2 )  IRESP = 0                                   CHE00370
 10       IF( ITAPE.LT.0 .OR. ITAPE.GT.2 )                                              CHE00380
     *CALL ERROR(1,10,'CHECK- 5 ** NOT ITAPE  0/1/2 (0 SET)    ')                       CHE00390
 11       IF( ITAPE.LT.0 .OR. ITAPE.GT.2 )  ITAPE = 0                                   CHE00400
 12       IF( IPCRS.LT.0 .AND. IPCRS.GT.1 )                                             CHE00410
     *CALL ERROR(1,10,'CHECK- 6 ** NOT IPCRS  0/1  (0 SET)     ')                       CHE00420
 13       IF( IPCRS.LT.0 .AND. IPCRS.GT.1 ) IPCRS = 0                                   CHE00430
 14       IF( IPPL .LT.0 .AND. IPPL .GT.1 )                                             CHE00440
     *CALL ERROR(1,10,'CHECK- 7 ** NOT IPPL  0/1  (0 SET)      ')                       CHE00450
 15       IF( IPPL .LT.0 .AND. IPPL .GT.1 ) IPPL = 0                                    CHE00460
 16       IF( IPMTX.LT.0 .OR. IPMTX.GT.3 )                                              CHE00470
     *CALL ERROR(1,10,'CHECK- 8 ** NOT IPMTX  0/1/2/3  (0 SET) ')                      CHE00480
 17       IF( IPMTX.LT.0 .OR. IPMTX.GT.3 )  IPMTX = 0                                   CHE00490
 18       IF( IPLOT.LT.0 .OR. IPLOT.GT.1 )                                              CHE00500
     *CALL ERROR(1,10,'CHECK- 9 ** NOT IPLOT  0/1  (0 SET)     ')                       CHE00510
 19       IF( IPLOT.LT.0 .OR. IPLOT.GT.1 )  IPLOT = 0                                   CHE00520
 20       IF( IPLTZ.LT.0 .OR. IPLTZ.GT.1 )                                              CHE00530
     *CALL ERROR(1,10,'CHECK-10 ** NOT IPLTZ  0/1  (0 SET)     ')                       CHE00540
 21       IF( IPLTZ.LT.0 .OR. IPLTZ.GT.1 )  IPLTZ = 0                                   CHE00550
 22       IF( IABS(IPMTV) .GT. 25 )     IPMTV = 25                                      CHE00560
C                                                                                       CHE00570
C******** CHECK MATERIAL NUMBER
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE   3

ISN   ST-NO                SOURCE PROGRAM     ( CHECK  )                          SEQUENCE

      C                                                                          CHE00580
 23         J = 0                                                               CHE00590
 24         DO 100 I= 1, NE                                                     CHE00600
 25         IF( MCS(I) .EQ. 0 )                          GO TO 200              CHE00610
 26         J = I                                                               CHE00620
 27       100 CONTINUE                                                          CHE00630
 28       200 CONTINUE                                                          CHE00640
 29         IF( NE .LT. 0 .AND. J .GT. 0 )     NE = J                          CHE00650
 30         IF( NE .GT. J )                    NE = J                          CHE00660
      C                                                                        CHE00670
      C******** CHECK ENERGY STRUCTURE                                         CHE00680
      C                                                                        CHE00690
 31         J = 0                                                             CHE00700
 32         DO 500 I= 1, IGM                                                  CHE00710
 33         IF( ENERGY(I) .LE. ENERGY(I+1) )      J = 1                       CHE00720
 34       500 CONTINUE                                                        CHE00730
 35         IF( J .EQ. 1 )      CALL ERROR(2, 7,'CHECK=12 ** ENERGY NO GOOD  ')CHE00740
 36         IF( ICOND .NE. 0 )             KER = ICOND                        CHE00750
 37         RETURN                                                            CHE00760
 38         END                                                               CHE00770
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE   4

ISN   ST-NO                SOURCE PROGRAM                                      SEQUENCE

  1         SUBROUTINE  CMPUTF( FLMT, VOL, FFLX, AFLX, IMX, IMY, IX, JY, WORK,CMP00010
     1      NM, ISCS, IGM, IM, JM, IMX, JMX, IWK2, KER )                       CMP00020
      C*************************************************************************CMP00030
      C     CMPUTF                                  -- 1.4.2 --                *CMP00040
      C                                                                        *CMP00050
      C       1. SUBROUTINE                                                    *CMP00060
      C            (1) CONTROUL FLUX*FLUX MATRIX CALCULATION                   *CMP00070
      C                                                                        *CMP00080
      C       2. INPUT                                                         *CMP00090
      C            (1) IMX(IM) = RADIAL FINE MESH INTERVALS IN COARSE MESH     *CMP00100
      C            (2) IMY(JM) = AXIAL  FINE MESH INTERVALS IN COARSE MESH     *CMP00110
      C            (3) ISCS    = ISCT + 1                                      *CMP00120
      C            (4) IGM     = ENERGY GROUPS                                 *CMP00130
      C            (5) IM      = RADIAL COARSE MESH                            *CMP00140
      C            (6) JM      = AXIAL  COARSE MESH                            *CMP00150
      C            (7) IMX     = MAX. OF RADIAL FINE MESH INTERVALS            *CMP00160
      C            (8) JMX     = MAX. OF AXIAL  FINE MESH INTERVALS            *CMP00170
      C            (9) IWK2    = MAX. OF WORK AREA                             *CMP00180
      C                                                                        *CMP00190
      C       3. OUTPUT                                                        *CMP00200
      C            (1) KER        RETURN CODE                                 *CMP00210
      C                                                                        *CMP00220
      C       4. WORK AREA                                                     *CMP00230
      C            (1) FLMT(ISCS,IGM,IGM)     = FLUX*FLUX MATRIX               *CMP00240
      C            (2) VOL(IMX,JMX)           = VOLUME                        *CMP00250
      C            (3) FFLX(ISCS,IMX,JMX,IGM) = FORWARD FLUX                  *CMP00260
      C            (4) AFLX(ISCS,IMX,JMX,IGM) = ADJOINT FLUX                  *CMP00270
      C            (5) WORK(IWK2)             = WORK AREA                     *CMP00280
      C                                                                        *CMP00290
      C       5. LOCAL VARIAVLES                                               *CMP00300
      C            (1) IX(IM) = ADDRESS OF RADIAL MESH                         *CMP00310
      C            (2) JY(JM) = ADDRESS OF AXIAL  MESH                         *CMP00320
      C            (3) IST    = TEMPORARY STORE OF RECORD NO. OF RESTART FILE  *CMP00330
      C                                                                        *CMP00340
      C       6. CALLED BY      (CMPUT1)                                       *CMP00350
      C                                                                        *CMP00360
      C       7. CALL           (SUMUP,AVCNV)                                  *CMP00370
      C                                                                        *CMP00380
      C*************************************************************************CMP00390
  2         COMMON /IONO  / MR,  MM,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,     CMP00400
     *                    MF4, MF5                                            CMP00410
  3         COMMON /CNTRL / IRR, IR1, IR2                                     CMP00420
  4         COMMON  IB(100), D(1)                                             CMP00430
  5         DIMENSION  LD(1)                                                  CMP00440
  6         DIMENSION  FLMT(ISCS,IGM,IGM), VOL(IMX,JMX), FFLX(NM,IMX,JMX,IGM  CMP00450
     1),     AFLX(NM,IMX,JMX,IGM), IMX(IM), IMY(JM), WORK(IWK2),             CMP00460
     2          IX(IM), JY(JM)                                                CMP00470
  7         EQUIVALENCE (IB(49),IT    ), (IB(50),JT    ), (IB(68),KVL   ),   CMP00480
     *              (IB(71),KFL   ), (IB(74),KFF   ), (IB(77),KFA   ),     CMP00490
     2              (IB(34),ISCT  ), (IB(61),MM    ), (IB(86),LW    ),     CMP00500
     3              (IB(87),LP1   ), (IB(88),LP2   ), (IB(89),LP3   ),     CMP00510
     4              (IB(90),LP4   )                                         CMP00520
  8         EQUIVALENCE (D(1),LD(1))                                          CMP00530
      C                                                                        CMP00540
      C******** CONTROUL FLUX*FLUX                                             CMP00550
      C                                                                        CMP00560
  9         KER = 0                                                           CMP00570
```

FACOM 230-75 M7 FORTRAN-IV H COMPILER (OPT2,CP) SOURCE PROGRAM LIST -780322-(V02,L12) DATE 79.06.22/09:32 PAGE 5

```
ISN  ST-NO                SOURCE PROGRAM     ( CMPUTF )                    SEQUENCE
                                                                           CMP00580
 10          IX(1) = 0                                                     CMP00590
 11          JY(1) = 0                                                     CMP00600
 12          DO 100 I= 1, IM-1                                             CMP00610
 13          IX(I+1) = IX(I) + IHX(I)                                      CMP00620
 14      100 CONTINUE                                                      CMP00630
 15          DO 200 J= 1, JM-1                                             CMP00640
 16          JY(J+1) = JY(J) + IHY(J)                                      CMP00650
 17      200 CONTINUE                                                      CMP00660
 18          IST = KFL                                                     CMP00670
     C                                                                     CMP00680
     C******** DO LOOP FOR COARSE MESH                                     CMP00690
     C                                                                     CMP00700
 19          ITJT = IT*JT                                                  CMP00710
 20          DO 5000 JJ = 1, JM                                            CMP00720
 21          DO 5000 II = 1, IM                                            CMP00730
     C                                                                     CMP00740
 22          IRR = KVL                                                     CMP00750
 23          IR1 = KFF                                                     CMP00760
 24          IR2 = KFA                                                     CMP00770
 25          FIND(MFR' IRR)                                                CMP00780
 26          FIND(MF1' IR1)                                                CMP00790
 27          FIND(MF2' IR2)                                                CMP00800
     C                                                                     CMP00810
     C---        SET VOLUME                                                CMP00820
 28          READ( MFR'IRR)   (WORK(I),I=1,ITJT)                           CMP00830
 29          DO 1000 J= 1, IHY(JJ)                                         CMP00840
 30          DO 1000 I= 1, IHX(II)                                         CMP00850
 31          IV = IX(II)+I + (JY(JJ)+J-1)*IT                               CMP00860
 32          VOL(I,J) = WORK(IV)                                           CMP00870
 33      1000 CONTINUE                                                     CMP00880
     C                                                                     CMP00890
     C---        SET FORWARD FLUX                                          CMP00900
 34          DO 1500 IG = 1, IGM                                           CMP00910
 35          DO 1500 IS = 1, NM                                            CMP00920
 36          READ( MF1'IR1)   (WORK(I),I=1,ITJT)                           CMP00930
 37          DO 1300 J= 1, IHY(JJ)                                         CMP00940
 38          DO 1300 I= 1, IHX(II)                                         CMP00950
 39          IV = IX(II)+I + (JY(JJ)+J-1)*IT                               CMP00960
 40          FFLX(IS,I,J,IG) = WORK(IV)                                    CMP00970
 41      1300 CONTINUE                                                     CMP00980
 42      1500 CONTINUE                                                     CMP00990
     C                                                                     CMP01000
     C---        SET ADJOINT FLUX                                          CMP01010
 43          DO 2500 IG = 1, IGM                                           CMP01020
 44          DO 2000 IS = 1, NM                                            CMP01030
 45          READ( MF2'IR2)   (WORK(I),I=1,ITJT)                           CMP01040
 46          IGG = IGM - IG + 1                                            CMP01050
 47          DO 1700 J= 1, IHY(JJ)                                         CMP01060
 48          DO 1700 I= 1, IHX(II)                                         CMP01070
 49          IV = IX(II)+I + (JY(JJ)+J-1)*IT                               CMP01080
 50          AFLX(IS,I,J,IGG) = WORK(IV)                                   CMP01090
 51      1700 CONTINUE                                                     CMP01100
 52      2000 CONTINUE                                                     CMP01110
 53          CALL ACONV( AFLX(1,1,1,1,IGG), D(LW), D(LP1), D(LP2), D(LP3), D(LP4)CMP01110
                    1       , IMX, IHX(II), JMX, IHY(JJ), NM, MM, ISCT )  CMP01120
                                                                           CMP01130
 54      2500 CONTINUE                                                     CMP01140
     C
```

FACOM 230-75 M7 FORTRAN-IV H COMPILER (OPT2,CP) SOURCE PROGRAM LIST -780322-(V02,L12) DATE 79.06.22/09:32 PAGE 6

```
ISN  ST-NO                SOURCE PROGRAM     ( CMPUTF )                    SEQUENCE
                                                                           CMP01150
     C******** SUM UP FLUX*FLUX                                            CMP01160
     C                                                                     CMP01170
 55          FIND( MFR'IST)                                                CMP01180
 56          DO 3000 JG = 1, IGM                                           CMP01190
 57          DO 3000 IG = 1, JG                                            CMP01200
 58          KG = JG - IG + 1                                              CMP01210
 59          CALL SUMUP( FLMT(1,IG,JG), VOL, FFLX(1,1,1,KG), AFLX(1,1,1,JG),CMP01220
                    1  NM, ISCS, 1, ISCS, IMX, 1, IHX(II), JMX, 1, IHY(JJ), KER )CMP01230
 60          DO 3000 K= 1, ISCS                                            CMP01240
 61          FLMT(K,IG,JG) =  FLOAT(2*K-1)*FLMT(K,IG,JG)                   CMP01250
 62      3000 CONTINUE                                                     CMP01260
 63          IRR = IST                                                     CMP01270
 64          WRITE(MFR'IRR) (((FLMT(K,I,J),K=1,ISCS),I=1,IGM),J=1,IGM)     CMP01280
 65          IST = IRR                                                     CMP01290
 66      5000 CONTINUE                                                     CMP01300
 67          RETURN                                                        CMP01310
 68          END
```

```
FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE   7

ISN  ST-NO              SOURCE PROGRAM                                                    SEQUENCE
  1        SUBROUTINE  CMPUTR( RATE, VOL, FLUX, SOUCE, IMX, IHY, IX, JY, WORK          CMP00010
     1    ,IM, JM, IMX, JMX, LWK, KER )                                                 CMP00020
      C*****************************************************************************CMP00030
      C     CMPUTR                                  -- 1,4,1 --                       *CMP00040
      C                                                                               *CMP00050
      C       1. SUBROUTINE                                                           *CMP00060
      C           (1) READ VOLUME  IN COARSE MESH FROM RESTART FILE (MFR)             *CMP00070
      C           (2) READ FLUX    IN COARSE MESH FROM SCRATCH DISK (MF1)             *CMP00080
      C           (3) READ SOURCE  IN COARSE MESH FROM SCRATCH DISK (MF2)             *CMP00090
      C           (4) SUM UP REACTION RATE                                            *CMP00100
      C           (5) WRITE  REACTION RATE                                            *CMP00110
      C                                                                               *CMP00120
      C       2. INPUT                                                                *CMP00130
      C           (1) IM      = RADIAL COARSE MESH                                    *CMP00140
      C           (2) JM      = AXIAL COARSE MESH                                     *CMP00150
      C           (3) IMX     = MAX. OF RADIAL FINE MESH INTERVALS                    *CMP00160
      C           (4) JMX     = MAX. OF AXIAL  FINE MESH INTERVALS                    *CMP00170
      C           (5) LWK     = MAX. OF WORK AREA                                     *CMP00180
      C           (6) IMX(IM)= RADIAL FINE MESH INTERVALS IN COARSE MESH              *CMP00190
      C           (7) IHY(JM)= AXIAL  FINE MESH INTERVALS IN COARSE MESH              *CMP00200
      C       3. OUTPUT                                                               *CMP00210
      C           (1) KER     = RETURN CODE                                           *CMP00220
      C                                                                               *CMP00230
      C       4. WORK AREA                                                            *CMP00240
      C           (1) RATE(IM,JM)     = REACTION RATE                                 *CMP00250
      C           (2) VOL (IMX,JMX)   = VOLUME                                        *CMP00260
      C           (3) FLUX(IMX,JMX)   = FORWARD FLUX                                  *CMP00270
      C           (4) SOUCE(IMX,JMX) = ADJOINT SOURCE                                 *CMP00280
      C           (5) WORK(LWK)       = WORK AREA                                     *CMP00290
      C                                                                               *CMP00300
      C       5. LOCAL VARIABLES                                                      *CMP00310
      C           (1) SUM     =  SUMMATION OF REACTION RATE                           *CMP00320
      C           (2) IX(IM)  =  ADDRESS OF RADIAL MESH                               *CMP00330
      C           (3) JY(JM)  =  ADDRESS OF AXIAL  MESH                               *CMP00340
      C                                                                               *CMP00350
      C       6. CALLED BY      (CMPUT1)                                              *CMP00360
      C                                                                               *CMP00370
      C       7. CALL           (SUMUP)                                               *CMP00380
      C                                                                               *CMP00390
      C*****************************************************************************CMP00400
  2        COMMON /IONO  / MR,  MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,              CMP00410
     *                    MF4, MF5                                                     CMP00420
  3        COMMON /CNTRL / IRR, IR1, IR2                                             CMP00430
  4        COMMON   IB(100), D(1)                                                    CMP00440
  5        DIMENSION  RATE(IM,JM), VOL(IMX,JMX), FLUX(IMX,JMX),                     CMP00450
     1            SOUCE(IMX,JMX), WORK(LWK), IMX(IM), IHY(JM),                      CMP00460
     2            IX(IM), JY(JM)                                                    CMP00470
  6        EQUIVALENCE (IB(19),LSUM  ), (IB(35),ISCS  ), (IB(36),IGM   ),          CMP00480
     1              (IB(49),IT    ), (IB(50),JT    ), (IB(68),KVL   ),            CMP00490
     2              (IB(70),KRT   ), (IB(71),KFL   ), (IB(74),KFF   ),            CMP00500
     3              (IB(75),NFF   ), (IB(79),K0S   ), (IB(80),N0S   ),            CMP00510
     4              (IB(84),N02   ), (IB(73),NRT   ), (IB(47),NM    )             CMP00520
      C                                                                             CMP00530
      C******** CONTROUL CALCULATION OF REACTION RATE                                CMP00540
      C                                                                             CMP00550
  7        SUM = 0.0                                                               CMP00560
  8        KER = 0                                                                 CMP00570

FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE   8

ISN  ST-NO              SOURCE PROGRAM     ( CMPUTR )                                 SEQUENCE
  9        IX(1) = 0                                                                 CMP00580
 10        JY(1) = 0                                                                 CMP00590
 11        DO 100 I= 1, IM-1                                                         CMP00600
 12        IX(I+1) = IX(I) + IMX(I)                                                  CMP00610
 13    100 CONTINUE                                                                  CMP00620
 14        DO 200 J= 1, JM-1                                                         CMP00630
 15        JY(J+1) = JY(J) + IHY(J)                                                  CMP00640
 16    200 CONTINUE                                                                  CMP00650
      C                                                                             CMP00660
      C******** DO LOOP FOR ENERGY AND COARSE MESH                                   CMP00670
      C                                                                             CMP00680
 17        ITJT = IT*JT                                                            CMP00690
 18        DO 5000 K= 1, IGM                                                       CMP00700
 19        DO 4000 JJ= 1, JM                                                       CMP00710
 20        DO 4000 II= 1, IM                                                       CMP00720
 21        IRR = KVL                                                               CMP00730
 22        IR1 = KFF                                                               CMP00740
 23        IR1 = IR1 + (K-1)*NFF*NM                                                CMP00750
 24        IR2 = K0S                                                               CMP00760
 25        IR2 = IR2 + (IGM-K)*N0S                                                 CMP00770
 26        FIND (MFR, IRR)                                                         CMP00780
 27        FIND (MF1, IR1)                                                         CMP00790
 28        FIND (MF2, IR2)                                                         CMP00800
      C---      SET VOLUME                                                        CMP00810
 29        READ( MFR,IRR)   (WORK(I),I=1,ITJT)                                     CMP00820
 30        DO 1000 J= 1, IHY(JJ)                                                   CMP00830
 31        DO 1000 I= 1, IMX(II)                                                   CMP00840
 32        IV = IX(II)+I + (JY(JJ)+J-1)*IT                                         CMP00850
 33        VOL(I,J) = WORK(IV)                                                     CMP00860
 34   1000 CONTINUE                                                                CMP00870
      C                                                                             CMP00880
      C---      SET FLUX                                                          CMP00890
 35        READ( MF1,IR1)   (WORK(I),I=1,ITJT)                                     CMP00900
 36        DO 1100 J= 1, IHY(JJ)                                                   CMP00910
 37        DO 1100 I= 1, IMX(II)                                                   CMP00920
 38        IV = IX(II)+I + (JY(JJ)+J-1)*IT                                         CMP00930
 39        FLUX(I,J) = WORK(IV)                                                    CMP00940
 40   1100 CONTINUE                                                                CMP00950
      C                                                                             CMP00960
      C---      SET RESPONCE FUNCTION                                             CMP00970
 41        READ( MF2,IR2)   (WORK(I),I=1,ITJT)                                     CMP00980
 42        DO 1200 J= 1,IHY(JJ)                                                    CMP00990
 43        DO 1200 I= 1,IMX(II)                                                    CMP01000
 44        IV = IX(II)+I + (JY(JJ)+J-1)*IT                                         CMP01010
 45        SOUCE(I,J) = WORK(IV)                                                   CMP01020
 46   1200 CONTINUE                                                                CMP01030
      C                                                                             CMP01040
      C******** SUM UP REACTION RATE                                                CMP01050
      C                                                                             CMP01060
 47        CALL SUMUP( RATE(II,JJ), VOL, SOUCE, FLUX, 1, 1, 1, 1,                  CMP01070
     1            IMX, 1, IMX(II), JMX, 1, IHY(JJ), KER )                         CMP01080
 48        SUM = SUM + RATE(II,JJ)                                                 CMP01090
 49   4000 CONTINUE                                                                CMP01100
 50        IRR = KRT + (K-1)*NRT                                                   CMP01110
 51        WRITE(MFR,IRR)  ((RATE(I,J),I=1,IM),J=1,JM)                             CMP01120
 52   5000 CONTINUE                                                                CMP01130
      C                                                                             CMP01140
```

```
     FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE   9

ISN   ST-NO                SOURCE PROGRAM     ( CMPUTR )                                  SEQUENCE

 53         D(LSUM)  = SUM                                                               CMP01150
 54         KFL = IRR                                                                    CMP01160
 55         RETURN                                                                       CMP01170
 56         END                                                                          CMP01180
```

```
     FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  10

ISN   ST-NO                SOURCE PROGRAM                                              SEQUENCE

  1         SUBROUTINE  CMPUT1 ( KER )                                                 CMP00010
     C*****************************************************************************CMP00020
     C      CMPUT1                                          -- 1.0 --                  CMP00030
     C                                                                                 CMP00040
     C       1. SUBROUTINE                                                             CMP00050
     C           (1) SET WORK AREA IN REACTION RATE CALCULATION                        CMP00060
     C                                                                                 CMP00070
     C           (2) SET WORK AREA IN FLUX*FLUX CALCULATION                            CMP00080
     C                                                                                 CMP00090
     C       2. LOCAL VARIABLES                                                        CMP00100
     C           (1) IRAT   = REACTION RATE STORAGE AREA                               CMP00110
     C           (2) IMX    = MAX. OF RADIAL  FINE MESH INTERVALS                      CMP00120
     C           (3) JMX    = MAX. OF AXIAL   FINE MESH INTERVALS                      CMP00130
     C           (4) IVOL   = MAX. OF VOLUMES IN COARSE MESH                           CMP00140
     C           (5) LRAT   = START POSITION OF REACTION RATE                          CMP00150
     C           (6) LVOL   = START POSITION OF VOLUME                                 CMP00160
     C           (7) LFLX   = START POSITION OF FLUX                                   CMP00170
     C           (8) LQSC   = START POSITION OF SOURCE                                 CMP00180
     C           (9) LWK1   = START POSITION OF WORK AREA 1                            CMP00190
     C          (10) IFL    = FLUX*FLUX AREA                                           CMP00200
     C          (11) LDFF   = START POSITION OF FLUX*FLUX                              CMP00210
     C          (12) LWK2   = START POSITION OF WORK AREA2                             CMP00220
     C          (13) IWK    = LENGTH OF WORK AREA 1                                    CMP00230
     C          (14) IWK2   = LENGTH OF WORK AREA 2                                    CMP00240
     C                                                                                 CMP00250
     C       3. CALLED BY       ( SUB1 )                                               CMP00260
     C                                                                                 CMP00270
     C       4. CALLS           ( CMPUTR, CMPUTF )                                     CMP00280
     C                                                                                 CMP00290
     C*****************************************************************************CMP00300
  2         COMMON   IB(100), D(1)                                                     CMP00310
  3         DIMENSION LD(1)                                                            CMP00320
  4         EQUIVALENCE ( D(1), LD(1) )                                                CMP00330
  5         EQUIVALENCE (IB( 2),LMAX  ), (IB(14),LIMX  ), (IB(15),LIMY  ),           CMP00340
           1            (IB(20),LWORK ), (IB(35),ISCS  ), (IB(36),IGM   ),           CMP00350
           2            (IB(38),IM    ), (IB(39),JM    ), (IB(47),NM    )           CMP00360
  6         KER = 0                                                                    CMP00370
     C                                                                               CMP00380
     C******** CALCULAT REACTION RATE                                                 CMP00390
     C                                                                               CMP00400
     C---      SET WORK AREA                                                         CMP00410
  7         IRAT = IM*JM                                                            CMP00420
  8         IMX  = 0                                                                CMP00430
  9         JMX  = 0                                                                CMP00440
 10         DO 100  I= 1, IM                                                        CMP00450
 11         IMX  = MAX( IMX, LD(LIMX-1+I) )                                         CMP00460
 12     100 CONTINUE                                                                CMP00470
 13         DO 200  J= 1, JM                                                        CMP00480
 14         JMX  = MAX( JMX, LD(LIMY-1+J) )                                         CMP00490
 15     200 CONTINUE                                                                CMP00500
 16         IVOL = IMX*JMX                                                          CMP00510
 17         LRAT = LWORK                                                            CMP00520
 18         LVOL = LRAT + IRAT                                                      CMP00530
 19         LFLX = LVOL + IVOL                                                      CMP00540
 20         LQSC = LFLX + IVOL                                                      CMP00550
 21         LIX  = LQSC + IVOL                                                      CMP00560
 22         LJY  = LIX  + IM                                                        CMP00570
```

```
      FACOM 230-75 MT FORTRAN-IV M COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  11

ISN   ST-NO                SOURCE PROGRAM      ( CMPUT1 )                          SEQUENCE

 23         LWK1 = LJY  + JM                                                      CMP00580
 24         IWK  = LMAX - LWK1                                                    CMP00590
      C                                                                          CMP00600
 25         CALL CMPUTR( D(LMAT), D(LVOL), D(LFLX), D(LOSC),LD(LIMX),LD(LIMY),CMP00610
     -                   LD(LIX), LD(LJY),                                     CMP00620
     1     D(LWK1), IM, JM, IMX, JMX, IWK, KER )                               CMP00630
      C                                                                          CMP00640
      C******** CALCULATE FLUX*FLUX MATRIX                                       CMP00650
      C                                                                          CMP00660
      C---      SET WORK AREA                                                    CMP00670
 26         IFL = ISCS*IGM*IGM                                                    CMP00680
 27         IF  = NM*IVOL*IGM                                                     CMP00690
 28         LDFF = LWORK                                                          CMP00700
 29         LVOL = LDFF + IFL                                                     CMP00710
 30         LFLX = LVOL + IVOL                                                    CMP00720
 31         LFXA = LFLX + IF                                                      CMP00730
 32         LIX  = LFXA + IF                                                      CMP00740
 33         LJY  = LIX  + IM                                                      CMP00750
 34         LWK2 = LJY  + JM                                                      CMP00760
 35         IWK2 = LMAX - LWK2                                                    CMP00770
      C                                                                          CMP00780
 36         CALL CMPUTF( D(LDFF), D(LVOL), D(LFLX), D(LFXA),LD(LIMX),LD(LIMY),CMP00790
     -                   LD(LIX), LD(LJY),                                     CMP00800
     1     D(LWK2), NM, ISCS, IGM, IM, JM, IMX, JMX, IWK2, KER )               CMP00810
      C                                                                          CMP00820
      C                                                                          CMP00830
 37         RETURN                                                              CMP00840
 38         END                                                                 CMP00850
```

```
      FACOM 230-75 MT FORTRAN-IV M COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  12

ISN   ST-NO                SOURCE PROGRAM                                      SEQUENCE

  1         SUBROUTINE   CMPUT2( PMX, TRUNC, P, C, RATE, FLMT, MAST,ROW, WORK,CMP00010
     1          MIXNUM, MIXCOM, DENMIX, IDCS, MATNO,                           CMP00020
     2          ISCS, IHM, IGM, IM, JM, MT, MS, NE, IWK, IP, KER)              CMP00030
      C*************************************************************************CMP00040
      C      COMPUT2                                  -- 1.6 --                 *CMP00050
      C                                                                         *CMP00060
      C       1. SUBROUTIN                                                      *CMP00070
      C            (1) CONTROUL CALCULATION OF                                  *CMP00080
      C                  1) SENSITIVITY MATRIX                                  *CMP00090
      C                  2) TRUNCATION ERROR                                    *CMP00100
      C                  3) SENSITIVITY SPECTRA                                 *CMP00110
      C                                                                         *CMP00120
      C       2. INPUT                                                          *CMP00130
      C            (1) MIXNUM(MS)  MIXING TABLE                                 *CMP00140
      C            (2) MIXCOM(MS)  MICRO MATERIAL TABLE                         *CMP00150
      C            (3) DENMIX(MS)  DENSITY TABLE                                *CMP00160
      C            (4) IDCS(IM,JM) CROSS SECTION ZONE IDENTIFICATION NUMBERS    *CMP00170
      C            (5) MATNO(NE)   MICRO MATERIAL NUMBER                        *CMP00180
      C            (6) ISCS = ISCT + 1                                          *CMP00190
      C            (7) IHM  SCATTERING TABLE LENGTH                             *CMP00200
      C            (8) IGM  ENERGY GROUPS                                       *CMP00210
      C            (9) IM   RADIAL COARSE MESH                                  *CMP00220
      C           (10) JM   AXIAL  COARSE MESH                                  *CMP00230
      C           (11) MT   LENGTH OF CROSS SECTION                             *CMP00240
      C           (12) MS   LENGTH OF MIXING TABLE                              *CMP00250
      C           (13) NE   NUMBER OF MICRO MATERIALS                           *CMP00260
      C           (14) IWK  WORK AREA                                           *CMP00270
      C           (15) IP   = 2                                                 *CMP00280
      C                                                                         *CMP00290
      C       3. OUTPUT                                                         *CMP00300
      C            (1) KER  RETURN CODE                                         *CMP00310
      C                                                                         *CMP00320
      C       4. WORK AREA                                                      *CMP00330
      C            (1) PMX(ISCS,IHM,IGM,IM) SENSITIVITY MATRIX                  *CMP00340
      C            (2) TRUNC(ISCS,IGM,IM)   TRUNCATION ERROR                    *CMP00350
      C            (3) P(IGM,IP,IM)         SENSITIVITY SPECTRA                 *CMP00360
      C            (4) C(IHM,IGM,MT)        CROSS SECTION                       *CMP00370
      C            (5) RATE(IGM,IM)         REACTION RATE                       *CMP00380
      C            (6) FLMT(ISCS,IGM,IGM)   FLUX MATRIX                         *CMP00390
      C            (7) MAST(MT)             MACRO MATERIAL NUMBER               *CMP00400
      C            (8) ROW(MT)              DENSITY                             *CMP00410
      C                                                                         *CMP00420
      C       5. CALLED BY      (SUB1)                                          *CMP00430
      C                                                                         *CMP00440
      C       6. CALLES         (REED, MATRIX, TRUNCP, RITE)                    *CMP00450
      C                                                                         *CMP00460
      C*************************************************************************CMP00470
  2         DIMENSION  PMX(ISCS,IHM,IGM,IM), TRUNC(ISCS,IGM,IM), P(IGM,IP,IM),CMP00480
     1           C(IHM,IGM,MT), RATE(IGM,IM),FLMT(ISCS,IGM,IGM),               CMP00490
     2           MAST(MT),    WORK(IWK), MIXNUM(MS), MIXCOM(MS),               CMP00500
     3           DENMIX(MS), IDCS(IM,JM), MATNO(NE), ROW(MT)                   CMP00510
  3         COMMON /IONO  / MR,  MB,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,      CMP00520
     *                    MF4, MF5                                             CMP00530
  4         COMMON /CNTRL / IRR, IR1, IR2                                       CMP00540
  5         COMMON  IB(100), D(1)                                               CMP00550
  6         DIMENSION LD(1)                                                     CMP00560
  7         EQUIVALENCE (LD(1),D(1))                                            CMP00570
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  13

ISN   ST-NO                  SOURCE PROGRAM      ( CMPUT2 )                                                    SEQUENCE

  8         EQUIVALENCE (IB(19),LSUM  ), (IB(42),IHT   ), (IB(43),IHS   ),                                    CMP00580
                       1            (IB(69),KCR   ), (IB(70),KRT   ), (IB(71),KFL   ),                      CMP00590
                       2            (IB(72),NFL   ), (IB(73),NRT   ), (IB( 3),LOPTN )                       CMP00600
                                                                                                             CMP00610
  9         MATR= LD(LOPTN+2)                                                                                CMP00620
 10         SUM = D(LSUM)                                                                                    CMP00630
 11         IREPS=LD(LOPTN+3)                                                                                CMP00640
 12         CALL REED( MF3, 0, 0.0, 0, 4 )                                                                   CMP00650
 13         CALL REED( MF4, 0, 0.0, 0, 4 )                                                                   CMP00660
 14         CALL REED( MF5, 0, 0.0, 0, 4 )                                                                   CMP00670
      C                                                                                                     CMP00680
      C******** SET CROSS SECTIONS                                                                          CMP00690
      C                                                                                                     CMP00700
 15         IRR = KCR                                                                                        CMP00710
 16         READ( MFR'IRR) ((((C(I,J,K),I=1,IHM),J=1,IGM),K=1,MT)                                            CMP00720
      C                                                                                                     CMP00730
      C******** DO LOOP FOR MICRO MATERIAL                                                                  CMP00740
      C                                                                                                     CMP00750
 17         DO 5000 M= 1, NE                                                                                 CMP00760
      C---       SEARCH MACRO MATERIAL NUMBER AND SET ATOM DENSITY                                          CMP00770
 18         MICR = MATNO(M)                                                                                  CMP00780
 19         IJ = 0                                                                                           CMP00790
 20         DO 100  K= 1, MS                                                                                 CMP00800
 21         N = MIXNUM(K)                                                                                    CMP00810
 22         L = MIXCOM(K)                                                                                    CMP00820
 23         A = DENM1X(K)                                                                                    CMP00830
 24         IF( MICR .NE. L )                                    GO TO  100                                  CMP00840
 25         IJ =  IJ + 1                                                                                     CMP00850
 26         MAST(IJ) = N                                                                                     CMP00860
 27         ROW(IJ)  = A                                                                                     CMP00870
 28       100 CONTINUE                                                                                       CMP00880
 29         IF( IJ .EQ. 0 )                                      GO TO 4500                                  CMP00890
      C                                                                                                     CMP00900
      C******** DO LOOP FOR COARSE MESH REGION OF AXIAL DIRECTION                                           CMP00910
      C                                                                                                     CMP00920
 30         DO 4300 JJ = 1, JM                                                                               CMP00930
      C---       SET ZERO TO PMX, TRUNC AND P                                                               CMP00940
 31         DO 200  K= 1, IM                                                                                 CMP00950
 32         DO 200  L= 1, IGM                                                                                CMP00960
 33         DO 200  J= 1, IHM                                                                                CMP00970
 34         DO 200  I= 1, ISCS                                                                               CMP00980
 35         PMX(I,J,L,K) = 0.0                                                                               CMP00990
 36       200 CONTINUE                                                                                       CMP01000
 37         DO 300  K= 1, IM                                                                                 CMP01010
 38         DO 300  J= 1, IGM                                                                                CMP01020
 39         DO 300  I= 1, ISCS                                                                               CMP01030
 40         TRUNC(I,J,K) = 0.0                                                                               CMP01040
 41       300 CONTINUE                                                                                       CMP01050
 42         DO 400  J= 1, IM                                                                                 CMP01060
 43         DO 400  K= 1, IP                                                                                 CMP01070
 44         DO 400  I= 1, IGM                                                                                CMP01080
 45         P(I,K,J) = 0.0                                                                                   CMP01090
 46       400 CONTINUE                                                                                       CMP01100
      C---       SET REACTION RATE                                                                          CMP01110
 47         IRR = KRT                                                                                        CMP01120
 48         DO 1000 K= 1, IGM                                                                                CMP01130
 49         READ( MFR'IRR)   (WORK(I),I=1,IM*JM)                                                             CMP01140
 50         DO 1000 I= 1, IM

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  14

ISN   ST-NO                  SOURCE PROGRAM      ( CMPUT2 )                                                    SEQUENCE

 51         RATE(K,I) = WORK(I+(JJ-1)*IM)                                                                    CMP01150
 52       1000 CONTINUE                                                                                      CMP01160
      C                                                                                                     CMP01170
      C******** DO LOOP FOR COARSE MESH REGION OF RADIAL DIRECTION                                          CMP01180
      C                                                                                                     CMP01190
 53         DO 4000 II = 1, IM                                                                               CMP01200
      C                                                                                                     CMP01210
      C---       CHECH MICRO MATERIAL IN CORSE MESH                                                         CMP01220
      C                                                                                                     CMP01230
 54         DO 2000 K= 1, IJ                                                                                 CMP01240
 55         IF( IABS(MAST(K)) .EQ. IABS(IDCS(II,JJ)) )  GO TO 2200                                           CMP01250
 56       2000 CONTINUE                                                                                      CMP01260
 57         GO TO 4000                                                                                       CMP01270
 58       2200 CONTINUE                                                                                      CMP01280
 59         KK = K                                                                                           CMP01290
      C---       SET FLUX MATRIX                                                                            CMP01300
 60         IRR = KFL + (II-1)*NFL + (JJ-1)*IM*NFL                                                           CMP01310
 61         READ( MFR'IRR) (((FLMT(I,J,L)  ,I=1,ISCS),J=1,IGM),L=1,IGM)                                      CMP01320
 62       3000 CONTINUE                                                                                      CMP01330
      C                                                                                                     CMP01340
      C******** CALCULATE SENSIVITY MATRIX ( PMX )                                                          CMP01350
      C                                                                                                     CMP01360
 63         CALL MATRIX( PMX(1,1,1,II), ROW(KK), C, FLMT, SUM,                                               CMP01370
                1       MAST(KK) ,ISCT, ISCS, IHM, IHT, IHS, IGM, MT, MICR, KER)                            CMP01380
                                                                                                             CMP01390
      C                                                                                                     CMP01400
      C******** CALCULATE TRUNCATION ERROR AND SENSITIVITY COEFFICIENT                                       CMP01410
      C                                                                                                     CMP01420
 64         CALL TRUNCP( TRUNC(1,1,II), P(1,1,II), PMX(1,1,1,II),                                            CMP01430
                1                RATE(1,II), SUM, MICR, MATR, IREPS,                                         CMP01440
                2                ISCS, IHM, IHT, IHS, IGM, IP,    KER )                                      CMP01450
 65       4000 CONTINUE                                                                                      CMP01460
      C                                                                                                     CMP01470
      C******** OUTPUT CONTROUL  ( WRITE TO FILE )                                                          CMP01480
      C                                                                                                     CMP01490
 66         CALL RITE( MF3, 0, PMX, ISCS*IHM*IGM*IM, 3 )                                                     CMP01500
 67         CALL RITE( MF4, 0, TRUNC, ISCS*IGM*IM, 3)                                                        CMP01510
 68         CALL RITE( MF5, 0, P, IGM*IM*2, 3 )                                                              CMP01520
 69       4300 CONTINUE                                                                                      CMP01530
 70         GO TO 5000                                                                                       CMP01540
 71       4500 CONTINUE                                                                                      CMP01550
 72         WRITE(MW,7000) MATNO(M)                                                                          CMP01560
 73         MATNO(M) = 0                                                                                     CMP01570
 74       5000 CONTINUE                                                                                      CMP01580
 75         RETURN                                                                                           CMP01590
 76       7000 FORMAT(1HO, ' MICRO MATERIAL NUMBER ',I5, '  IS NOT FOUND ' )                                 CMP01600
 77         END
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322=(V02,L12)  DATE  79.06.22/09:32    PAGE  15

ISN   ST-NO                SOURCE PROGRAM                                                    SEQUENCE

  1         SUBROUTINE ECHECK (VEC,ICOUNT,IOP)                                             ECH00010
      C                                                  -- 1,7,2,1 --                     ECH00020
      C     IOP EQUALITY INDICATOR ( -1/0/1 EQUAL TO ZERO/NOT EQUAL/EQUAL BUT              ECH00030
      C         NON ZERO )                                                                 ECH00040
      C                                                                                    ECH00050
  2         DIMENSION VEC(1)                                                               ECH00060
      C                                                                                    ECH00070
  3         IOP=0                                                                          ECH00080
  4         IF (ICOUNT.GT.0) GO TO 110                                                     ECH00090
  5       100 CONTINUE                                                                     ECH00100
  6         RETURN                                                                         ECH00110
      C                                                                                    ECH00120
      C     CHECK ENTRIES FOR EQUALITY                                                     ECH00130
      C                                                                                    ECH00140
  7       110 CONTINUE                                                                     ECH00150
  8         DO 120 IDXX=1,ICOUNT                                                           ECH00160
  9         IF (VEC(1).NE.VEC(IDXX)) GO TO 100                                             ECH00170
 10       120 CONTINUE                                                                     ECH00180
      C                                                                                    ECH00190
      C     CHECK TO SEE IF ALL ENTRIES ARE ZERO                                           ECH00200
      C                                                                                    ECH00210
 11         IOP=1                                                                         ECH00220
 12         IF (VEC(1).EQ.0.0) IOP=-1                                                     ECH00230
 13         GO TO 100                                                                     ECH00240
 14         END                                                                           ECH00250
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322=(V02,L12)  DATE  79.06.22/09:32    PAGE  16

ISN   ST-NO                SOURCE PROGRAM                                                    SEQUENCE

  1         SUBROUTINE ECRD ( CORE, IP, NWDS, IEREX )                                      ECR00010
      C                                                  -- 1,1,3,1 --                     ECR00020
      C     LCM TRANSFER TO CORE REPLACEMENT ROUTINE                                       ECR00030
      C                                                                                    ECR00040
      C     COMMON /FWBGN1/ IDUSE(18),LAST,LASTEC,IGCOMP,IPSO,LTSO,IPFL,LTFL,             ECR00050
      C    1IPFX,LTFX,LXFX,IPXS,IPXSCT,LTXS,LTOXS,LTAXS,IP0S,LT0S,IEREC,IZ,I4,            ECR00060
      C    216,ISPAN0,IPHAF,IPVAF,LTHAF,LTVAF,IFD                                          ECR00070
      C     COMMON IA(250),A(1)                                                            ECR00080
  2         COMMON IB(100), D(1)                                                           ECR00090
  3         EQUIVALENCE (IB(20),LWORK )                                                    ECR00100
      C                                                                                    ECR00110
  4         DIMENSION CORE ( 1 )                                                           ECR00120
      C                                                                                    ECR00130
      C     INDEX = LAST + IP                                                              ECR00140
  5         INDEX = LWORK + IP                                                             ECR00150
  6         DO 10 IDX = 1, NWDS                                                            ECR00160
  7         CORE ( IDX ) = D ( INDEX )                                                     ECR00170
  8         INDEX = INDEX + 1                                                              ECR00180
  9       10 CONTINUE                                                                      ECR00190
 10         RETURN                                                                         ECR00200
 11         END                                                                            ECR00210
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322=(V02,L12)  DATE  79.06.22/09:32    PAGE  17

ISN   ST-NO                  SOURCE PROGRAM                                                    SEQUENCE

  1         SUBROUTINE EC=R ( CORE, IP, N=DS, IEREX )                                        EC=00010
      C                                                -- 1.6.3.1 --                         EC=00020
      C       CORE TO LCM TRANSFER REPLACEMENT ROUTINE                                       EC=00030
      C                                                                                      EC=00040
      C       COMMON /FWBGN1/ IDUSE(18),LAST,LASTEC,IGCDMP,IPSD,LTSD,IPFL,LTFL,              EC=00050
      C      1IPFX,LTFX,LXFX,IPXS,IPXSCT,LTXS,LTOXS,LTAXS,IP0S,LT0S,IEREC,I2,I4,            EC=00060
      C      216,ISPAN0,IPMAF,IPVAF,LTHAF,LTVAF,IFO                                          EC=00070
      C       COMMON IA(250),A(1)                                                            EC=00080
  2           COMMON IB(100), D(1)                                                         EC=00090
  3           EQUIVALENCE (IB(20),LWORK )                                                  EC=00100
      C                                                                                    EC=00110
  4           DIMENSION CORE ( 1 )                                                         EC=00120
      C                                                                                    EC=00130
      C       INDEX = LAST + IP                                                            EC=00140
  5           INDEX = LWORK + IP                                                           EC=00150
  6           DO 10 IDX = 1, N=DS                                                          EC=00160
  7           D ( INDEX ) = CORE ( IDX )                                                   EC=00170
  8           INDEX = INDEX + 1                                                            EC=00180
  9        10 CONTINUE                                                                     EC=00190
 10           RETURN                                                                       EC=00200
 11           END                                                                          EC=00210
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322=(V02,L12)  DATE  79.06.22/09:32    PAGE  18

ISN   ST-NO                  SOURCE PROGRAM                                                    SEQUENCE

  1         SUBROUTINE  ERROR( NC, N=, MESAGE )                                              ERR00010
      C*****************************************************************************       *ERR00020
      C       ERROR                                    -- 1.8 --                           *ERR00030
      C                                                                                    *ERR00040
      C        1, SUBROUTINE                                                               *ERR00050
      C            (1) ERROR MESSAGE PRINT OUT                                             *ERR00060
      C                                                                                    *ERR00070
      C                                                                                    *ERR00080
      C        2, INPUT                                                                    *ERR00090
      C            (1) NC      = ERROR CODE ( 0=MESSAGE, 1=WORNING, 2=ERROR )             *ERR00100
      C            (2) N=      = NO. OF MESSAGE WORDS                                      *ERR00110
      C            (3) MESAGE = MESSAGE CHARACTER$                                         *ERR00120
      C                                                                                    *ERR00130
      C*****************************************************************************       ERR00140
  2           DIMENSION  MESAGE(N=),  MHEAD(2,3)                                           ERR00150
  3           COMMON /ICNO  / MR,  M=,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,                 ERR00160
                              MF4, MF5                                                     ERR00170
  4           COMMON /PCOND / ICOND, N=AR, NERR                                            ERR00180
  5           DATA MHEAD / 'MESSAGE WORNING ERROR   ' /                                    ERR00190
      C                                                                                    ERR00200
  6           NCC = NC                                                                     ERR00210
  7           IF( NC.LT.0 .OR. NC.GT.2 )   NCC = 2                                         ERR00220
  8           IF( NCC.GT.ICOND )           ICOND = NCC                                     ERR00230
  9           IF( NC .EQ.1 )               N=AR  = N=AR + 1                                ERR00240
 10           IF( NC .EQ.2 )               NERR  = NERR + 1                                ERR00250
 11           WRITE(M=,7000) (MHEAD(I,NCC+1),I=1,2), (MESAGE(I),I=1,N=)                    ERR00260
 12        7000 FORMAT(1HO,'**** ',2A6,' ****', 6X, 20A6 )                                 ERR00270
 13           RETURN                                                                       ERR00280
 14           END
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322=(V02,L12)  DATE  79.06.22/09:32    PAGE  19

ISN   ST=NO                  SOURCE PROGRAM                                                    SEQUENCE

  1          SUBROUTINE EXPAND(P1,P2,T1,T2,T3,*,NM,MM,ISCT1)                                  EXP00010
      C                                          -- 1.4.2.1.1 --                             EXP00020
      C    ADJOINT FLUX MOMENTS T1 ARE EXPANDED BY THE ORTHOGONAL POLYNOMIALS P1            EXP00030
      C    AND THEN, THESE ANGULAR FLUXES T2 ARE CONVERTED TO THE EXPANSION                 EXP00040
      C    COEFFICIENTS OF THE ORTHOGONAL POLYNOMIALS P2.                                   EXP00050
      C                                                                                     EXP00060
  2          DIMENSION P1(NM,MM),P2(NM,MM),T1(NM),T2(MM),T3(NM),*(MM)                      EXP00070
      C                                                                                     EXP00080
  3          DO 100 M=1,MM                                                                 EXP00090
  4        100 T2(M)=0.0                                                                   EXP00100
  5          DO 200 M=1,MM                                                                 EXP00110
  6          N=0                                                                           EXP00120
  7          DO 200 N1=1,ISCT1                                                             EXP00130
  8          AN=2*(N1-1)+1                                                                 EXP00140
  9          DO 200 N2=1,N1                                                                EXP00150
 10          N=N+1                                                                         EXP00160
 11        200 T2(M)=T2(M)+AN*P1(N,M)*T1(N)                                                EXP00170
      C                                                                                     EXP00180
 12          DO 300 N=1,NM                                                                 EXP00190
 13          DO 300 M=1,MM                                                                 EXP00200
 14        300 T3(N)=T3(N)+*(M)*P2(N,M)*T2(M)                                              EXP00210
      C                                                                                     EXP00220
 15          RETURN                                                                        EXP00230
 16          END                                                                           EXP00240
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322=(V02,L12)  DATE  79.06.22/09:32    PAGE  20

ISN   ST=NO                  SOURCE PROGRAM                                                    SEQUENCE

  1          SUBROUTINE FFREAD(IN,K,V,NF,NIN,NOU,IPRTRG)                                      FFR00010
      C                                          -- 1.1.1.1 -                                FFR00020
  2          DIMENSION NY(80),IN(2),K(2),V(2)                                              FFR00030
  3          DATA NT,NBB,NDP,NPL,NPA,NM/'T   ','    ','.   ','+   ','+   ',               FFR00040
     1                                     '-   '/,NSS/'S   '/                             FFR00050
  4          DATA NDL,NS,NE/'0   ','*   ','E   '/                                         FFR00060
  5          DATA NQ,NM,NN/'0   ','M   ','N   '/                                          FFR00070
  6          DATA NR,NI,NFF,NA,NL,NK/'R   ','(   ','F   ','A   ','L   ','K   '/FFR00080
      C      DATA NSL/Z7D4040400/                                                          FFR00090
      C      DATA NCST2,NCST1/-264224705,-1132297597/ ,IFREE/0/                            FFR00100
  7          DATA NSL/'M'  /                                                               FFR00110
  8          DATA N0,N1,N2,N3,N4,N5,N6,N7,N8,N9/'0   ','1   ','2   ','3   ',              FFR00120
     1    '4   ','5   ','6   ','7   ','8   ','9   '/                                      FFR00130
  9       1998 DO 1 I=1,37                                                                 FFR00140
 10          IN(I)=0                                                                       FFR00150
 11          V(I)=0.0                                                                      FFR00160
 12        1 K(I)=NBB                                                                      FFR00170
 13          IEXP=0                                                                        FFR00180
 14          NSCL=0                                                                        FFR00190
 15          NDPN=0                                                                        FFR00200
 16          IEX=0                                                                         FFR00210
 17          NUM=0                                                                         FFR00220
 18          ISGN=1                                                                        FFR00230
 19          IBLNK=0                                                                       FFR00240
 20          NF=1                                                                          FFR00250
 21          NCC=1                                                                         FFR00260
 22          IFC=0                                                                         FFR00270
 23          IDS=0                                                                         FFR00280
 24        112 READ (NIN,10) NY                                                            FFR00290
 25          IF(IPRTRG.GT.0)WRITE(NOU,30)NY                                                FFR00300
 26         30 FORMAT(' ',T53,80A1)                                                        FFR00310
 27          IF(NY(1).NE.NSL)GO TO 111                                                     FFR00320
 28          WRITE(NOU,10)(NY(I),I=2,80)                                                   FFR00330
 29          GO TO 112                                                                     FFR00340
 30         10 FORMAT(80A1)                                                                FFR00350
 31        111 NYNCC=NY(NCC)                                                               FFR00360
 32          IF(IFREE.EQ.0)GO TO 122                                                       FFR00370
 33          IFC=IFC+1                                                                     FFR00380
 34          IF(IFC.GT.12)IFC=1                                                            FFR00390
 35          IF(IFC.EQ.3)GO TO 124                                                         FFR00400
 36          IF(IFC.EQ.11 .AND. IEX.NE.0 .AND. NYNCC.EQ.NBB)GO TO 106                      FFR00410
 37          IF(NYNCC.EQ.NE .AND. IFC.GT.4)GO TO 203                                       FFR00420
 38        122 IF(NYNCC.EQ.NBB)GO TO 101                                                   FFR00430
 39          IF(NYNCC.EQ.NPL .OR. NYNCC.EQ.NPA)GO TO 103                                   FFR00440
 40          IF(NYNCC.EQ.NM1)GO TO 104                                                     FFR00450
 41          IF(NYNCC.EQ.NE .AND. IBLNK.EQ.1)GO TO 203                                     FFR00460
 42          IBLNK=1                                                                       FFR00470
 43          IF(IEX.NE.0)GO TO 107                                                         FFR00480
 44          IF(NYNCC.EQ.NDP)GO TO 102                                                     FFR00490
      C 124  IF(NYNCC.LT.NCST1 .AND. NYNCC.GT.NCST2)GO TO 105                              FFR00500
 45       124 IF(NYNCC.EQ.N0 .OR. NYNCC.EQ.N1 .OR. NYNCC.EQ.N2 .OR.                       FFR00510
     1    NYNCC.EQ.N3 .OR. NYNCC.EQ.N4 .OR. NYNCC.EQ.N5 .OR.                              FFR00520
     2    NYNCC.EQ.N6 .OR. NYNCC.EQ.N7 .OR. NYNCC.EQ.N8 .OR.NYNCC.EQ.N9)                 FFR00530
     3    GO TO 105                                                                       FFR00540
 46        121 IF(K(NF).NE.NBB .AND. NYNCC.EQ.NBB)GO TO 101                              FFR00550
 47          K(NF)=NYNCC                                                                   FFR00560
 48          IN(NF)=NUM                                                                    FFR00570
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  21

ISN   ST-NO                  SOURCE PROGRAM      ( FFREAD )                                                  SEQUENCE

 49           NUM=0                                                                                          FFR00580
 50           IBLNK=0                                                                                        FFR00590
 51           IF(NYNCC.EQ.NBB)GO TO 106                                                                      FFR00600
 52           IF(K(NF),NE,NDL .AND. K(NF),NE,NS)GO TO 113                                                    FFR00610
 53           IFREE=0                                                                                        FFR00620
 54           IDS=1                                                                                          FFR00630
 55           IF(NF,EQ,1)GO TO 108                                                                           FFR00640
 56           IF(K(NF),NE,K(NF-1))GO TO 108                                                                  FFR00650
 57           IDS=0                                                                                          FFR00660
 58           K(NF)=NBB                                                                                      FFR00670
 59           GO TO 106                                                                                      FFR00680
 60       113 IF(IFREE.EQ.0 .AND.                                                                            FFR00690
             1   NYNCC.NE,NR .AND. NYNCC.NE.NI .AND. NYNCC.NE.NFF .AND.                                     FFR00700
             1   NYNCC.NE,NA .AND. NYNCC.NE.NL .AND. NYNCC.NE.NK .AND.                                      FFR00710
             2   NYNCC.NE,NQ .AND. NYNCC.NE.NM .AND. NYNCC.NE,NN )GO TO 108                                 FFR00720
 61           IF(IFREE.EQ.1 .AND. NYNCC.EQ.NSS)GO TO 108                                                     FFR00730
 62           IF(NCC.EQ.72)WRITE(NOU,20)NY                                                                   FFR00740
 63        20 FORMAT('0 ****** INCOMPLETE FIELD AT END OF CARD  SOME DATA MAY BEFFR00750
             1 LOST'/'          CARD IMAGE FOLLOWS'/' '80A1)                                                FFR00760
 64           GO TO 106                                                                                      FFR00770
     C 105 NUMM=10 - ((IABS(NYNCC) - 96452540)/16777216)                                                     FFR00780
       105 IF(NYNCC.EQ.N0)NUMM=0                                                                            FFR00790
 65            IF(NYNCC.EQ.N1)NUMM=1                                                                         FFR00800
 66            IF(NYNCC.EQ.N2)NUMM=2                                                                         FFR00810
 67            IF(NYNCC.EQ.N3)NUMM=3                                                                         FFR00820
 68            IF(NYNCC.EQ.N4)NUMM=4                                                                         FFR00830
 69            IF(NYNCC.EQ.N5)NUMM=5                                                                         FFR00840
 70            IF(NYNCC.EQ.N6)NUMM=6                                                                         FFR00850
 71            IF(NYNCC.EQ.N7)NUMM=7                                                                         FFR00860
 72            IF(NYNCC.EQ.N8)NUMM=8                                                                         FFR00870
 73            IF(NYNCC.EQ.N9)NUMM=9                                                                         FFR00880
 74            NUM=NUM*10 + NUMM                                                                             FFR00890
 75            NSCL=NSCL + NDPN                                                                              FFR00900
 76            GO TO 206                                                                                     FFR00910
 77        102 NDPN=-1                                                                                       FFR00920
 78            GO TO 206                                                                                     FFR00930
 79       C 107 NUMM=10 - ((IABS(NYNCC) - 96452540)/16777216)                                                FFR00940
 80        107 IF(NYNCC.EQ.N0)NUMM=0                                                                         FFR00950
 81            IF(NYNCC.EQ.N1)NUMM=1                                                                         FFR00960
 82            IF(NYNCC.EQ.N2)NUMM=2                                                                         FFR00970
 83            IF(NYNCC.EQ.N3)NUMM=3                                                                         FFR00980
 84            IF(NYNCC.EQ.N4)NUMM=4                                                                         FFR00990
 85            IF(NYNCC.EQ.N5)NUMM=5                                                                         FFR01000
 86            IF(NYNCC.EQ.N6)NUMM=6                                                                         FFR01010
 87            IF(NYNCC.EQ.N7)NUMM=7                                                                         FFR01020
 88            IF(NYNCC.EQ.N8)NUMM=8                                                                         FFR01030
 89            IF(NYNCC.EQ.N9)NUMM=9                                                                         FFR01040
 90            IEXP=IEXP*10 + IEX*NUMM                                                                       FFR01050
 91        206 IF(IFC.EQ.12)GO TO 301                                                                        FFR01060
 92            GO TO 106                                                                                     FFR01070
 93        103 IF(NUM.NE.0)GO TO 203                                                                         FFR01080
 94            ISGN=1                                                                                        FFR01090
 95            GO TO 106                                                                                     FFR01100
 96        203 IEX=1                                                                                         FFR01110
 97            GO TO 106                                                                                     FFR01120
 98        104 IF(NUM.NE.0)GO TO 204                                                                         FFR01130
 99            ISGN=-1                                                                                       FFR01140

      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  22

ISN   ST-NO                  SOURCE PROGRAM      ( FFREAD )                                                  SEQUENCE

100           GO TO 106                                                                                      FFR01150
101       204 IEX=-1                                                                                         FFR01160
102           GO TO 106                                                                                      FFR01170
103       123 IFREE=1                                                                                        FFR01180
104           IDS=0                                                                                          FFR01190
105           GO TO 109                                                                                      FFR01200
106       101 IF(IDS.EQ.1)GO TO 123                                                                          FFR01210
107           IF(IFREE.EQ.1 .AND. IFC.EQ.12 .AND. K(NF),NE,NBB)GO TO 301                                     FFR01220
108           IF(IBLNK.EQ.0)GO TO 106                                                                        FFR01230
109           IF(IFREE.EQ.1 .AND. IFC.NE.12)GO TO 106                                                        FFR01240
110       301 VNUM=ISGN*NUM                                                                                  FFR01250
111           V(NF)=VNUM*10.0**(IEXP+NSCL)                                                                   FFR01260
112           NDPN=0                                                                                         FFR01270
113           IEX=0                                                                                          FFR01280
114           IEXP=0                                                                                         FFR01290
115           NSCL=0                                                                                         FFR01300
116           IBLNK=0                                                                                        FFR01310
117           NUM=0                                                                                          FFR01320
118           ISGN=1                                                                                         FFR01330
119       108 NF=NF + 1                                                                                      FFR01340
120           IF(NYNCC.EQ.NSS)GO TO 106                                                                      FFR01350
121       109 IFC=0                                                                                          FFR01360
122           IF(IFREE.EQ.1)NCC=((NCC+11)/12)*12                                                             FFR01370
123           IF(K(NF-1),EQ,NT)GO TO 999                                                                     FFR01380
124       106 IF(NCC.GE.73)GO TO 999                                                                         FFR01390
125           NCC=NCC+1                                                                                      FFR01400
126           IF(NCC.LE.72)GO TO 111                                                                         FFR01410
127           GO TO 101                                                                                      FFR01420
128       999 NF=NF-1                                                                                        FFR01430
129           IF(NF.LE.0)GO TO 1998                                                                          FFR01440
130           RETURN                                                                                         FFR01450
131           END                                                                                            FFR01460
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79,06,22/09:32    PAGE  23

ISN   ST-NO                SOURCE PROGRAM                                                    SEQUENCE
  1         SUBROUTINE FIDO     (LL2,J3,N5,N6,D,LDTK)                                      FID00010
      C                                                  -- 1.1.1 -                        FID00020
      C    *** GENERALIZED INPUT RDUTINE - NOTE ABSENSE OF SPACE WASTING GO TO            FID00030
      C        FOUND IN DTF-II                                                            FID00040
  2         DIMENSION IN(37),X(37),V(37),LDTK(1),FMT(3),*(12)                           FID00050
  3         DIMENSION VMT(18), D(1)                                                     FID00060
      C     COMMON /SKPBUF/ LOCATN,JUMP,LFAST,LSLO*,JMP1,JMP2,JMP3                      FID00070
      C     COMMON /BULKBU/ D(1)                                                        FID00080
  4         EQUIVALENCE (BB,LBB)                                                        FID00090
  5         DATA LDL,LS,LR1,LI,LT,LSS/'(   ','*   ','R   ',')   ','T   ',             FID00100
           1'S   */                                                                     FID00110
  6         DATA FMT(1),E1,E2,E3,E4/'(1X,','1OE1','.2,5)','10I1','2)  '/               FID00120
  7         DATA LF,LA,LAP,LPL,LMI/'F   ','A   ','*   ','+   ','-   '/                FID00130
  8         DATA LZ,LV,LU,BB/'Z   ','V   ','U   ',' '/                                 FID00140
  9         DATA L0,LM,LN/'0   ','M   ','N   '/,LE/'E   '/                             FID00150
 10         DATA LL1,LK1/'L   ','K   '/                                                 FID00160
 11         DIMENSION PRT(3)                                                            FID00170
 12         DATA LO,LC,PRT(1),PRT(2),PRT(3),IPRTRG/'O   ','C   ','OFF ',              FID00180
           1     'PRT ','ON  ',-1/                                                      FID00190
 13         J=0                                                                         FID00200
 14         J3=0                                                                        FID00210
 15         III=0                                                                       FID00220
 16         IVMT=0                                                                      FID00230
 17         NCOUNT=0                                                                    FID00240
 18       1 CALL FFREAD(IN,X,V,NF,N5,N6,IPRTRG)                                         FID00250
 19      10 FORMAT(6(I2,A1,F9.0),T5,2A4,5(4X2A4))                                       FID00260
 20         DO 27 I=1,NF                                                                FID00270
 21         IF(K(I).NE.LPL .AND. K(I).NE.LAP .AND. K(I).NE.LMI)GO TO 27                 FID00280
      C    *** EXPONENTIATION (E,+,-)                                                  FID00290
 22         L=IN(I)                                                                     FID00300
 23         IF(L.EQ.0)GO TO 27                                                          FID00310
 24         E=10.0**L                                                                   FID00320
 25         IF(K(I).EQ.LMI)GO TO 28                                                     FID00330
 26         V(I)=V(I)*E                                                                 FID00340
 27         GO TO 27                                                                    FID00350
 28      28 V(I)=V(I)/E                                                                 FID00360
 29      27 CONTINUE                                                                    FID00370
 30    1002 DO 2  I=1,NF                                                                FID00380
 31         IF(III.EQ.0) GO TO 4                                                        FID00390
 32         IF(III-2) 3,44,48                                                           FID00400
 33       4 III=0                                                                       FID00410
 34         IF(K(I).EQ.LBB)GO TO 14                                                     FID00420
 35         IF(K(I).EQ.LDL)GO TO 5                                                      FID00430
 36         IF(K(I).EQ.LS )GO TO 6                                                      FID00440
 37         IF(K(I).EQ.LR1)GO TO 7                                                      FID00450
 38         IF(K(I).EQ.LI )GO TO 8                                                      FID00460
 39         IF(K(I).EQ.LT )GO TO 9                                                      FID00470
 40         IF(K(I).EQ.LSS)GO TO 11                                                     FID00480
 41         IF(K(I).EQ.LF)GO TO 23                                                      FID00490
 42         IF(K(I).EQ.LA)GO TO 26                                                      FID00500
 43         IF(K(I).EQ.LZ)GO TO 31                                                      FID00510
 44         IF(K(I).EQ.LE)GO TO 39                                                      FID00520
 45         IF(K(I).EQ.L0)GO TO 35                                                      FID00530
 46         IF(K(I).EQ.LM .OR. K(I).EQ.LN)GO TO 36                                      FID00540
 47         IF(K(I).EQ.LU)GO TO 33                                                      FID00550
 48         IF(K(I).EQ.LV)GO TO 34                                                      FID00560
 49         IF(K(I).EQ.LL1) GO TO 42                                                    FID00570

      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79,06,22/09:32    PAGE  24

ISN   ST-NO                SOURCE PROGRAM     ( FIDO   )                                  SEQUENCE
 50         IF(K(I).EQ.LK1) GO TO 46                                                    FID00580
 51         IF(K(I).EQ.LO) GO TO 55                                                     FID00590
 52         IF(K(I).EQ.LC) GO TO 56                                                     FID00600
 53         GO TO 14                                                                    FID00610
      C    *** TERMINATE (T)                                                           FID00620
 54       9 J2=0                                                                        FID00630
 55         IF(J.EQ.0)GO TO 16                                                          FID00640
 56         GO TO 12                                                                    FID00650
      C    *** VARIABLE FORMAT CONTROL (U,V)                                           FID00660
 57      33 READ(N5,80)VMT                                                            FID00670
 58      34 IVMT=1                                                                    FID00680
      C    *** BEGIN NEW ARRAY (*,#)                                                   FID00690
 59       6 KKK=0                                                                     FID00700
 60         GO TO 13                                                                  FID00710
 61       5 KKK=1                                                                     FID00720
 62      13 IF(NCOUNT+J .EQ. 0)GO TO 15                                               FID00730
 63         J2=1                                                                      FID00740
 64      12 WRITE (N6,20) LL,LB,J                                                     FID00750
 65         IF(J.EQ.NCOUNT)GO TO 16                                                   FID00760
 66         IMAX=J1 + J - 1                                                           FID00770
 67         FMT(2)=E1                                                                 FID00780
 68         FMT(3)=E2                                                                 FID00790
 69         IF(KK.NE.1)GO TO 22                                                       FID00800
 70         FMT(2)=E3                                                                 FID00810
 71         FMT(3)=E4                                                                 FID00820
 72      22 WRITE (N6,FMT) (D(II),II=J1,IMAX)                                         FID00830
 73         J3=J3 + 1                                                                 FID00840
 74         WRITE (N6,30) NCOUNT,LL,LB                                                FID00850
 75      16 IF(J2.NE.0)GO TO 15                                                       FID00860
 76         WRITE (N6,50) LT                                                          FID00870
 77         RETURN                                                                    FID00880
 78      15 LL=IN(I)                                                                  FID00890
 79         LL3=LL + LL2 - 1                                                          FID00900
 80         KK=KKK                                                                    FID00910
 81         LB=K(I)                                                                   FID00920
 82         J=V(I)                                                                    FID00930
 83         J1=LDTK(LL3) + J                                                          FID00940
 84         NCOUNT=LDTK(LL3+1) - LDTK(LL3) - J                                        FID00950
      C     IF(LOCATN + LDTK(LL3) .GT. LFAST .OR. LOCATN + LDTK(LL3+1) .LT.          FID00960
      C    1  LFAST)GO TO 41                                                         FID00970
      C     NCOUNT=NCOUNT - JUMP                                                     FID00980
 85      41 J=0                                                                      FID00990
 86         IF(IVMT.EQ.0)GO TO 2                                                      FID01000
      C    *** VARIABLE FORMAT CONTROL (U,V)                                         FID01010
 87      32 IF(NCOUNT.EQ.0)GO TO 1                                                    FID01020
 88         J=NCOUNT                                                                  FID01030
 89         NCC=J1 + NCOUNT - 1                                                       FID01040
 90         READ(N5,VMT) (D(J2),J2=J1,NCC)                                            FID01050
 91         IVMT=0                                                                    FID01060
 92         GO TO 1                                                                   FID01070
      C    *** FILL ARRAY (F)                                                        FID01080
 93      23 IF(J.GE.NCOUNT)GO TO 25                                                   FID01090
 94         NCC=J+1                                                                   FID01100
 95         DO 24 II=NCC,NCOUNT                                                       FID01110
 96         J2=J1 + II -1                                                             FID01120
 97         D(J2)=V(I)                                                                FID01130
 98      24 IF(KK.NE.0)LDTK(J2)=V(I)                                                  FID01140
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  25

ISN   ST-NO                  SOURCE PROGRAM      ( FIDO    )                                                    SEQUENCE

 99           J=NCOUNT                                                                                          FIDO1150
100           GO TO 2                                                                                           FIDO1160
101        25 WRITE (N6,60) LL,LB                                                                               FIDO1170
102           GO TO 2                                                                                           FIDO1180
                                                                                                                FIDO1190
      C    *** END ARRAY (E)                                                                                    FIDO1200
103        39 IF(J.LE.NCOUNT)J=NCOUNT                                                                           FIDO1210
104           GO TO 2                                                                                           FIDO1220
      C    *** ADDRESS MODIFICATION (A)                                                                         FIDO1230
105        26 J=V(I)                                                                                            FIDO1240
106           IF(J.GT.NCOUNT .OR. J.LE.0)WRITE(N6,70)J,LL,LB                                                    FIDO1250
107           J=J-1                                                                                             FIDO1260
108           GO TO 2                                                                                           FIDO1270
      C    *** SKIP (S)                                                                                         FIDO1280
109        11 J=J + IN(I)                                                                                       FIDO1290
110           GO TO 2                                                                                           FIDO1300
      C    *** TURN PRINT TRIGGER ON/OFF                                                                        FIDO1310
111        55 IPRTRG=-IPRTRG                                                                                    FIDO1320
112           WRITE(N6,110)PRT(2),PRT(IPRTRG+2),IN(I),LO                                                        FIDO1330
113       110 FORMAT(' ',T53,2A4,I7,A1)                                                                         FIDO1340
114           GO TO 2                                                                                           FIDO1350
      C    *** PRINT COUNT IN CURRENT ARRAY                                                                     FIDO1360
115        56 WRITE(N6,90)LL,LB,J,IN(I),LC                                                                      FIDO1370
116           GO TO 2                                                                                           FIDO1380
117        90 FORMAT(T90,I5,A1,' ARRAY',I7,' ENTRIES READ AT',I6,A1)                                            FIDO1390
      C    *** NO MODIFICATION                                                                                  FIDO1400
118        14 CONTINUE                                                                                          FIDO1410
119        17 J2=J1 + J                                                                                         FIDO1420
120           D(J2)=V(I)                                                                                        FIDO1430
121           IF(KK.NE.0)LDTK(J2)=V(I)                                                                          FIDO1440
122           J=J + 1                                                                                           FIDO1450
123           GO TO 2                                                                                           FIDO1460
      C    *** ZERO (Z)                                                                                         FIDO1470
124        31 IN(I)=V(I) + IN(I)                                                                                FIDO1480
125           V(I)=0.0                                                                                          FIDO1490
      C    *** REPEAT (R)                                                                                       FIDO1500
126         7 L=IN(I)                                                                                           FIDO1510
127           DO 18 II=1,L                                                                                      FIDO1520
128           J2=J1 + J                                                                                         FIDO1530
129           D(J2)=V(I)                                                                                        FIDO1540
130           IF(KK.NE.0)LDTK(J2)=V(I)                                                                          FIDO1550
131        18 J=J + 1                                                                                           FIDO1560
132           GO TO 2                                                                                           FIDO1570
      C    *** SEQUENCE REPEAT (@)                                                                              FIDO1580
133        35 L=IN(I) + V(I)                                                                                    FIDO1590
134           LSE@=1                                                                                            FIDO1600
135           IF(V(I).EQ.0.0 .OR. IN(I).EQ.0) GO TO 51                                                          FIDO1610
136           L=V(I)                                                                                            FIDO1620
137           LSE@=IN(I)                                                                                        FIDO1630
138        51 DO 52 LS@=1,LSE@                                                                                  FIDO1640
139           DO 37 II=1,L                                                                                      FIDO1650
140           J2=J1 + J                                                                                         FIDO1660
141           J4=J2 - L                                                                                         FIDO1670
142           D(J2)=D(J4)                                                                                       FIDO1680
143        37 J=J + 1                                                                                           FIDO1690
144        52 CONTINUE                                                                                          FIDO1700
145           GO TO 2                                                                                           FIDO1710
      C    *** INVERTED SEQUENCE REPEAT (N)

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  26

ISN   ST-NO                  SOURCE PROGRAM      ( FIDO    )                                                    SEQUENCE

146        36 L=IN(I) + V(I)                                                                                    FIDO1720
147           LSE@=1                                                                                            FIDO1730
148           IF(V(I).EQ.0.0 .OR. IN(I).EQ.0) GO TO 53                                                          FIDO1740
149           L=V(I)                                                                                            FIDO1750
150           LSE@=IN(I)                                                                                        FIDO1760
151        53 DO 54 LS@=1,LSE@                                                                                  FIDO1770
152           DO 38 II=1,L                                                                                      FIDO1780
153           J2=J1 + J                                                                                         FIDO1790
154           J4=J2 - II + 1                                                                                    FIDO1800
155           D(J2)=D(J4)                                                                                       FIDO1810
      C    *** REVERSED SIGN INVERTED SEQUENCE REPEAT (M)                                                       FIDO1820
156           IF(K(I).EQ.LM)D(J2)=-D(J2)                                                                        FIDO1830
157        38 J=J + 1                                                                                           FIDO1840
158        54 CONTINUE                                                                                          FIDO1850
159           GO TO 2                                                                                           FIDO1860
      C    *** LOGARITHMIC INTERPOLATION (L)                                                                    FIDO1870
160        42 L=IN(I)+1                                                                                         FIDO1880
161           VV=V(I)                                                                                           FIDO1890
162           III=2                                                                                             FIDO1900
163           GO TO 2                                                                                           FIDO1910
164        44 DEL=EXP(ALOG(V(I)/VV)/L)                                                                          FIDO1920
165           J2=J1+J                                                                                           FIDO1930
166           D(J2)=VV                                                                                          FIDO1940
167           J=J+1                                                                                             FIDO1950
168           DO 45 II=2,L                                                                                      FIDO1960
169           J2=J1+J                                                                                           FIDO1970
170           D(J2)=DEL*D(J2-1)                                                                                 FIDO1980
171        45 J=J+1                                                                                             FIDO1990
172           IF(III.NE.0) GO TO 4                                                                              FIDO2000
173           GO TO 2                                                                                           FIDO2010
      C    *** FIXED 10 LOG INTERP, (K)                                                                         FIDO2020
174        46 L=IN(I)+1                                                                                         FIDO2030
175           VV=V(I)                                                                                           FIDO2040
176           III=3                                                                                             FIDO2050
177           GO TO 2                                                                                           FIDO2060
178        48 DIF=(V(I)-VV)*.1111111                                                                            FIDO2070
179           DEL=EXP(2.302585/L)                                                                               FIDO2080
180           J2=J1+J                                                                                           FIDO2090
181           D(J2)=VV                                                                                          FIDO2100
182           VV=VV+DIF                                                                                         FIDO2110
183           J=J+1                                                                                             FIDO2120
184           DO 49 II=2,L                                                                                      FIDO2130
185           J2=J1+J                                                                                           FIDO2140
186           DIF=DIF*DEL                                                                                       FIDO2150
187           D(J2)=VV+DIF                                                                                      FIDO2160
188        49 J=J+1                                                                                             FIDO2170
189           IF(III.NE.0) GO TO 4                                                                              FIDO2180
190           GO TO 2                                                                                           FIDO2190
      C    *** INTERPOLATE (I)                                                                                  FIDO2200
191         8 IF(KK.NE.0)WRITE (N6,40) LL,LB                                                                   FIDO2210
192           L=IN(I) + 1                                                                                       FIDO2220
193           VV=V(I)                                                                                           FIDO2230
194           III=1                                                                                             FIDO2240
195           GO TO 2                                                                                           FIDO2250
196         3 DEL=(V(I)-VV)/FLOAT(L)                                                                            FIDO2260
197           DO 21 II=1,L                                                                                      FIDO2270
198           J2=J1 + J                                                                                         FIDO2280
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  27

 ISN   ST-NO                SOURCE PROGRAM     ( FIDO   )                                  SEQUENCE

  199         DELT=DEL*FLOAT(II-1) + VV                                                   FID02290
  200         D(J2)=      DELT                                                            FID02300
  201         IF(KK.NE.0)LDTK(J2)=DELT                                                    FID02310
  202      21 J=J + 1                                                                     FID02320
  203         IF(III.NE.0)GO TO 4                                                         FID02330
  204         GO TO 2                                                                     FID02340
  205       2 CONTINUE                                                                    FID02350
  206         GO TO 1                                                                     FID02360
  207      20 FORMAT(1HO,I5,A1,6H ARRAY,I7,13H ENTRIES READ)                              FID02370
  208      30 FORMAT(14HO****** ERROR I7,20H ENTRIES REQUIRED IN I3,A1,6H ARRAY/F1D02380
        121HO DATA EDIT CONTINUES)                                                        FID02390
  209      40 FORMAT(39HO****** WARNING  INTERPOLATION USED IN I2,A1,14H INTEGERF1D02400
        1 ARRAY/21HO DATA EDIT CONTINUES)                                                 FID02410
  210      50 FORMAT(1HO5XA1)                                                             FID02420
  211      60 FORMAT(31HO****** FILL OPTION IGNORED IN I2,A1,6H ARRAY)                    FID02430
  212      70 FORMAT(24HO****** WARNING  ADDRESSI7,20H IS BEYOND LIMITS OFI3,A1,F1D02440
        1 6H ARRAY)                                                                       FID02450
  213      80 FORMAT(18A4)                                                                FID02460
  214         END                                                                         FID02470
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  28

 ISN   ST-NO                SOURCE PROGRAM                                              SEQUENCE

       C*************************************************************************FTM00010
       C                                                                          *FTM00020
       C                      M  A  I  N              -- 0.0 --                   *FTM00030
       C                                                                          *FTM00040
       C                                                                          *FTM00050
       C      ---   TWO DIMENSIONAL SENSITIVITY ANALYSIS   ---                   *FTM00060
       C                                                                          *FTM00070
       C                                                                          *FTM00080
       C               CLIANT          M.YAMAUTI                                  *FTM00090
       C               CODED BY        K.MINAMI, M.NAKAYAMA                       *FTM00100
       C                                                                          *FTM00110
       C                                    OCTOBER 1978                          *FTM00120
       C                                                                          *FTM00130
       C                                                                          *FTM00140
       C*************************************************************************FTM00150
  1          COMMON /IGNO  / MR,  MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,       FTM00160
            *                  MF4, MF5                                          FTM00170
  2          COMMON /CNTRL / IRR, IR1, IR2                                      FTM00180
  3          COMMON /PCOND / ICOND, NWAR, NERR                                  FTM00190
  4          COMMON /TITLE / ITITLE( 20)                                        FTM00200
       C                                                                         FTM00210
  5          COMMON   IB(100), D( 100000)                                       FTM00220
       C                                                                         FTM00230
  6          EQUIVALENCE ( D(2), LMAX )                                         FTM00240
  7          EQUIVALENCE (IB(63),LNGR  ), (IB(64),LNG1  ), (IB(65),LNG2  ),    FTM00250
            1          (IB(83),NG1   ), (IB(84),NG2   )                        FTM00260
  8          DATA BLANK / '    ' /                                              FTM00270
       C                                                                         FTM00280
       C******** SET FILE NUMBER                                                 FTM00290
       C                                                                         FTM00300
  9          MR  = 5                                                            FTM00310
 10          MW  = 6                                                            FTM00320
 11          MFF = 1                                                            FTM00330
 12          MFA = 2                                                            FTM00340
 13          MFC = 3                                                            FTM00350
 14          MFR = 4                                                            FTM00360
       C                                                                         FTM00370
 15          MF1 = 11                                                           FTM00380
 16          MF2 = 12                                                           FTM00390
 17          MF3 = 13                                                           FTM00400
 18          MF4 = 14                                                           FTM00410
 19          MF5 = 15                                                           FTM00420
       C                                                                         FTM00430
       C---       IB AREA 0 CLEAR                                              FTM00440
       C                                                                         FTM00450
 20          DO  50 I= 1, 100                                                   FTM00460
 21          IB(I) = 0                                                          FTM00470
 22       50 CONTINUE                                                           FTM00480
       C                                                                         FTM00490
       C---       SET CONSTANT DATA                                            FTM00500
       C                                                                         FTM00510
 23          LMAX = 100000                                                      FTM00520
 24          LNGR   = 900                                                       FTM00530
 25          LNG1   = 900                                                       FTM00540
 26          LNG2   = 900                                                       FTM00550
 27          DEFINE FILE   4 ( 200, 900, U, IRR )                               FTM00560
 28          DEFINE FILE  11 ( 200, 900, U, IR1 )                               FTM00570
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  29

ISN   ST-NO                    SOURCE PROGRAM      ( FTMAIN )                                          SEQUENCE
                                                                                                       FTM00580
 29           DEFINE FILE  12 ( 200, 900, U, IR2 )                                                     FTM00590
 30           NR1 = 1                                                                                  FTM00600
 31           NR2 = 1                                                                                  FTM00610
      C                                                                                               FTM00620
      C******** SET 0 TO CONDITION CORD                                                                FTM00630
      C                                                                                               FTM00640
 32           ICOND = 0                                                                                FTM00650
 33           NWAR  = 0                                                                                FTM00660
 34           NERR  = 0                                                                                FTM00670
      C                                                                                               FTM00680
      C******** SET BLANK TO TITLE                                                                     FTM00690
      C                                                                                               FTM00700
 35           DO 100 I= 1, 20                                                                          FTM00710
 36           ITITLE(I) = BLANK                                                                        FTM00720
 37         100 CONTINUE                                                                               FTM00730
      C                                                                                               FTM00740
      C******** CALL REAL MAIN ROUTINE                                                                 FTM00750
      C                                                                                               FTM00760
 38           CALL SUB1                                                                                FTM00770
 39           STOP                                                                                     FTM00780
 40           END
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  30

ISN   ST-NO                    SOURCE PROGRAM                                                          SEQUENCE
                                                                                                       HEA00010
  1           SUBROUTINE  HEADER                                                                       HEA00020
      C*************************************************************************                      *HEA00030
      C     HEADER                                          -- 1,1,4 --                                *HEA00040
      C                                                                                                *HEA00050
      C      1, SUBROUTINE                                                                             *HEA00060
      C          (1) WRITE OPTIONS OF SENSITIVITY ANALISI                                              *HEA00070
      C          (2) WRITE MATERIAL NUMBERS OF MICRO CROSS SECTION SETS                                *HEA00080
      C          (3) WRITE ENERGY STRUCTURE                                                            *HEA00090
      C          (4) WRITE PARAMETERS OF TWOTRAN-II                                                    *HEA00100
      C          (5) WRITE COARSE MESH MAP                                                             *HEA00110
      C                                                                                                *HEA00120
      C      2, CALLED BY      (INPUT1, INPUT4)                                                        *HEA00130
      C                                                                                                *HEA00140
      C                                                                                                *HEA00150
      C*************************************************************************                      *HEA00160
  2           COMMON /IOND  / MR,  MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,                           HEA00170
     *                        MF4, MF5                                                                HEA00180
  3           COMMON /TITLE / ITITLE( 20)                                                            HEA00190
  4           COMMON  IB(100), D(1)                                                                  HEA00200
  5           DIMENSION LD(1), IDATE(2)                                                              HEA00210
  6           EQUIVALENCE (LD(1),D(1)  )                                                             HEA00220
     *                    ,(LD(30),IPMTX ), (LD(33),IPMTV )                                           HEA00230
  7           EQUIVALENCE (IB( 2),LMAX  ), (IB( 3),LOPTN ), (IB( 4),LMATE ),                         HEA00240
     1                    (IB( 5),LENGY ), (IB( 6),LIPMTV), (IB( 7),LIPARM),                          HEA00250
     2                    (IB( 8),LIDUSE), (IB( 9),LIA   )                                            HEA00260
  8           EQUIVALENCE (IB(14),LIMX  ), (IB(15),LIMY  )                                           HEA00270
  9           DIMENSION  NXYZ1(3), NXYZ2(3), NXYZ3(3), NXYZ4(3)                                      HEA00280
 10           DOUBLE PRECISION  NXYZ1, NXYZ2, NXYZ3, NXYZ4                                           HEA00290
 11           DATA NXYZ1/'FINE X  ','FINE R  ','FINE R  '/                                           HEA00300
 12           DATA NXYZ2/'FINE Y  ','FINE Z  ','FINE T  '/                                           HEA00310
 13           DATA NXYZ3/'X       ','R       ','R       '/                                           HEA00320
 14           DATA NXYZ4/'Y       ','Z       ','T       '/                                           HEA00330
 15           IGEOM = LD(LIA+31)                                                                     HEA00340
      C                                                                                               HEA00350
      C******** WRITE CAPTION                                                                         HEA00360
      C                                                                                               HEA00370
 16           CALL DATE(IDATE)                                                                       HEA00380
 17           WRITE(MW,7000) IDATE                                                                   HEA00390
      C                                                                                               HEA00400
      C---       WRITE TITLE                                                                         HEA00410
 18           WRITE(MW,7100) ITITLE                                                                  HEA00420
      C                                                                                               HEA00430
      C******** WRITE INPUT OPTION OF SENSITIVITY ANALYSIS                                             HEA00440
      C                                                                                               HEA00450
 19           WRITE(MW,7110) (LD(L),L=LOPTN,LOPTN+4 )                                                HEA00460
 20           WRITE(MW,7120) (LD(L),L=LOPTN+5,LOPTN+10)                                              HEA00470
      C                                                                                               HEA00480
      C******** WRITE MATERIAL NUMBER OF MICRO CROSS SECTION SETS                                      HEA00490
      C                                                                                               HEA00500
 21           WRITE(MW,7130) (LD(L),L=LMATE,LENGY-1)                                                 HEA00510
      C                                                                                               HEA00520
      C******** WRITE ENERGY STRUCTURE                                                                 HEA00530
      C                                                                                               HEA00540
 22           WRITE(MW,7140)  (D(L),L=LENGY,LIPMTV-1)                                                HEA00550
      C                                                                                               HEA00560
      C******* REQUIRED COARSE MESH                                                                    HEA00570
      C
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  31

ISN   ST-NO                SOURCE PROGRAM     ( HEADER )                          SEQUENCE
 23         IF( IPMTX .EQ. 0 )                          GO TO   100               HEA00580
 24         IF( IPMTV .GT. 0 )                                                    HEA00590
           *WRITE(MW,7150) (LD(L),L=LIPMTV,LIPARM-1)                              HEA00600
 25         IF( IPMTV .EQ. 0 )       WRITE(MW,7170)                               HEA00610
 26         IF( IPMTV .LT. 0 )       WRITE(MW,7160)                               HEA00620
 27    100 CONTINUE                                                               HEA00630
       C                                                                          HEA00640
       C********* WRITE TWOTRAN-II INPUT PARAMETERS                               HEA00650
       C                                                                          HEA00660
 28         WRITE(MW,7500)                                                       HEA00670
 29         WRITE(MW,7200)                                                       HEA00680
 30         WRITE(MW,7210) (LD(L),L=LIDUSE,LIDUSE*17)                            HEA00690
 31         WRITE(MW,7220) (LD(L),L=LIA,LIA+4), NXYZ3(IGEOM), LD(LIA+5),         HEA00700
      1                    NXYZ4(IGEOM), (LD(L),L=LIA+6,LIA+11)                 HEA00710
 32         WRITE(MW,7230)  LD(LIA+12), (LD(L),L=LIA+14,LIA+19), LD(LIA+32),     HEA00720
      *                    LD(LIA+20), LD(LIA+33)                               HEA00730
 33         WRITE(MW,7240)  LD(LIA+22), LD(LIA+25), LD(LIA+28), NXYZ3(IGEOM),    HEA00740
      *                    LD(LIA+29), NXYZ4(IGEOM)                             HEA00750
 34         WRITE(MW,7250)  LD(LIA+31), LD(LIA+30), LD(LIA+34), LD(LIA+245),     HEA00760
      *                    LD(LIA+24), LD(LIA+26)                               HEA00770
       C                                                                          HEA00780
 35         WRITE(MW,7300)  (D(L),L=LIA+36,LIA+42)                               HEA00790
 36         WRITE(MW,7310)   D(LIA+47)                                           HEA00800
 37         WRITE(MW,7320)   D(LIA+48),  D(LIA+49)                               HEA00810
       C                                                                          HEA00820
 38         RETURN                                                               HEA00830
 39    7000 FORMAT(1H1////36X, 60('*')/36X, '*', 58X, '*'/36X, '*', 58X, '*'     HEA00840
           */36X,'*                  S E N S I T I V I T Y   A N A L Y S I S    *HEA00850
           *'/36X, '*', 58X, '*'/ 36X, '*', 58X, '*'                            HEA00860
           */36X,'*                  O F   T W O T R A N - II                  *HEA00870
           *'/36X, '*', 58X, '*'/ 36X, '*', 58X, '*'                            HEA00880
           */36X, 60('*')                                                       HEA00890
           *//101X, 'DATA    ', 2A4  )                                          HEA00900
 40    7100 FORMAT(////19X, 'C A S E   = ', 20A4 )                               HEA00910
 41    7110 FORMAT(/////26X, I3, 2X,                                            HEA00920
           *'NE      NUMBER OF MICRO CROSS SECTION SETS'                        HEA00930
           *//26X, I3, 2X,                                                      HEA00940
           *'IGM     NUMBER OF ENERGY GROUPS'                                   HEA00950
           *//26X, I3, 2X,                                                      HEA00960
           *'MATR    MATERIAL NUMBER FOR THE RESPONSE FUNCTION'                 HEA00970
           *//26X, I3, 2X,                                                      HEA00980
           *'IRESP   0/1/2  EFFECT OF CROSS SECTION CHANGE OF DETECTOR'         HEA00990
           *//45X,          'NOT CONSIDER / CONSIDER / BOTH'                    HEA01000
           *///26X, I3, 2X,                                                     HEA01010
           *'ITAPE   0/1/2  RESTART OPTION   TOTAL / RESTART / ONLY FLUX MATRIX'HEA01020
           *' )                                                                 HEA01030
 42    7120 FORMAT(//26X, I3, 2X,                                               HEA01040
           *'IPCRS  0/1  PRINT OF MICRO CROSS SECTION   NO / YES'              HEA01050
           *//26X, I3, 2X,                                                     HEA01060
           *'IPPL   0/1  PRINT OF PL EFFECT FOR SENSITIVITY MATRIX   NO / YES'HEA01070
           *//26X, I3, 2X,                                                     HEA01080
           *'IPMTX  0/1/2/3  PRINT OF SENSITIVITY MATRIX' //45X,               HEA01090
           *'NO / ONLY SCALAR CROSS SECTION'//45X,                             HEA01100
           *'/ SCALAR + SCATTERING MATRIX (FOR EACH PL COMPONENT AND SUM)'     HEA01110
           *//45X,                                                             HEA01120
           -'/ SCALAR + SCATTERING MATRIX (SUM OF PL COMPONENT)'               HEA01130
           -//26X, I3, 2X,                                                    HEA01140

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79,06,22/09:32    PAGE  32

ISN   ST-NO                SOURCE PROGRAM     ( HEADER )                          SEQUENCE
          -'IPLOT  0/1  PLOT OF SENSITIVITY SPECTRA   NO / YES'                  HEA01150
          -//26X, I3, 2X,                                                       HEA01160
          -'IPLTZ  0/1  PLOT OF SENSITIVITY SPECTRA FOR EACH COARSE MESH REGI'HEA01170
          -ON   NO / YES'                                                       HEA01180
          1//26X, I3, 2X,                                                       HEA01190
          1'IPMTV  -1/0/N  PRINT OF SENSITIVITY MATRIX AND '                    HEA01200
          1'PLOT OF SENSITIVITY SPECTRA'//45X,                                  HEA01210
          1'ALL COARSE MESH / NO / REQUIRED MESH')                              HEA01220
 43    7130 FORMAT(1H1///11X, 'MATERIAL NUMBER OF MICRO CROSS SECTION SET'      HEA01230
          - /1X,( /11X, 20(1X,I4) ) )                                           HEA01240
 44    7140 FORMAT(///11X,'ENERGY STRUCTURE '                                   HEA01250
          - /1X,( /11X, 1P8E12.4 ) )                                            HEA01260
 45    7150 FORMAT(///11X,'PRINT SENSITIVITY MATRIX FOR REQUIRED COARSE MESH'   HEA01270
      1        ,(/11X,8('(',I3,',',I3,')',3X)))                                HEA01280
 46    7160 FORMAT(///11X,'PRINT SENSITIVITY MATRIX FOR ALL COARSE MESH' )      HEA01290
 47    7170 FORMAT(///11X,'PRINT SENSITIVITY MATRIX ONLY SUM IN VOLUME' )       HEA01300
 48    7200 FORMAT(///'      THIS CASE WAS PROCESSED BY THE TWOTRUN-II CODE OF   HEA01310
          -04/24/73 ')                                                          HEA01320
 49    7210 FORMAT(1H , 18A4)                                                   HEA01330
 50    7220 FORMAT (1HO,14,26H ITH    0/1 DIRECT/ADJOINT/1X,14,43H ISCT   0/N HEA01340
          1ISOTROPIC/NTH ORDER ANISOTROPIC/1X,14,58H ISN    SN ORDER ( +/= BUHEA01350
          2ILT-IN/STANDARD INTERFACE FILE ) /1X,14,18H IGM    NO. GROUPS/1X,IHEA01360
          34,24H IM     NO. COARSE MESH ,A1,11H INTERVALS /1X,14,24H JM     NHEA01370
          4D, COARSE MESH ,A1,11H INTERVALS /1X,12,12,12,4X,81HLEFT,RIGHT,HEA01380
          5BOTTOM,TOP BOUNDARY CONDITION 0/1/2/3 VACUUM/REFLECTIVE/WHITE/PEROHEA01390
          6DIC /1X,14,53H IEVT   0/1/2/3/4  0/K/ALPHA/C/DELTA  CALCULATION   HEA01400
          7 /1X,14,114H ISTART =5/-4/-3/-2/-1/0/1/2/3/4/6 STARTING OPTIONS ( HEA01410
          8MINUS FOR ISOTROPIC COMPONENT ONLY ) SEE MANUAL FOR DETAILS /)     HEA01420
 51    7230 FORMAT(1X,14,31H MT       TOTAL NO. OF MATERIALS                   HEA01430
      1                                  /1X,14,35H MS     NO. OF MHEA01440
          21XTURE INSTRUCTIONS/1X,14,34H IMT    ROW OF TOTAL CROSS SECTION/1XHEA01450
          3,14,41H IMS    ROW OF SELF SCATTER CROSS SECTION/1X,14,39H IMM    HEA01460
          4LAST ROW OF CROSS SECTION TABLE/1X,14,63M1@OPT   0/1/2/3/4/5 NONE/HEA01470
          5SAME AS ISTART FOR SOURCE DISTRIBUTION/1X,14,51H I@AN   O/N  ISOTRHEA01480
          6OPIC/NTH ORDER ANISOTROPIC SOURCE/1X,12,12,12,6X,6OM1@R/1@B/1@T R)HEA01490
          7GHT,BOTTOM,TOP BOUNDARY SOURCE ( 0/1 NO/YES ) )                    HEA01500
 52    7240 FORMAT (1X,14,55H IPVT   0/1/2 NONE/K/ALPHA  PARAMETRIC E(GENVALUEHEA01510
          1 TYPE /1X,14,33H ITL   MAX NO. INNER ITERATIONS /1X,14,26H IXM    HEA01520
          2 0/1 NO/YES MODIFY ,A1,20H RAD)] (IEVT=4 ONLY)//1X,14,26H IYM    OHEA01530
          3/1 NO/YES MODIFY ,A1,20H RAD)] (IEVT=4 ONLY) )                     HEA01540
 53    7250 FORMAT (1X,14,41H IGEOM  1/2/3 (X,Y)/(R,Z)/(R,T) GEOMETRY /1X,14,6HEA01550
          11H IEDOPT 0/1/2/3/4=NONE/N EDIT OPTIONS SEE MANUAL FOR DETAILS /1XHEA01560
          2,14,51H ISDF   0/1 NO/YES INPUT FINE MESH DENSITY FACTORS          HEA01570
          3          /1X,14,53H IANG    =1/0/1 PRINT AND STORE/NO/STORE ANHEA01580
          4ULAR FLUX /1X,14,96H IMC    NO. OF HORIZON, MAT,MESH INTERVALS (IHEA01590
          5F,NE.0, REBAL,MESH,NE,MAT,MESH WHICH IS EDIT MESH) /1X,14, 42H JMCHEA01600
          6    NO. OF VERTICAL MAT,MESH INTERVALS// )                         HEA01610
 54    7300 FORMAT (1X,1PE11.3,24H EV     EIGENVALUE GUESS/1X,1PE11.3,27H EVM HEA01620
          1   EIGENVALUE MODIFIER/1X,1PE11,3,30H PV     PARAMETRIC E(GENVALUEHEA01630
          2 /1X,1PE11,3,33H XLAL   SEARCH LAMBDA LOWER LIMIT/1X,1PE11,3,33H XHEA01640
          3LAH   SEARCH LAMBDA UPPER LIMIT/1X,1PE11,3,33H XLAX   FINE MESH SEHEA01650
          4ARCH PRECISION //1X,1PE11,3,30H EPS    CONVRGENCE PRECISION  )     HEA01660
 55    7310 FORMAT (1X,1PE11.3,32H NORM   NORMALIZATION  AMPLITUDE)            HEA01670
 56    7320 FORMAT (1X,1PE11.3,37H POD    PARAMETER OSCILLATION DAMPER /1X,1PEHEA01680
          111.3,61H BMGT   TOTAL BUCKLING HEIGHT IN CM FOR (X,Y) AND (R,T) ONHEA01690
          2LY //)                                                             HEA01700
 57    7500 FORMAT(1H1)                                                       HEA01710

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  33

ISN   ST-NO                SOURCE PROGRAM     ( HEADER )                          SEQUENCE
 58         END                                                                  HEA01720
```

```
FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  34

ISN  ST-NO                SOURCE PROGRAM                                                    SEQUENCE
  1        SUBROUTINE  INPUT1 ( KER )                                                      INP00010
      C*****************************************************************                 *INP00020
      C      INPUT1                                    -- 1.1 --                          *INP00030
      C                                                                                   *INP00040
      C       1. SUBROUTINE                                                               *INP00050
      C           (1) READ CARD DATA                                                      *INP00060
      C           (2) CHECK DATA                                                          *INP00070
      C           (3) WRITE CAPTION                                                       *INP00080
      C           (4) READ PARAMETER FROM FORWARD FILE(MFF)                               *INP00090
      C           (5) ADDRESS SET                                                         *INP00100
      C                                                                                   *INP00110
      C       2. CALLED BY      ( SUB1 )                                                  *INP00120
      C       3. CALLS          ( FIDO, CHECK, HEADER, REED, ERROR )                      *INP00130
      C*****************************************************************                 *INP00140
  2        COMMON /TITLE / ITITLE(20)                                                     INP00150
  3        COMMON /IONO  / MR, MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,                    INP00160
           *               MF4, MF5                                                       INP00170
  4        COMMON   IB( 100), D(1)                                                        INP00180
  5        DIMENSION  LD( 500 )                                                           INP00190
  6        EQUIVALENCE ( D(1), LD(1) )                                                    INP00200
  7        EQUIVALENCE (LD( 2),LMAX  ), (LD( 3),LOPTN ), (LD( 4),LMATE ),                INP00210
           1           (LD( 5),LENGY ), (LD( 6),LIPMTV), (LD( 7),LIPARM),                INP00220
           2           (LD( 8),LIDUSE), (LD( 9),LIA   ), (LD(10),LMIXNM),                INP00230
           3           (LD(11),LMIXCM), (LD(12),LMIXDN), (LD(13),LIDCS ),                INP00240
           4           (LD(14),LIMX  ), (LD(15),LIMY  ), (LD(16),LXR   ),                INP00250
           5           (LD(17),LYR   ), (LD(18),LFL   ), (LD(19),LSUM  ),                INP00260
           6           (LD(20),LWORK )                                                   INP00270
  8        EQUIVALENCE (LD(23),NE    ), (LD(24),IGM   ), (LD(25),MATR  ),                INP00280
           1           (LD(26),IRESP ), (LD(27),ITAPE ), (LD(28),IPCRS ),                INP00290
           2           (LD(29),IPPL  ), (LD(30),IPMTX ), (LD(31),IPLOT ),                INP00300
           3           (LD(32),IPLTZ ), (LD(33),IPMTV )                                  INP00310
      C                                                                                   INP00320
  9        EQUIVALENCE (IB(23),NORDM ), (IB(26),LAS1  )                                   INP00330
 10        EQUIVALENCE (IB(34),ISCT  ), (IB(35),ISCS  ), (IB(37),IGM1  ),                INP00340
           1           (IB(38),IM    ), (IB(39),JM    ), (IB(40),MT    ),                INP00350
           2           (IB(44),IHM   ), (IB(47),NM    ), (IB(48),NMG   ),                INP00360
           3           (IB(49),IT    ), (IB(50),JT    ), (IB(61),MM    ),                INP00370
           4           (IB(63),LNGR  ), (IB(64),LNG1  ), (IB(65),LNG2  ),                INP00380
           5           (IB(66),KIB   ), (IB(67),KD    )                                  INP00390
 11        EQUIVALENCE (IB(68),KVL   ), (IB(69),KCR   ), (IB(70),KRT   ),                INP00400
           1           (IB(71),KFL   ), (IB(72),NFL   ), (IB(74),KFF   ),                INP00410
           2           (IB(75),NFF   ), (IB(77),KFA   ), (IB(78),NFA   ),                INP00420
           3           (IB(79),KQS   ), (IB(80),NQS   ), (IB(73),NRT   ),                INP00430
           4           (IB(83),NQ1   ), (IB(84),NQ2   ),                                 INP00440
           5           (IB(86),LM    ), (IB(87),LP1   ), (IB(88),LP2   ),                INP00450
           6           (IB(89),LP3   ), (IB(90),LP4   )                                  INP00460
 12        KER = 0                                                                        INP00470
      C                                                                                   INP00480
      C******** READ CARD DATA                                                            INP00490
      C                                                                                   INP00500
 13        J = 1                                                                          INP00510
 14        WRITE(MW,7000)                                                                 INP00520
 15     100 CONTINUE                                                                      INP00530
 16        READ(MR, 7100,END=200)  (ITITLE(I),I=1,20)                                     INP00540
 17        WRITE(MFC,7100)         (ITITLE(I),I=1,20)                                     INP00550
 18        WRITE(MW,7200)        J,(ITITLE(I),I=1,20)                                     INP00560
 19        J = J + 1                                                                      INP00570

FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  35

ISN  ST-NO                SOURCE PROGRAM     ( INPUT1 )                                   SEQUENCE

 20        GO TO 100                                                                      INP00580
      C                                                                                   INP00590
 21     200 CONTINUE                                                                     INP00600
 22        ENDFILE  MFC                                                                   INP00610
 23        REWIND   MFC                                                                   INP00620
 24        WRITE(MW,7500)                                                                 INP00630
      C******** READ TITLE CARD                                                           INP00640
 25        READ(MFC,7100)     (ITITLE(I),I=1,20)                                          INP00650
 26        LOPTN  = 23                                                                    INP00660
 27        LMATE  = LOPTN + 11                                                            INP00670
      C******** READ OPTION                                                               INP00680
 28        CALL FIDO( 3, KER, MFC, MW, D, LD )                                            INP00690
 29        IGM1 = IGM + 1                                                                 INP00700
 30        LENGY  = LMATE + NE                                                            INP00710
 31        LIPMTV = LENGY + IGM1                                                          INP00720
 32        IIP = IPMTV                                                                    INP00730
 33        IF( IIP .LE. 0 )   IIP = 0                                                     INP00740
 34        LIPARM = LIPMTV + 2*IABS(IIP)                                                  INP00750
      C******** READ MICRO MATERIAL NUMBER                                                INP00760
 35        CALL FIDO( 3, KER, MFC, MW, D, LD )                                            INP00770
      C******** READ ENERGY GROUPS                                                        INP00780
 36        CALL FIDO( 3, KER, MFC, MW, D, LD )                                            INP00790
      C******** READ COARSE MESH SETS                                                     INP00800
 37        CALL FIDO( 3, KER, MFC, MW, D, LD )                                            INP00810
 38        REWIND   MFC                                                                   INP00820
      C                                                                                   INP00830
      C******** CHECK INPUT DATA                                                          INP00840
      C                                                                                   INP00850
 39        CALL CHECK( NE, IGM, MATR, IRESP, ITAPE, IPCRS, IPPL, IPMTX,                   INP00860
           1      IPMTV, IPLOT, IPLTZ, LD(LMATE), D(LENGY), IGM1, KER )                  INP00870
 40        IF( KER.GE.2 )                                  GO TO 8000                     INP00880
 41        IF( ITAPE .EQ. 1 )                              GO TO 9000                     INP00890
      C                                                                                   INP00900
      C******** READ PARAMETER FROM FORWARD FILE AND ADDRESS SET                          INP00910
      C                                                                                   INP00920
 42        CALL REED(MFF, 0, 0.0, 0, 6 )                                                  INP00930
 43        CALL REED(MFF, LD(LIPARM), 0.0, ITEMP, 6 )                                     INP00940
 44        LIDUSE = LIPARM + ITEMP                                                        INP00950
 45        CALL REED(MFF, LD(LIDUSE), 0.0, ITEMP, 6 )                                     INP00960
 46        LIA    = LIDUSE + ITEMP                                                        INP00970
 47        CALL REED(MFF, 0,       D(LIA), ITEMP, 3 )                                     INP00980
 48        LMIXNM = LIA + ITEMP                                                           INP00990
      C                                                                                   INP01000
 49        MS     = LD(LIA+14)                                                            INP01010
 50        LMIXCM = LMIXNM + MS                                                           INP01020
 51        LMIXDN = LMIXCM + MS                                                           INP01030
 52        LIDCS  = LMIXDN + MS                                                           INP01040
      C                                                                                   INP01050
 53        IM     = LD(LIA+4)                                                             INP01060
 54        JM     = LD(LIA+5)                                                             INP01070
 55        MM     = LD(LIA+56)                                                            INP01080
 56        NM     = LD(LIA+57)                                                            INP01090
 57        LIMX   = LIDCS + IM*JM                                                         INP01100
 58        LIMY   = LIMX + IM                                                             INP01110
 59        LXR    = LIMY + JM                                                             INP01120
 60        LYR    = LXR  + IM+1                                                           INP01130
 61        LW     = LYR  + JM+1                                                           INP01140
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79,06,22/09:32    PAGE  36

ISN   ST-NO                SOURCE PROGRAM     ( INPUT1 )                                  SEQUENCE
 62         LP1    = LW   + MM                                                           INP01150
 63         LP2    = LP1  + NM*MM                                                        INP01160
 64         LP3    = LP2  + NM*MM                                                        INP01170
 65         LP4    = LP3  + NM*MM                                                        INP01180
 66         LSUM   = LP4  + NM*MM                                                        INP01190
 67         LWORK  = LSUM + 1                                                            INP01200
                                                                                         INP01210
 68         DO 1000 I=1, 22                                                             INP01220
 69    1000 IB(I) = LD(I)                                                               INP01230
                                                                                         INP01240
 70         IB(23) = LD(LIPARM+1)                                                       INP01250
                                                                                         INP01260
 71         IB(26) = LD(LIDUSE+18)                                                      INP01270
 72         IB(27) = LD(LIDUSE+19)                                                      INP01280
 73         IB(28) = LD(LIDUSE+22)                                                      INP01290
 74         IB(29) = LD(LIDUSE+26)                                                      INP01300
 75         IB(30) = LD(LIDUSE+30)                                                      INP01310
 76         IB(31) = LD(LIDUSE+34)                                                      INP01320
                                                                                         INP01330
 77         IB(34) = LD(LIA+1+  2)                                                      INP01340
 78         IB(35) = IB(34) + 1                                                         INP01350
 79         IB(36) = IGM                                                                INP01360
 80         IB(37) = IGM1                                                               INP01370
 81         IB(38) = LD(LIA-1+  5)                                                      INP01380
 82         IB(39) = LD(LIA-1+  6)                                                      INP01390
 83         IB(40) = LD(LIA-1+ 13)                                                      INP01400
 84         IB(41) = LD(LIA-1+ 15)                                                      INP01410
 85         IB(42) = LD(LIA-1+ 16)                                                      INP01420
 86         IB(43) = LD(LIA-1+ 17)                                                      INP01430
 87         IB(44) = LD(LIA-1+ 18)                                                      INP01440
 88         IB(45) = LD(LIA-1+ 25)                                                      INP01450
 89         IB(46) = LD(LIA-1+ 27)                                                      INP01460
 90         IB(47) = LD(LIA-1+ 58)                                                      INP01470
 91         IB(48) = LD(LIA-1+ 59)                                                      INP01480
 92         IB(49) = LD(LIA-1+ 64)                                                      INP01490
 93         IB(50) = LD(LIA-1+ 65)                                                      INP01500
 94         IB(51) = LD(LIA-1+ 80)                                                      INP01510
 95         IB(52) = LD(LIA-1+ 81)                                                      INP01520
 96         IB(53) = LD(LIA-1+ 87)                                                      INP01530
 97         IB(54) = LD(LIA-1+111)                                                      INP01540
 98         IB(55) = LD(LIA-1+118)                                                      INP01550
 99         IB(56) = LD(LIA-1+128)                                                      INP01560
100         IB(57) = LD(LIA-1+129)                                                      INP01570
101         IB(58) = LD(LIA-1+130)                                                      INP01580
102         IB(59) = LD(LIA-1+112)                                                      INP01590
103         IB(60) = LD(LIA-1+113)                                                      INP01600
                                                                                        INP01610
104         IF( IGM .NE. LD(LIA+3) )                    GO TO 8100                      INP01620
                                                                                        INP01630
105         KIB    = 1                                                                  INP01640
106         KD     = KIB + 100/LNGR                                                     INP01650
107         IF( MOD( 100*LNGR ) .NE. 0 )   KD = KD + 1                                  INP01660
108         KVL    = KD + LWORK/LNGR                                                    INP01670
109         IF( MOD( LWORK*LNGR ) .NE. 0 )  KVL = KVL + 1                               INP01680
110         KCR    = KVL + IT*JT/LNGR                                                   INP01690
111         IF( MOD( IT*JT, LNGR ) .NE. 0 )   KCR = KCR + 1                             INP01700
112         KRT    = KCR + IMM*IGM*MT/LNGR                                              INP01710


      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79,06,22/09:32    PAGE  37

ISN   ST-NO                SOURCE PROGRAM     ( INPUT1 )                                  SEQUENCE

113         IF( MOD( IMM*IGM*MT, LNGR ) .NE. 0 )  KRT = KRT + 1                         INP01720
114         NRT    = IM*JM/LNGR                                                         INP01730
115         IF( MOD( IM*JM, LNGR ) .NE. 0 )        NRT = NRT + 1                        INP01740
116         KFL    = KRT + NRT*IGM                                                      INP01750
117         NFL    = NM*IGM*IGM/LNGR                                                    INP01760
118         IF( MOD( NM*IGM*IGM, LNGR ) .NE. 0 ) NFL = NFL + 1                          INP01770
                                                                                        INP01780
119         KFF    = 1                                                                  INP01790
120         NFF    =    IT*JT/LNG1                                                      INP01800
121         IF( MOD(    IT*JT, LNG1 ) .NE. 0 )     NFF = NFF + 1                        INP01810
122         KFA    = 1                                                                  INP01820
123         NFA    = NFF                                                                INP01830
124         K0S    = KFA + NFA*IGM*NM                                                   INP01840
125         N0S    = (N02-N01+1)*IT*JT/LNG2                                             INP01850
126         IF( MOD( (N02-N01+1)*IT*JT, LNG2 ) .NE. 0 )    N0S = N0S + 1                INP01860
      *     WRITE(MW,7400)  IB                                                         INP01870
      C                                                                                INP01880
      C******** PRINT OUT CAPTION                                                      INP01890
      C                                                                                INP01900
127         CALL HEADER                                                              INP01910
      C                                                                                INP01920
128         GO TO 9000                                                               INP01930
      C                                                                                INP01940
      C******** ERROR STOP                                                            INP01950
      C                                                                                INP01960
 8000 CONTINUE                                                                        INP01970
130         KER = 2                                                                  INP01980
131         CALL ERROR(2, 5,'INPUT1- 1 ** TRACE  ')                                  INP01990
132         GO TO 9000                                                               INP02000
 8100 CONTINUE                                                                        INP02010
134         KER = 2                                                                  INP02020
135         WRITE(MW,7300)  IGM, LD(LIA+3)                                           INP02030
136         CALL ERROR(2,10,'INPUT1-2 ** INPUT IGM ERROR             ')              INP02040
      C                                                                              INP02050
 9000 CONTINUE                                                                       INP02060
138         RETURN                                                                   INP02070
139    7000 FORMAT(1H1//41X,'INPUT DATA LIST'                                        INP02080
      *          //11X,  '....+....1....+....2....+....3....+....4',                INP02090
      *                 '....+....5....+....6....+....7....+....8'/)               INP02100
140    7100 FORMAT(20A4)                                                             INP02110
141    7200 FORMAT(1HO,4X, I3,3X, 20A4 )                                             INP02120
142    7300 FORMAT(1HO,4X,'INPUT   IGM =', I10/                                      INP02130
     1          5X,'T*OTRAN IGM =', I10)                                            INP02140
     *7400 FORMAT(/'  IB'/(5X,10I10))                                               INP02150
143    7500 FORMAT(1H1)                                                              INP02160
144         END                                                                      INP02170
```

```
FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  38

ISN   ST-NO                SOURCE PROGRAM                                                    SEQUENCE
  1         SUBROUTINE  INPUT2                                                             INP00010
           1     ( WICDS, VFLX, CROSS, WORK,                                               INP00020
           2       IM, JM, IT, JT, IMM, IGM, MT, MWORK, KER )                              INP00030
      C*****************************************************************                  *INP00040
      C     INPUT2                    -- 1.2 --                                           *INP00050
      C                                                                                     *INP00060
      C      1. SUBROUTINE                                                                *INP00070
      C          (1) READ FORWARD DUMP FILE(MFF)                                          *INP00080
      C          (2) SET PARAMETERS                                                       *INP00090
      C                1. MIXING TABLES                                                   *INP00100
      C                2. MATERIAL ASSIGNMENT                                             *INP00110
      C                3. COARSE MESH BOUNDARYS                                           *INP00120
      C          (3) WRITE RESTART FILE(MFR)                                              *INP00130
      C                1. VOLUMES                                                         *INP00140
      C                2. CROSS SECTIONS                                                  *INP00150
      C          (4) WRITE SCRATCH DISK(MF1)                                              *INP00160
      C                1  FORWARD FLUXES                                                  *INP00170
      C                                                                                   *INP00180
      C      2. CALLED BY     ( SUB1 )                                                    *INP00190
      C                                                                                   *INP00200
      C      3. CALLS         ( REED )                                                    *INP00210
      C*****************************************************************                  *INP00220
  2         DIMENSION  WICDS(IM,JM), VFLX(IT,JT), CROSS(IMM,IGM,MT),                      INP00230
           *           WORK(MWORK)                                                      INP00240
  3         COMMON /IONO  / MR,  MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,                  INP00250
           *                  MF4, MF5                                                   INP00260
  4         COMMON /CNTRL / IRR, IR1, IR2                                                 INP00270
  5         COMMON      IB(100), D(1)                                                     INP00280
  6         DIMENSION  LD(1)                                                              INP00290
  7         EQUIVALENCE ( DC 1),LD(1) )                                                   INP00300
  8         EQUIVALENCE (IB( 9),LIA   )                                                   INP00310
  9         EQUIVALENCE (IB(10),LMIXNM), (IB(11),LMIXCM), (IB(12),LMIXDN),                INP00320
           1            (IB(13),LIDCS ), (IB(14),LIMX  ), (IB(15),LIMY  ),              INP00330
           1            (IB(16),LXR   ), (IB(17),LYR   ),                               INP00340
           2            (IB(20),LWORK ), (IB(23),NORDM ), (IB(26),LAST  ),              INP00350
           3            (IB(27),LASTEC), (IB(28),LTSO  ), (IB(29),LTFX  ),              INP00360
           4            (IB(30),LTXS  ),                                                INP00370
           5            (IB(34),ISCT  ), (IB(35),ISCS  ),                               INP00380
           6            (IB(37),IGM1  ), (IB(41),MS    ), (IB(42),IMT   ),              INP00390
           7            (IB(43),IMS   ), (IB(45),IMC   ),                               INP00400
           8            (IB(46),JMC   ), (IB(47),NM    ), (IB(48),NM0   ),              INP00410
           2            (IB(51),LIMXO ), (IB(52),LIMYO ), (IB(53),LA5   ),              INP00420
           3            (IB(54),LDC   ), (IB(55),LYH   ), (IB(56),LMN   ),              INP00430
           4            (IB(57),LMC   ), (IB(58),LMO   ), (IB(61),MM    )               INP00440
 10         EQUIVALENCE (IB(63),LNGR  ), (IB(64),LNG1  ),                                INP00450
           1            (IB(68),KVL   ), (IB(69),KCR   ), (IB(70),KRT   ),              INP00460
           2            (IB(74),KFF   ), (IB(75),NFF   ),                               INP00470
           3            (IB(59),LXRAD ), (IB(60),LYRAD ),                               INP00480
           5            (IB(86),LW    ), (IB(87),LP1   ), (IB(88),LP2   ),              INP00490
           6            (IB(89),LP3   ), (IB(90),LP4   )                                INP00500
 11         KER = 0                                                                      INP00510
      C                                                                                   INP00520
      C******** READ CONSTANT DATA                                                        INP00530
      C                                                                                   INP00540
 12         CALL REED( MFF, 0, WORK, ITEMP, 3)                                           INP00550
      C----      SET MIXING TABLE                                                        INP00560
 13         DO 100 I=1, MS                                                               INP00570


FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  39

ISN   ST-NO                SOURCE PROGRAM     ( INPUT2 )                                  SEQUENCE
 14         D(LMIXNM-1+I) = WORK(LMN-1+I)                                                INP00580
 15         D(LMIXCM-1+I) = WORK(LMC-1+I)                                                INP00590
 16         D(LMIXDN-1+I) = WORK(LMD-1+I)                                                INP00600
 17       100 CONTINUE                                                                   INP00610
      C----      SET MATERIAL ASSIGNMENT                                                 INP00620
 18         J = 0                                                                        INP00630
 19         DO 200 K= 1, IMC*JMC                                                         INP00640
 20         IF( MOD( K, IMC ) .EQ. 1 )  J = J + 1                                        INP00650
 21         I = K - (J-1)*IMC                                                            INP00660
 22         IF( J .GT. JM )                                  GO TO 210                   INP00670
 23         IF( I .GT. IM )                                  GO TO 200                   INP00680
 24         WICDS(I,J) = WORK(LDC-1+K)                                                   INP00690
 25       200 CONTINUE                                                                   INP00700
 26       210 CONTINUE                                                                   INP00710
      C                                                                                   INP00720
 27         DO 300 J=1, JM                                                               INP00730
 28         DO 300 I=1, IM                                                               INP00740
 29         D(LIDCS-1+I+(J-1)*IM) = WICDS(I,J)                                           INP00750
 30       300 CONTINUE                                                                   INP00760
      C----      SET COARSE MESH BOUNDARYS                                               INP00770
 31         DO 400 I= 1, IM                                                              INP00780
 32         D(LIMX-1+I) = WORK(LIMXO-1+I)                                                INP00790
 33       400 CONTINUE                                                                   INP00800
 34         DO 500 J= 1, JM                                                              INP00810
 35         D(LIMY-1+J) = WORK(LIMYO-1+J)                                                INP00820
 36       500 CONTINUE                                                                   INP00830
      C                                                                                   INP00840
 37         DO 600 I= 1, IM+1                                                            INP00850
 38         D(LXR-1+I) = WORK(LXRAD-1+I)                                                 INP00860
 39       600 CONTINUE                                                                   INP00870
 40         DO 700 J= 1, JM+1                                                            INP00880
 41         D(LYR-1+J) = WORK(LYRAD-1+J)                                                 INP00890
 42       700 CONTINUE                                                                   INP00900
      C                                                                                   INP00910
 43         IC = 0                                                                       INP00920
 44         LLW = LD(LIA+118)                                                            INP00930
 45         LLP1 = LD(LIA+123)                                                           INP00940
 46         LLP2 = LD(LIA+124)                                                           INP00950
 47         LLP3 = LD(LIA+125)                                                           INP00960
 48         LLP4 = LD(LIA+126)                                                           INP00970
 49         DO 800 J = 1, MM                                                             INP00980
 50         D(LW-1+J) = WORK(LLW-1+J)                                                    INP00990
 51         DO 800 I = 1, NM                                                             INP01000
 52         IC = IC + 1                                                                  INP01010
 53         D(LP1-1+IC) = WORK(LLP1-1+IC)                                                INP01020
 54         D(LP2-1+IC) = WORK(LLP2-1+IC)                                                INP01030
 55         D(LP3-1+IC) = WORK(LLP3-1+IC)                                                INP01040
 56         D(LP4-1+IC) = WORK(LLP4-1+IC)                                                INP01050
 57       800 CONTINUE                                                                   INP01060
      C----      SET VOLUME TO RESTART FILE                                              INP01070
 58         DO 1100 J= 1, JT                                                             INP01080
 59         DO 1100 I= 1, IT                                                             INP01090
 60         VFLX(I,J) = WORK(LA5-1+I) * WORK(LYH-1+J)                                    INP01100
 61       1100 CONTINUE                                                                  INP01110
 62         IRR = KVL                                                                    INP01120
 63         WRITE(MFR,IRR)  ((VFLX(I,J),I=1,IT),J=1,JT)                                  INP01130
 64         IF( IRR .NE. KCR )       KCR = IRR                                           INP01140
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  40

ISN   ST-NO                SOURCE PROGRAM      ( INPUT2 )                          SEQUENCE
      C                                                                           INP01150
      C******** READ FORWARD FLUX AND SET IT TO SCRATCH DISK                       INP01160
      C                                                                           INP01170
 65         IR1  = KFF                                                           INP01180
 66         DO 2500 L= 1, IGM                                                    INP01190
 67         CALL REED( MFF, 0, WORK, ITEMP, 3 )                                  INP01200
 68         DO 2300 K= 1, NM                                                     INP01210
 69         DO 2100 J= 1, JT                                                     INP01220
 70         DO 2100 I= 1, IT                                                     INP01230
 71         VFLX(I,J)= WORK(K+((I-1)+(J-1)*IT)*NM)                               INP01240
 72  2100   CONTINUE                                                            INP01250
 73         WRITE(MF1'IR1)  ((VFLX(I,J),I=1,IT),J=1,JT)                          INP01260
 74  2300   CONTINUE                                                            INP01270
 75  2500   CONTINUE                                                            INP01280
 76         NFF = (IR1-1)/IGM/NM                                                 INP01290
      C                                                                         INP01300
      C******** READ CROSS SECTION AND SET IT TO RESTART FILE                    INP01310
      C                                                                         INP01320
 77         LS = LTSO                                                          INP01330
 78         DO 3000 K= 1, NORDM                                                INP01340
 79         L = (K-1)*LAST + 1                                                 INP01350
 80         CALL REED( MFF, 0, WORK(L), ITEMP, 3 )                             INP01360
 81  3000   CONTINUE                                                          INP01370
 82         DO 3200 K= 1, IGM                                                  INP01380
 83         DO 3200 J= 1, MT                                                   INP01390
 84         DO 3200 I= 1, IHM                                                  INP01400
 85         LL = LS + (K-1)*LTXS + (J-1)*IHM + I                               INP01410
 86         CROSS(I,K,J) = WORK(LL)                                            INP01420
 87  3200   CONTINUE                                                          INP01430
 88         WRITE(MFR'IRR) (((CROSS(I,K,J),I=1,IHM),K=1,IGM),J=1,MT)           INP01440
 89         KRT = IRR                                                          INP01450
 90         CALL REED( MFF, 0, 0.0, 0, 4 )                                     INP01460
 91         RETURN                                                             INP01470
 92         END                                                                INP01480
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  41

ISN   ST-NO                SOURCE PROGRAM                                      SEQUENCE
  1         SUBROUTINE  INPUT3                                                INP00010
           1   ( AFLX, SOURCE, WORK, IT, JT, N01, N02, MWORK, KER )             INP00020
      C*****************************************************************      *INP00030
      C     INPUT3                    -- 1,3 --                               *INP00040
      C                                                                       *INP00050
      C     1. SUBROUTINE                                                     *INP00060
      C          (1) READ ADJOINT DUMP FILE(MFA)                              *INP00070
      C          (2) WRITE SCRATCH DISK(MF2)                                  *INP00080
      C                1. ADJOINT FLUXES                                      *INP00090
      C                2. REACTOR SOURCE                                      *INP00100
      C                                                                       *INP00110
      C     2. CALLED BY      ( SUB1 )                                        *INP00120
      C                                                                       *INP00130
      C     3  CALL           ( REED )                                        *INP00140
      C                                                                       *INP00150
      C*****************************************************************      *INP00160
      C                                                                         INP00170
  2         DIMENSION  AFLX(IT,JT), WORK(MWORK), SOURCE(N02,IT,JT)            INP00180
  3         COMMON /CONO  / MR,  MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,      INP00190
           *                MF4, MF5                                          INP00200
  4         COMMON /CNTRL / IRR, IR1, IR2                                     INP00210
  5         COMMON   IB(100),  D(1)                                           INP00220
  6         EQUIVALENCE (IB(23),NORDM ), (IB(26),LAST  ), (IB(31),LT0S  ),    INP00230
           1            (IB(28),LTSO  ), (IB(29),LTFX  ), (IB(30),LTXS  ),    INP00240
           2            (IB(34),ISCT  ), (IB(35),ISCS  ), (IB(36),IGM   ),    INP00250
           3            (IB(37),IGM1  ), (IB(40),MT    ), (IB(44),IHM   ),    INP00260
           4            (IB(47),NM    ), (IB(48),NM0   ),                      INP00270
           5            (IB(65),LNG2  ), (IB(77),KFA   ), (IB(78),NFA   ),     INP00280
           6            (IB(79),K0S   ), (IB(80),N0S   )                       INP00290
  7         KER = 0                                                           INP00300
      C                                                                       INP00310
      C******** SKIP 4 RECORDS                                                INP00320
      C                                                                       INP00330
  8         CALL REED( MFA, 1, 0.0, 4, 7 )                                    INP00340
      C                                                                       INP00350
      C******** READ ADJOINT FLUX AND SET IT TO SCRATCH DISK                   INP00360
      C                                                                       INP00370
  9         IR2 = 1                                                           INP00380
 10         DO 1500 L= 1, IGM                                                 INP00390
 11         CALL REED( MFA, 0, WORK, ITEMP, 3 )                               INP00400
 12         DO 1300 K= 1, NM                                                  INP00410
 13         DO 1100 J= 1, JT                                                  INP00420
 14         DO 1100 I= 1, IT                                                  INP00430
 15         AFLX(I,J) = WORK(K+((I-1)+(J-1)*IT)*NM)                           INP00440
 16  1100   CONTINUE                                                         INP00450
 17         WRITE(MF2'IR2)  ((AFLX(I,J),I=1,IT),J=1,JT)                       INP00460
 18  1300   CONTINUE                                                         INP00470
 19  1500   CONTINUE                                                         INP00480
 20         K0S = IR2                                                         INP00490
 21         NFA = (IR2-1)/IGM/NM                                              INP00500
      C                                                                       INP00510
      C******** READ REACTOR SOURCE AND SET IT TO SCRATCH DISK                 INP00520
      C                                                                       INP00530
 22         LS = LTSO + LTXS*IGM + 1                                          INP00540
 23         DO 2000 K= 1, NORDM                                               INP00550
 24         L = (K-1)*LAST + 1                                                INP00560
 25         CALL REED( MFA, 0, WORK(L), ITEMP, 3 )                            INP00570
```

```
FACOM 230-75 MT FORTRAN-IV M COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  42

ISN   ST-NO                  SOURCE PROGRAM      ( INPUT3 )                                  SEQUENCE

 26     2000 CONTINUE                                                                        INP00580
 27          DO 2500 K= 1, IGM                                                               INP00590
 28          DO 2200 J= 1, JT                                                                INP00600
 29          DO 2200 I= 1, IT                                                                INP00610
 30          DO 2200 L= N01, N02                                                             INP00620
 31          LC = N01-1*L                                                                    INP00630
 32          LL = LS + (K-1)*LTQS + (J-1)*NM*IT + (I-1)*NM + LC - 1                          INP00640
 33          SOURCE(L,I,J) = WORK(LL)                                                        INP00650
 34     2200 CONTINUE                                                                        INP00660
 35          WRITE(MF2'IR2) (((SOURCE(L,I,J),L=N01,N02),I=1,IT),J=1,JT)                      INP00670
 36     2500 CONTINUE                                                                        INP00680
 37          CALL REED( MFA, 0, 0,0, 0, 4 )                                                  INP00690
 38          RETURN                                                                          INP00700
 39          END                                                                             INP00710
```

```
FACOM 230-75 MT FORTRAN-IV M COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  43

ISN   ST-NO                  SOURCE PROGRAM                                                 SEQUENCE

  1          SUBROUTINE  INPUT4 ( KER )                                                    INP00010
     C*****************************************************************                  *INP00020
     C      INPUT4                                        -- 1.5 --                        *INP00030
     C                                                                                     *INP00040
     C       1. SUBROUTINE                                                                 *INP00050
     C            (1) READ RESTART CONSTANT DATA                                           *INP00060
     C            (2) ADDRESS RESET                                                        *INP00070
     C                                                                                     *INP00080
     C       2. OUTPUT                                                                     *INP00090
     C            (1) KER  = RETURN CODE                                                   *INP00100
     C                                                                                     *INP00110
     C       3. CALLED BY      (SUB1)                                                      *INP00120
     C       4. CALL           (HEADER)                                                    *INP00130
     C*****************************************************************                  *INP00140
  2          COMMON /IONO  / MR,  MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,                 INP00150
     *                      MF4, MF5                                                       INP00160
  3          COMMON /CNTRL / IRR, IR1, IR2                                                INP00170
  4          COMMON   IB(100), D(1)                                                       INP00180
  5          DIMENSION LD(1)                                                              INP00190
  6          EQUIVALENCE (LD(1),D(1))                                                     INP00200
  7          EQUIVALENCE (IB( 2),LMAX  ), (LD( 2),NMAX  ),                               INP00210
     1                   (IB( 3),LOPTN ), (LD( 3),NOPTN ),                               INP00220
     2                   (IB( 4),LMAT  ), (LD( 4),NMAT  ),                               INP00230
     3                   (IB( 5),LENGV ), (LD( 5),NENGV ),                               INP00240
     3                   (IB( 6),LIPMTV), (LD( 6),NIPMTV),                               INP00250
     4                   (IB( 7),LIPARM), (LD( 7),NIPARM),                               INP00260
     5                   (IB( 8),LIDUSE), (LD( 8),NIDUSE),                               INP00270
     6                   (IB( 9),LIA   ), (LD( 9),NIA   ),                               INP00280
     7                   (IB(10),LMIXNM), (LD(10),NMIXNM),                               INP00290
     8                   (IB(11),LMIXCM), (LD(11),NMIXCM),                               INP00300
     9                   (IB(12),LMIXDN), (LD(12),NMIXDN),                               INP00310
     0                   (IB(13),LIDCS ), (LD(13),NIDCS ),                               INP00320
     1                   (IB(14),LIHX  ), (LD(14),NIHX  ),                               INP00330
     2                   (IB(15),LIHY  ), (LD(15),NIHY  ),                               INP00340
     2                   (IB(16),LXR   ), (LD(16),NXR   ),                               INP00350
     2                   (IB(17),LYR   ), (LD(17),NYR   ),                               INP00360
     3                   (IB(19),LSUM  ), (LD(19),NSUM  ),                               INP00370
     4                   (IB(20),LWORK ), (LD(20),NWORK ),                               INP00380
     6                   (IB(26),LAST  )                                                 INP00390
  8          EQUIVALENCE (IB(86),LM    ), (IB(87),LP1   ), (IB(88),LP2   ),              INP00400
     1                   (IB(89),LP3   ), (IB(90),LP4   )                                INP00410
  9          KER = 0                                                                      INP00420
     C                                                                                    INP00430
     C******** READ CONSTANT PARAMETERS ( IB )                                            INP00440
     C                                                                                    INP00450
 10          IRR = 1                                                                      INP00460
 11          FIND( MFR' IRR )                                                             INP00470
 12          READ( MFR' IRR )  (LD(I),I=NIPARM,NIPARM+99)                                 INP00480
 13          DO 10  I= 1, 62                                                              INP00490
 14          IB(I) = LD(NIPARM-1+I)                                                       INP00500
 15       10 CONTINUE                                                                     INP00510
 16          DO 30  I= 66, 82                                                             INP00520
 17          IB(I) = LD(NIPARM-1+I)                                                       INP00530
 18       30 CONTINUE                                                                     INP00540
 19          DO 40  I= 85, 100                                                            INP00550
 20          IB(I) = LD(NIPARM-1+I)                                                       INP00560
 21       40 CONTINUE                                                                     INP00570
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322=(V02,L12)  DATE  79.06.22/09:32    PAGE  44

ISN   ST-NO                SOURCE PROGRAM      ( INPUT4 )                                  SEQUENCE

      C                                                                                    INP00580
      C---      CHECK NUMBER OF ENERGY GROUPS                                              INP00590
   22       IF( IB(36) .EQ. LD(24) )                          GO TO  80                   INP00600
   23       KER = 2                                                                       INP00610
   24       WRITE(MW,7000)  IB(36), LD(24)                                                INP00620
   25       CALL ERROR(2,10,'INPUT4=1 ** NOT SUIT OLD IGM TO NEW ONE ')                   INP00630
   26       GO TO 9000                                                                    INP00640
      C                                                                                    INP00650
   27    80 CONTINUE                                                                     INP00660
      C                                                                                    INP00670
      C******** READ PARAMETERS                                                          INP00680
      C                                                                                    INP00690
   28       LW  = LWORK                                                                   INP00700
   29       READ(MFR,IRR)  (D(I),I=LW,LW+LWORK-1)                                         INP00710
   30       ICNT = NIPARM                                                                 INP00720
   31       DO 100 I= LIPARM, LWORK                                                       INP00730
   32       D(ICNT) = D(LW-1+I)                                                           INP00740
   33       ICNT = ICNT + 1                                                               INP00750
   34     100 CONTINUE                                                                    INP00760
      C                                                                                    INP00770
      C******** RESET PARAMETERS                                                         INP00780
      C                                                                                    INP00790
   35       LMAX   = NMAX                                                                 INP00800
   36       LOPTN  = NOPTN                                                                INP00810
   37       LMAT   = NMAT                                                                 INP00820
   38       LENGY  = NENGY                                                                INP00830
   39       LIPMTV = NIPMTV                                                               INP00840
   40       IC = NIPARM - LIPARM                                                          INP00850
   41       LIPARM = NIPARM                                                               INP00860
   42       LIDUSE = NIDUSE + LIDUSE + IC                                                 INP00870
   43       LIA    = NIA    = LIA    + IC                                                 INP00880
   44       LMIXNM = NMIXNM = LMIXNM + IC                                                 INP00890
   45       LMIXCM = NMIXCM = LMIXCM + IC                                                 INP00900
   46       LMIXDN = NMIXDN = LMIXDN + IC                                                 INP00910
   47       LIDCS  = NIDCS  = LIDCS  + IC                                                 INP00920
   48       LIMX   = NIMX   = LIMX   + IC                                                 INP00930
   49       LIMY   = NIMY   = LIMY   + IC                                                 INP00940
   50       LXR    = NXR    = LXR    + IC                                                 INP00950
   51       LYR    = NYR    = LYR    + IC                                                 INP00960
   52       LSUM   = NSUM   = LSUM   + IC                                                 INP00970
   53       LWORK  = NWORK  = LWORK  + IC                                                 INP00980
   54       LW     = LW   +IC                                                             INP00990
   55       LP1    = LP1 + IC                                                             INP01000
   56       LP2    = LP2 + IC                                                             INP01010
   57       LP3    = LP3 + IC                                                             INP01020
   58       LP4    = LP4 + IC                                                             INP01030
      C                                                                                    INP01040
      C******** PRINT OUT CAPTION                                                        INP01050
      C                                                                                    INP01060
   59       CALL HEADER                                                                   INP01070
      C                                                                                    INP01080
   60    9000 CONTINUE                                                                   INP01090
   61    7000 FORMAT(5X,'OLD NO. IGM =', I10/5X,'NEW NO. IGM =', I10)                    INP01100
   62       RETURN                                                                        INP01110
   63       END                                                                           INP01120

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  =780322=(V02,L12)  DATE  79.06.22/09:32    PAGE  45

ISN   ST-NO                SOURCE PROGRAM                                              SEQUENCE

    1       SUBROUTINE MAPPER ( XRAD,YRAD,IDUM,IDCS,IMX,IMY,IM,IP,JM,JP,IMJM,  MAP00010
           1IBL,IBT,IBR,IBB,IGEOM,L )                                                  MAP00020
      C                                          -- 1.7.1 --                          MAP00030
      C     MATERIAL MAP BY BROAD ZONES                                                MAP00040
      C                                                                                MAP00050
      C     COMMON /UNITS/ NINP,NOUT,NAFLUX,NDUMP1,NDUMP2,NEXTRA,NEDIT,IAFLUX,MAP00060
      C    1ITFLUX,ISNCON,IFIXSR,ISOTXS                                                MAP00070
    2       COMMON /IONO  / MR, NOUT, MFF, MFA, MFC, MFR, MF1, MF2, MF3,       MAP00080
           1                MF4, MF5                                                   MAP00090
      C                                                                                MAP00100
    3       DIMENSION XRAD(IP),YRAD(JP),IDUM(IP),IDCS(IMJM),IMX(IM),IMY(JM)    MAP00110
    4       DIMENSION IWR(3), IFBND(5), NXYZ01(3), NXYZ02(3)                           MAP00120
      C                                                                                MAP00130
    5       REAL*8 NXYZ01,NXYZ02                                                       MAP00140
      C                                                                                MAP00150
    6       DATA IWR,ISTR/1H0,1H1,1H ,1H*/                                             MAP00160
    7       DATA IFBND/1H0,1H1,1H2,1H3,1H4/                                            MAP00170
    8       DATA NXYZ01/6HY      ,6HZ      ,6HT      /                               MAP00180
    9       DATA NXYZ02/6HX      ,6HR      /                                         MAP00190
      C                                                                                MAP00200
   10       IF (L.EQ.1) WRITE (NOUT,180)                                               MAP00210
   11       IF (L.EQ.2) WRITE (NOUT,190)                                               MAP00220
   12       IS=1                                                                       MAP00230
   13       IE=MINO(18,IM)                                                             MAP00240
   14       JBT=IFBND(IBT+1)                                                           MAP00250
   15       JTP=IFBND(IBT+1)                                                           MAP00260
   16       JLF=IFBND(IBL+1)                                                           MAP00270
   17       JRT=IFBND(IBR+1)                                                           MAP00280
   18       IA=0                                                                       MAP00290
   19     100 IF (IE.LT.IM) JRT=IWR(3)                                                 MAP00300
   20       IMM=IE-IS                                                                  MAP00310
   21       IMP=6*(IMM+1)                                                              MAP00320
   22       IMPM=IMP-1                                                                 MAP00330
   23       WRITE (NOUT,230)NXYZ01(IGEOM)                                              MAP00340
   24       IF (IS.EQ.1) GO TO 110                                                     MAP00350
   25       WRITE (NOUT,260)                                                           MAP00360
   26     110 CONTINUE                                                                 MAP00370
   27       WRITE (NOUT,210)YRAD(JP),JLF,(JTP,I=1,IMP)                                 MAP00380
   28       DO 140 J=1,JM                                                              MAP00390
   29       MJ=JP-J                                                                    MAP00400
   30       NXS=(MJ-1)*IM+IA                                                           MAP00410
   31       NXE=NXS+IE-IA-1                                                            MAP00420
   32       NXS=NXS+1                                                                  MAP00430
   33       IF (IMM.GT.0) GO TO 120                                                    MAP00440
   34       WRITE (NOUT,220)JLF,JRT                                                    MAP00450
   35       WRITE (NOUT,200)MJ,IMY(MJ),JLF,IDCS(NXE+1),JRT                             MAP00460
   36       WRITE (NOUT,220)JLF,JRT                                                    MAP00470
   37       GO TO 130                                                                  MAP00480
   38     120 WRITE (NOUT,220)JLF,(ISTR,I=1,IMM),JRT                                   MAP00490
   39       WRITE (NOUT,200) MJ,IMY(MJ),JLF,(IDCS(I),ISTR,I=NXS,NXE),          MAP00500
           1IDCS(NXE+1),JRT                                                           MAP00510
   40       WRITE (NOUT,220)JLF,(ISTR,I=1,IMM),JRT                                     MAP00520
   41     130 IF (J.EQ.JM) GO TO 140                                                   MAP00530
   42       WRITE (NOUT,210)YRAD(MJ),JLF,(ISTR,I=1,IMPM),JRT                           MAP00540
   43     140 CONTINUE                                                                 MAP00550
   44       WRITE (NOUT,210)YRAD(1),JLF,(JBT,I=1,IMP)                                  MAP00560
   45       K=IE+1                                                                     MAP00570
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  46

ISN   ST-NO                  SOURCE PROGRAM      ( MAPPER )                                        SEQUENCE

                                                                                                   MAP00580
                                                                                                   MAP00590
                                                                                                   MAP00600
                                                                                                   MAP00610
                                                                                                   MAP00620
                                                                                                   MAP00630
                                                                                                   MAP00640
                                                                                                   MAP00650
                                                                                                   MAP00660
                                                                                                   MAP00670
                                                                                                   MAP00680
                                                                                                   MAP00690
                                                                                                   MAP00700
                                                                                                   MAP00710
                                                                                                   MAP00720
                                                                                                   MAP00730
                                                                                                   MAP00740
                                                                                                   MAP00750
                                                                                                   MAP00760
                                                                                                   MAP00770
                                                                                                   MAP00780
                                                                                                   MAP00790
                                                                                                   MAP00800
                                                                                                   MAP00810
                                                                                                   MAP00820
                                                                                                   MAP00830
                                                                                                   MAP00840
                                                                                                   MAP00850
                                                                                                   MAP00860
                                                                                                   MAP00870
                                                                                                   MAP00880
                                                                                                   MAP00890
                                                                                                   MAP00900
                                                                                                   MAP00910
                                                                                                   MAP00920
```

```
      FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  47

ISN   ST-NO                  SOURCE PROGRAM                                                        SEQUENCE

                                                                                                   MAT00010
                                                                                                   MAT00020
                                                                                                   *MAT00030
                                                                                                   *MAT00040
                                                                                                   *MAT00050
                                                                                                   *MAT00060
                                                                                                   *MAT00070
                                                                                                   *MAT00080
                                                                                                   *MAT00090
                                                                                                   *MAT00100
                                                                                                   *MAT00110
                                                                                                   *MAT00120
                                                                                                   *MAT00130
                                                                                                   *MAT00140
                                                                                                   *MAT00150
                                                                                                   *MAT00160
                                                                                                   *MAT00170
                                                                                                   *MAT00180
                                                                                                   *MAT00190
                                                                                                   *MAT00200
                                                                                                   *MAT00210
                                                                                                   *MAT00220
                                                                                                   *MAT00230
                                                                                                   *MAT00240
                                                                                                   *MAT00250
                                                                                                   *MAT00260
                                                                                                   *MAT00270
                                                                                                   *MAT00280
                                                                                                   *MAT00290
                                                                                                   *MAT00300
                                                                                                   *MAT00310
                                                                                                   MAT00320
                                                                                                   MAT00330
                                                                                                   MAT00340
                                                                                                   MAT00350
                                                                                                   MAT00360
                                                                                                   MAT00370
                                                                                                   MAT00380
                                                                                                   MAT00390
                                                                                                   MAT00400
                                                                                                   MAT00410
                                                                                                   MAT00420
                                                                                                   MAT00430
                                                                                                   MAT00440
                                                                                                   MAT00450
                                                                                                   MAT00460
                                                                                                   MAT00470
                                                                                                   MAT00480
                                                                                                   MAT00490
                                                                                                   MAT00500
                                                                                                   MAT00510
                                                                                                   MAT00520
                                                                                                   MAT00530
                                                                                                   MAT00540
```

```
FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  48

ISN  ST-NO                SOURCE PROGRAM                                          SEQUENCE
  1        SUBROUTINE  PLOTER( PM, PV,ENGY, MATNO,                               PL000010
          1          IIM, JJM, EGRP, PLOC, BUFF,                                 PL000020
          2          IGM, MESH, IGM1, IPLTV, N, NE, IPTV, IPMTV )                PL000030
       C*****************************************************************       PL000040
       C     PLOTER                                    -- 1.7.4 --               *PL000050
       C                                                                         *PL000060
       C      1. SUBROUTINE                                                      *PL000070
       C          (1) PLOT CONTROULE OF SENSITIVITY SPECTRA                      *PL000080
       C                                                                         *PL000090
       C      2. INPUT                                                           *PL000100
       C          (1) PM(IGM,MESH)  SENSITIVITY  SPECTRA                         *PL000110
       C          (2) PV(IGM)       SUM OF SENSITIVITY SPECTRA IN VOLUME         *PL000120
       C          (3) ENGY(IGM1)    ENERGY                                       *PL000130
       C          (4) MATNO         MICRO MATERIAL NUMBER                        *PL000140
       C          (5) IIM(MESH)     RADIAL COARSE MESH NUMBER                    *PL000150
       C          (6) JJM(MESH)     AXIAL  COARSE MESH NUMBER                    *PL000160
       C          (7) IGM           NUMBER OF ENERGY GROUP                       *PL000170
       C          (8) IGM1          IGM + 1                                      *PL000180
       C          (9) MESH          NUMBER OF COARSE MESH                        *PL000190
       C         (10) IPLTV         OPTION OF PLOT TO COARSE MESH                *PL000200
       C         (11) IPTV(2,IPMTV) REQUIRED COARSE MESH NUMBERS                 *PL000210
       C         (12) IPMTV         NUMBER OF REQUIRED COARSE MESH               *PL000220
       C         (13) NE            TOTAL NUMBER OF REQUIRED MATERIAL            *PL000230
       C         (14) N             NUMBER OF REQUIRED MATERIAL                  *PL000240
       C                                                                         *PL000250
       C      3. LOCAL VARIABLES                                                 *PL000260
       C          (1) EGRP(101)      TEMPORALY STOARD ENERGY                     *PL000270
       C          (2) PLOC(101)      TEMPORALY STOARD SENSITIVITY SPECTRA        *PL000280
       C          (3) HEAD(4,10)     TYPE MESSAGE                                *PL000290
       C          (5) XMIN           MINIMUM OF ENERGY                           *PL000300
       C          (6) DX             RADIAL FACTOR                               *PL000310
       C          (7) YMAX           MAXMUM LENGTH OF AXIAL DIRECTION            *PL000320
       C          (8) YMIN           MINIMUM OF SENSITIVITY SPECTRA              *PL000330
       C          (9) DY             AXIAL FACTOR                                *PL000340
       C         (10) BUFF(1024)     WORK AREA                                   *PL000350
       C                                                                         *PL000360
       C      4. CALLED BY      (PRINT)                                          *PL000370
       C                                                                         *PL000380
       C      5. CALL           (PLT)                                            *PL000390
       C                                                                         *PL000400
       C*****************************************************************       PL000410
  2        DIMENSION  PM(IGM,MESH), PV(IGM), ENGY(IGM1), IIM(MESH),             PL000420
          1           JJM(MESH), EGRP(101), PLOC(101), HEAD(4,10),              PL000430
          2           BUFF(1024), IPTV(2,IPMTV)                                 PL000440
  3        DIMENSION  XTIME(2), XUNIT(2), DX(2)                                 PL000450
  4        COMMON /IOND  / MR,  MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,         PL000460
          *                MF4, MF5                                             PL000470
  5        COMMON /TITLE /  TITLE( 20)                                          PL000480
  6        COMMON IB(100), D(1)                                                 PL000490
  7        LOGICAL  OPT                                                         PL000500
  8        DATA  OPT / .TRUE. /                                                 PL000510
  9        DATA (HEAD(1,I),I=1,4) /'SUM ','IN V','OLUM','E   '/,                PL000520
          1     (HEAD(1,I),I=1,4) /'FOR ','EACH','-CO','RSE '/                  PL000530
       C                                                                         PL000540
 10        IF( .NOT. OPT )                              GO TO 100               PL000550
       C                                                                         PL000560
 11        OPT = .FALSE.                                                        PL000570

FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  49

ISN  ST-NO                SOURCE PROGRAM      ( PLOTER )                          SEQUENCE
 12        CALL PLOTS(BUFF,1024)                                                PL000580
 13        XLNGT = 320.0                                                        PL000590
 14        YLNGT = 250.0                                                        PL000600
 15        YCM   =  40.0                                                        PL000610
       CC        SCALE FACTOR FOR X-AXIS                                       PL000620
       C                                                                       PL000630
 16        XTIME(1) = ALOG10(ENGY(1)) - ALOG10(ENGY(IGM1))                      PL000640
 17        XUNIT(1) = XLNGT / XTIME(1)                                          PL000650
 18        DX(1) = 1.0 / XUNIT(1)                                               PL000660
       CC        SCALE FACTOR FOR Y-AXIS                                       PL000670
       C                                                                       PL000680
 19        YMIN  = 1.0E-4                                                       PL000690
 20        YTIME = 5.0                                                          PL000700
 21        YMAX  = YLNGT - YCM                                                  PL000710
 22        YUNIT = YMAX / YTIME                                                 PL000720
 23        DY    = 1.0 / YUNIT                                                  PL000730
       C                                                                       PL000740
 24      100 CONTINUE                                                           PL000750
       C                                                                       PL000760
 25        DO 200 I= 1, IGM1                                                    PL000770
 26        EGRP(I) = ENGY(I)                                                    PL000780
 27      200 CONTINUE                                                           PL000790
 28        DO 300 I= 1, IGM                                                     PL000800
 29        PLOC(I) = PV(I)                                                      PL000810
 30      300 CONTINUE                                                           PL000820
 31        CALL PLT ( EGRP, PLOC, MATNO, TITLE, HEAD(1,1), 0, 0, 0,             PL000830
          1           XLNGT, YLNGT, YCM, XTIME, XUNIT, DX, YMIN, YTIME,        PL000840
          2           YMAX, YUNIT, DY, IGM1, IGM, 20, 4 )                      PL000850
       C                                                                       PL000860
       C******** PLOT COARSE MESH SPECTRA                                       PL000870
       C                                                                       PL000880
 32        IF( IPLTV .EQ. 0 )                    GO TO 2000                   PL000890
 33        IF( IPMTV .EQ. 0 )                              GO TO 2000         PL000900
 34        DO 1000 K= 1, MESH                                                 PL000910
 35        IF( IPMTV .LT. 0 )                              GO TO  450         PL000920
 36        DO 400 IP= 1, IPMTV                                                PL000930
 37        IF( IPTV(1,IP) .NE. IIM(K) )                    GO TO  400         PL000940
 38        IF( IPTV(2,IP) .NE. JJM(K) )                    GO TO  400         PL000950
 39        GO TO 450                                                          PL000960
 40      400 CONTINUE                                                         PL000970
 41        GO TO 1000                                                         PL000980
 42      450 CONTINUE                                                         PL000990
 43        DO  500 I=1 1, IGM                                                 PL001000
 44        PLOC(I) = PM(I,K)                                                  PL001010
 45      500 CONTINUE                                                         PL001020
       C                                                                     PL001030
 46        CALL PLT ( EGRP, PLOC, MATNO, TITLE, HEAD(1,2), IIM(K), JJM(K), 1,PL001040
          1           XLNGT, YLNGT, YCM, XTIME, XUNIT, DX, YMIN, YTIME,      PL001050
          2           YMAX, YUNIT, DY, IGM1, IGM, 20, 4 )                    PL001060
 47     1000 CONTINUE                                                        PL001070
       C                                                                     PL001080
       C                                                                     PL001090
 48     2000 CONTINUE                                                        PL001100
 49        IF( N .EQ. NE )    CALL PLOT (0.0, 0.0, 999)                      PL001110
 50        RETURN                                                           PL001120
 51        END                                                              PL001130
```

```
FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  50

ISN   ST-NO                SOURCE PROGRAM                                          SEQUENCE
  1         SUBROUTINE  PLT ( GRPN, PE, MATNO, T, HEAD, IMSH, JMSH, LC,          PLT00010
        1               XLNGT, YLNGT, YCM, XTIME, XUNIT, DX, YMIN, YTIME,       PLT00020
        2               YMAX, YUNIT, DY, ING1, ING, IT, IH )                    PLT00030
      C*****************************************************************       *PLT00040
      C      PLT                                  -- 1.8.6.1 --                *PLT00050
      C       1. SUBROUTINE                                                     *PLT00060
      C            (1) PLOT SENSITIVITY SPECTRA                                 *PLT00070
      C                                                                         *PLT00080
      C       2. INPUT                                                          *PLT00090
      C            (1) GRPN(101) ENERGY                                         *PLT00100
      C            (2) PE(101)   SENSITIVITY SPECTRA                            *PLT00110
      C            (3) MATNO     MICRO MATERIAL NUMBER                          *PLT00120
      C            (4) T(IT)     TITLE                                          *PLT00130
      C            (5) HEAD(IH)  TYPE MESSAGE                                   *PLT00140
      C            (6) IMSH      RADIAL COARSE MESH NUMBER                      *PLT00150
      C            (7) JMSH      AXIAL  COARSE MESH NUMBER                      *PLT00160
      C            (8) LC        0/1  TOTAL/COARSE MESH  SELECTING OPTION       *PLT00170
      C            (9) XLNGT     RADIAL LENGTH                                  *PLT00180
      C           (10) YLNGT     AXIAL  LENGTH                                  *PLT00190
      C           (11) YCM       40.0                                           *PLT00200
      C           (12) XTIME(2)  LOG(GRPN(1))-LOG(GRPN?IGM1))                   *PLT00210
      C           (13) XUNIT(2)  XLNGT/XTIME                                    *PLT00220
      C           (14) DX(2)     1.0/XUNIT                                      *PLT00230
      C           (15) YMIN      1.0E-4                                         *PLT00240
      C           (16) YTIME     5.0                                            *PLT00250
      C           (17) YMAX      YLNGT-YCM                                      *PLT00260
      C           (18) YUNIT     YMAX/YTIME                                     *PLT00270
      C           (19) DY        1.0/YUNIT                                      *PLT00280
      C           (20) ING1      ING + 1                                        *PLT00290
      C           (21) ING       NUMBER OF ENERGY GROUP                         *PLT00300
      C           (22) IT        TITLE LENGTH                                   *PLT00310
      C           (23) IH        TYPE MESSAGE LENGTH                            *PLT00320
      C                                                                         *PLT00330
      C       3. CALLED BY      (PRINT)                                         *PLT00340
      C                                                                         *PLT00350
      C                                                                         *PLT00360
      C*****************************************************************       *PLT00370
  2         DIMENSION  GRPN(101), PE(101), T(IT), HEAD(IH),                     PLT00380
        1              XTIME(2), XUNIT(2), DX(2), EGRP(101)                     PLT00390
                                                                                PLT00400
      C                                                                         PLT00410
      C     SET INDICATOR IF NEUTRON OR GAMMA                                   PLT00420
  3         IND=1                                                               PLT00430
      C     PLOT AXIS AND HEADER                                                PLT00440
  4         XMIN=GRPN(ING1)                                                     PLT00450
  5         XMAX=XLNGT                                                          PLT00460
  6         YMAX=YLNGT-YCM                                                      PLT00470
  7         CALL LGAXS(0.0,0.0,'ENERGY  (EV)',-12,XMAX,0.0,XMIN,DX(IND))       PLT00480
  8         CALL LGAXS(0.0,0.0,'SENSITIVITY PER UNIT LETHARGY',29,YMAX,90.0,    PLT00490
        *     YMIN,DY)                                                          PLT00500
  9         CALL PLOT(0.0,0.0,0.444)                                            PLT00510
 10         NX=XTIME(IND)+1                                                     PLT00520
 11         XLOG=ALOG10(XMIN)                                                   PLT00530
 12         ILOG=XLOG                                                           PLT00540
 13         IF(XLOG.LE.0.0) GO TO 200                                           PLT00550
 14         XRES=1.0-XLOG+FLOAT(ILOG)                                           PLT00560
 15         GO TO 210                                                           PLT00570
 16     200 XRES=FLOAT(ILOG)-XLOG

FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  51

ISN   ST-NO                SOURCE PROGRAM      ( PLT     )                     SEQUENCE

 17     210 CONTINUE                                                           PLT00580
 18         DO 220 J=1,NX                                                      PLT00590
 19         XX=XUNIT(IND)*(FLOAT(J-1)+XRES)                                    PLT00600
 20         IF(XX.EQ.0.0 .OR. XX.GE.XMAX) GO TO 220                            PLT00610
 21         YY=YMAX                                                            PLT00620
      C     IF(XX.LE.250.0) YY=YMAX*0.8                                        PLT00630
 22         CALL PLOT(XX,0.0,3)                                                PLT00640
 23         CALL PLOT(XX,YY  ,2)                                               PLT00650
 24     220 CONTINUE                                                           PLT00660
 25         CALL PLOT(XMAX,0.0,3)                                              PLT00670
 26         CALL PLOT(XMAX,YMAX,2)                                             PLT00680
 27         NY=YTIME                                                           PLT00690
 28         DO 230 J=1,NY                                                      PLT00700
 29         YY=YUNIT*FLOAT(J)                                                  PLT00710
 30         XX=XMAX                                                            PLT00720
      C     IF(J.EQ.NY) XX=20.0                                                PLT00730
 31         CALL PLOT(0.0,YY,3)                                                PLT00740
 32         CALL PLOT(XX  ,YY,2)                                               PLT00750
 33     230 CONTINUE                                                           PLT00760
      C     CALL PLOT(250.0,YMAX,3)                                            PLT00770
      C     CALL PLOT(XMAX,YMAX,2)                                             PLT00780
 34         CALL PLOT(0.0,0.0,0.444)                                           PLT00790
      C                                                                         PLT00800
 35         CALL SYMBOL(40.0,YLNGT,5.0,T,0.0,48)                               PLT00810
 36         CALL SYMBOL(20.0,YLNGT-10.0,5.0,'MATNO=',0.0,6)                    PLT00820
 37         CALL NUMBER(999.0,999.0,5.0,FLOAT(MATNO),0.0,-1)                   PLT00830
 38         CALL SYMBOL( 80.0,999.0,5.0,'ZONE=',0.0,5)                         PLT00840
 39         IF( LC .EW. 0 )                                  GO TO 235         PLT00850
 40         CALL SYMBOL(999.0,999.0,5.0,'(',0.0,1)                             PLT00860
 41         CALL NUMBER(999.0,999.0,5.0,FLOAT(IMSH),0.0,-1)                    PLT00870
 42         CALL SYMBOL(999.0,999.0,5.0,',',0.0,1)                             PLT00880
 43         CALL NUMBER(999.0,999.0,5.0,FLOAT(JMSH),0.0,-1)                    PLT00890
 44         CALL SYMBOL(999.0,999.0,5.0,')',0.0,1)                             PLT00900
 45     235 CONTINUE                                                           PLT00910
 46         IF( LC .EQ. 0 )                                                    PLT00920
        *    CALL SYMBOL(999.0,999.0,5.0,'TOTAL',0.0,5)                        PLT00930
 47         CALL SYMBOL(140.0,999.0,5.0,'TYPE=',0.0,5)                         PLT00940
 48         CALL SYMBOL(999.0,999.0,5.0,HEAD,0.0,IH)                           PLT00950
 49         CALL PLOT(0.0,0.0,0.444)                                           PLT00960
      CC    PLOT SENSITIVITY                                                   PLT00970
 50         MAXG=ING                                                           PLT00980
 51         DO 240 I=1,ING1                                                    PLT00990
 52         EGRP(I)=GRPN(I)                                                    PLT01000
 53     240 CONTINUE                                                           PLT01010
 54         XRES=ALOG10(EGRP(MAXG+1))                                          PLT01020
 55         YRES=ALOG10(YMIN)                                                  PLT01030
 56         X1=XUNIT(IND)*(ALOG10(EGRP(1))-XRES)                               PLT01040
 57         IDASH=0                                                            PLT01050
 58         IF(PE(1).EQ.0.0) PE(1)=YMIN                                        PLT01060
 59         IF(PE(1).GT.0.0) GO TO 275                                         PLT01070
 60         IDASH=1                                                            PLT01080
 61         PE(1)=-PE(1)                                                       PLT01090
 62     275 CONTINUE                                                           PLT01100
 63         Y1=YUNIT*(ALOG10(PE(1))-YRES)                                      PLT01110
 64         IF(Y1.LT.0.0) Y1=0.0                                               PLT01120
 65         CALL PLOT(X1,Y1,3)                                                 PLT01130
 66         DO 280 I=1,MAXG                                                    PLT01140
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  52

ISN   ST-NO                SOURCE PROGRAM     ( PLT    )                          SEQUENCE

 67         X2=XUNIT(IND)*(ALOG10(EGRP(I+1))-XRES)                                PLT01150
 68         IF(IDASH.EQ.0) CALL DASHP(X2,Y1,1.0)                                  PLT01160
 69         IF(IDASH.NE.0) CALL PLOT(X2,Y1,2)                                     PLT01170
 70         IF(I.EQ.MAXG) GO TO 280                                               PLT01180
 71         IDASH=0                                                               PLT01190
 72         IF(PE(I+1).EQ.0.0) PE(I+1)=-YMIN                                      PLT01200
 73         IF(PE(I+1).GT.0.0) GO TO 277                                          PLT01210
 74         IDASH=1                                                               PLT01220
 75         PE(I+1)=-PE(I+1)                                                      PLT01230
 76     277 CONTINUE                                                              PLT01240
 77         Y2=YUNIT*(ALOG10(PE(I+1))-YRES)                                       PLT01250
 78         IF(Y2.LT.0.0) Y2=0.0                                                  PLT01260
 79         IF(IDASH.EQ.0) CALL DASHP(X2,Y2,1.0)                                  PLT01270
 80         IF(IDASH.NE.0) CALL PLOT(X2,Y2,2)                                     PLT01280
 81         CALL PLOT(0.0,0.0,0.444)                                              PLT01290
 82         Y1=Y2                                                                 PLT01300
 83     280 CONTINUE                                                              PLT01310
 84         CALL PLOT(0.0,0.0,0.444)                                              PLT01320
 85         CALL PLOT(0.0,0.0,0.888)                                              PLT01330
 86         CALL PLOT(400.0,0.0,-3)                                               PLT01340
 87         CALL PLOT(0.0,0.0,0.666)                                              PLT01350
 88     500 CONTINUE                                                              PLT01360
 89         RETURN                                                                PLT01370
 90         END                                                                   PLT01380
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  53

ISN   ST-NO                SOURCE PROGRAM                                        SEQUENCE

  1        SUBROUTINE  PRINT                                                     PRI00010
     1    ( C, RATE, IIM, JJM, TRUNC, TRUNV, TRUNE, PMX, PMX0,                  PRI00020
     2      PMXS, PMXL, P, PE, PV, PM, WORK, IPTV, IPMTV, MATNO, NE,             PRI00030
     3      IMJM, IM, JM, IMM, IMT, IGM, MT, ISCT, ISCS, MWORK, KER )            PRI00040
C*****************************************************************************PRI00050
C     PRINT                                                                     *PRI00060
C                                                -- 1,7 --                      *PRI00070
C      1. SUBROUTINE                                                            *PRI00080
C         (1) PRINT CONTROUL                                                    *PRI00090
C               1. COARSE MESH MAP                                              *PRI00100
C               2. CROSS SECTION                                                *PRI00110
C               3. REACTION RATE                                                *PRI00120
C               4. PL EFFECT                                                    *PRI00130
C               5. SENSITIVITY MATRIX                                           *PRI00140
C               6. SENSITIVITY SPECTRA                                          *PRI00150
C                                                                               *PRI00160
C         (2) PLOT SENSITIVITY SPECTRA                                          *PRI00170
C                                                                               *PRI00180
C                                                                               *PRI00190
C      2. INPUT                                                                 *PRI00200
C         (1) C(IMM,IGM,MT)              = CROSS SECTION                        *PRI00210
C         (2) RATE(JM,IM,IGM)            = REACTION RATE                        *PRI00220
C         (3) IIM(IMJM)                  = RADIAL COARSE MESH                   *PRI00230
C         (4) JJM(IMJM)                  = AXIAL  COARSE MESH                   *PRI00240
C         (5) TRUNC(ISCS,IGM,IM,JM)      = TRUNCATION ERROR                     *PRI00250
C         (6) TRUNV(ISCS,IGM)            = SUM OF TRUNC IN VOLUME               *PRI00260
C         (7) TRUNE(ISCS,IMJM)           = SUM OF TRUNC IN ENERGY               *PRI00270
C         (8) PMX(ISCS,IMM,IGM,IM)       = SENSITIVITY MATRIX                   *PRI00280
C         (9) PMX0(ISCS,IMT,IGM,IMJM)    = SUM OF PMX(SCALAR) IN VOLUME         *PRI00290
C        (10) PMXS(IMM,IGM,ISCS,IMJM)    = SUM OF PMX(SCATTER) IV VOLUME        *PRI00300
C        (11) PMXL(IMM,IGM,IMJM)         = SUM OF PMX IN VOLUME AND ORDER       *PRI00310
C        (12) P(IGM,IM,JM,2)             = SENSITIVITY SPECTRA                  *PRI00320
C        (13) PE(IMJM,2)                 = SUM OF P IN ENERGY                   *PRI00330
C        (14) PV(IGM,2)                  = SUM OF P IN VOLUME                   *PRI00340
C        (15) PM(IGM,IMJM,2)             = SENSITIVITY SPECTRA IN COARSE        *PRI00350
C                                          MESH                                 *PRI00360
C        (16) WORK(MWORK)                = WORK AREA                            *PRI00370
C        (17) IPTV(2,IPMTV)              = COARSE MESH POSITION                 *PRI00380
C        (18) MATNO(NE)                  = MATERIAL NUMBERS                     *PRI00390
C                                                                               *PRI00400
C        (19) NE    = NUMBER OF MATERIAL                                        *PRI00410
C        (20) IMJM  = IM*JM                                                     *PRI00420
C        (21) IM    = RADIAL COARSE MESH                                        *PRI00430
C        (22) JM    = AXIAL  COARSE MESH                                        *PRI00440
C        (23) IMM   = CROSS SECTION TABLE LENGTH                                *PRI00450
C        (24) IMT   = POSITION OF TOTAL CROSS SECTION                           *PRI00460
C        (25) IGM   = ENERGY GROUP                                              *PRI00470
C        (26) MT    = TOTAL NUMBER OF MATERIALS                                 *PRI00480
C        (27) ISCT  = SCATTERING ORDER                                          *PRI00490
C        (28) ISCS  = ISCT + 1                                                  *PRI00500
C        (29) MWORK = NUMBER OF WORK AREA                                       *PRI00510
C                                                                               *PRI00520
C      3. OUTPUT                                                                *PRI00530
C         (1) KER   = RETURN CORD                                               *PRI00540
C                                                                               *PRI00550
C      4. CALLED BY      (SUB1 )                                                *PRI00560
C                                                                               *PRI00570
C      5. CALLS          (REED, MAPPER, WRITE, WOT, PLOTER)                     *PRI00580
```

```
FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  54

ISN   ST-NO                  SOURCE PROGRAM                                                    SEQUENCE
      C                                                                                       *PRI00580
      C*********************************************************************************     *PRI00590
 2          COMMON /IONO  / MR,  MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,                     PRI00600
     *                    MF4, MF5                                                          PRI00610
 3          COMMON /CNTRL / IRR, IW1, IR2                                                   PRI00620
 4          COMMON  IB(100), D(1)                                                           PRI00630
 5          DIMENSION  CC(IMM,IGM,MT), RATE(JM,IM,IGM), IIM(IMJM), JJM(IMJM),               PRI00640
           1     TRUNC(ISCS,IGM,IM,JM), TRUNV(ISCT,IGM), THUNE(ISCT,(MJM),                PRI00650
           2     PMX(ISCS,IMM,IGM,IM), PMXD(IMT,IGM,IMJM),                                 PRI00660
           3     PMXS(IMM,IGM,ISCS,IMJM), PMXL(IMM,IGM,IMJM),                              PRI00670
           4     P(IGM,IM,JM,2), PE(IMJM,2), PV(IGM,2), PM(IGM,IMJM,2),                    PRI00680
           5     WORK(MWONK), IPTV(2,IPMTV), MATNO(NE)                                     PRI00690
 6          DIMENSION  LD(1)                                                                PRI00700
 7          EQUIVALENCE (LD(1),D(1))                                                        PRI00710
 8          EQUIVALENCE (LD(27),ITAPE ), (LD(26),IRESP ), (LD(28),IPCRS ),                  PRI00720
           1            (LD(29),IPPL  ), (LD(30),IPMTX ), (LD(31),IPLOT )                  PRI00730
 9          EQUIVALENCE (IB( 9),LIA   ), (IB(14),LIMX  ), (IB(15),LIMY  ),                  PRI00740
           1            (IB(16),LXR   ), (IB(17),LYR   ), (IB(18),LFL   ),                 PRI00750
           2            (IB(19),LSUM  ), (IB(20),LWORK ), (IB(13),LIDCS )                  PRI00760
10          EQUIVALENCE (IB(69),KCR   ), (IB(70),KRT   )                                    PRI00770
11          EQUIVALENCE (IB( 4),LMATE ), (IB( 5),LENGY ), (IB(37),IGM1  )                   PRI00780
           1           ,(IB(10),LMIXNM), (IB(11),LMIXCM), (IB(12),LMIXDN),                 PRI00790
           2            (IB(41),MS    )                                                    PRI00800
12          DIMENSION  ENERGY(50), PVV(2)                                                   PRI00810
13          REAL*8   H(4,11), HH(3)                                                         PRI00820
14          DATA  H /'TWOTRAN','-II CROSS',' SECTION','GROUP   ',                           PRI00830
           2       'REACTION',' RATE EN','ERGY GR,','X MESH  ',                             PRI00840
           3       'SUM OF R','EACTION ','RATE    ',' '       ,                             PRI00850
           4       '         ',' ','PL-ORDER',' GROUP  ',' '       ,' '       ,           PRI00860
           5       '         ',' ','PL-ONDER',' '      ,' '       ,' '       ,           PRI00870
           6       'COARSE   ',' ','POSITION',' GROUP  ',' '       ,' '       ,           PRI00880
           7       'COARSE   ',' ','POSITION',' GROUP  ',' '       ,' '       ,           PRI00890
           8       'COARSE   ',' ','POSITION',' GROUP  ',' '       ,' '       ,           PRI00900
           9       '         ',' ','  GROUP  ',' '      ,' '       ,' '       ,           PRI00910
           0       '         ',' ',' TOTAL  ',' '      ,' '       ,' '       ,           PRI00920
           1       '         ',' ','  GROUP  ',' TOTAL  ',' '       ,' '       /           PRI00930
15          DATA HH /'X MESH  ',' R MESH  ',' R MESH  '/                                    PRI00940
      C                                                                                     PRI00950
      C******** DRAW COARSE MESH MAP                                                        PRI00960
      C                                                                                     PRI00970
16          IGEOM = LD(LIA+31)                                                              PRI00980
17          CALL MAPPER( D(LXR), D(LYR), WORK, D(LIDCS), D(LIMX), D(LIMY),                  PRI00990
           *             IM, IM+1,                                                        PRI01000
           1             JM, JM+1, IM*JM, LD(LIA+6), LD(LIA+9), LD(LIA+7),                PRI01010
           2             LD(LIA+8), IGEOM, 1)                                             PRI01020
      C                                                                                     PRI01030
      C******* PRINT MIXING TABLE                                                          PRI01040
      C                                                                                     PRI01050
18          WRITE(MW,7000)                                                                  PRI01060
19          WRITE(MW,7005) (I, LD(LMIXNM+I-1),LD(LMIXCM+I-1),D(LMIXDN+I-1),              PRI01070
           1                                                  I=1,MS)                      PRI01080
      C                                                                                     PRI01090
      C******** PRINT CROSS SECTION                                                        PRI01100
      C                                                                                     PRI01110
20          IF( IPCRS .EQ. 0 )                                 GO TO 100                  PRI01120
21          WRITE(MW,7000)                                                                  PRI01130
22          IRR = KCR                                                                       PRI01140


FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  55

ISN   ST-NO                  SOURCE PROGRAM      ( PRINT  )                                SEQUENCE
                                                                                            PRI01150
23          READ(MFR'IRR)    C                                                              PRI01160
24          CALL WRITE( 3, 2, C, IMM, IGM, MT, H(1,1), H(2,1), H(3,1), H(4,1))             PRI01170
25        100 CONTINUE                                                                      PRI01180
      C                                                                                     PRI01190
      C******** PRINT REACTION RATE                                                        PRI01200
      C                                                                                     PRI01210
26          WRITE(MW,7010)                                                                  PRI01220
27          IRR = KRT                                                                       PRI01230
28          H(4,2) = HH(IGEOM)                                                              PRI01240
29          DO 200 K= 1, IGM                                                                PRI01250
30          READ(MFR'IRR)    (WORK(J),J=1,IM*JM)                                            PRI01260
31          DO 200 J= 1, JM                                                                 PRI01270
32          DO 200 I= 1, IM                                                                 PRI01280
33          IV = I + (J-1)*IM                                                               PRI01290
34          RATE(J,I,K) = WORK(IV)                                                          PRI01300
35        200 CONTINUE                                                                      PRI01310
36          CALL WRITE( 3, 2, RATE, JM, IM, IGM, H(1,2),H(2,2),H(3,2),H(4,2))              PRI01320
37          SUM = D(LSUM)                                                                   PRI01330
38          WRITE(MW,7020)  (H(I,3),I=1,3), SUM                                             PRI01340
39          IF( ITAPE .EQ. 2 )                                 GO TO 9000                 PRI01350
      C                                                                                     PRI01360
      C******** DO LOOP FOR NE TIMES                                                       PRI01370
      C                                                                                     PRI01380
40          CALL REED(MF3, 0, 0.0, 0, A )                                                   PRI01390
41          CALL REED(MF4, 0, 0.0, 0, A )                                                   PRI01400
42          CALL REED(MF5, 0, 0.0, 0, A )                                                   PRI01410
43          DO 300 I= 1, IGM                                                                PRI01420
44          ENERGY(I) = ALOG( D(LENGY-1+I)/D(LENGY+I) )                                     PRI01430
45        300 CONTINUE                                                                      PRI01440
      C                                                                                     PRI01450
46          DO 5000 N= 1, NE                                                                PRI01460
      C           MATERIAL NUMBER CHECK                                                     PRI01470
47          IF( MATNO(N) .EQ. 0 )                              GO TO 5000                 PRI01480
      C                                                                                     PRI01490
      C******** PRINT PL EFFECT                                                            PRI01500
      C                                                                                     PRI01510
48          WRITE(MW,7030)      MATNO(N)                                                    PRI01520
49          IF( IPPL .EQ. 0 )                                  GO TO 1900                 PRI01530
50          WRITE(MW,7040)                                                                  PRI01540
51          DO 1000 J= 1, JM                                                                PRI01550
52          CALL REED(MF4, 0, TRUNC(1,1,1,J), ITEMP, 3 )                                    PRI01560
53        1000 CONTINUE                                                                     PRI01570
      C           SUM OF VOLUME                                                             PRI01580
54          DO 1200 K= 1, IGM                                                               PRI01590
55          DO 1200 L= 1, ISCT                                                              PRI01600
56          LL= L+1                                                                         PRI01610
57          TRUNV(L,K) = 0.0                                                                PRI01620
58          DO 1100 J= 1, JM                                                                PRI01630
59          DO 1100 I= 1, IM                                                                PRI01640
60          TRUNV(L,K) = TRUNV(L,K) + TRUNC(LL,K,I,J)                                       PRI01650
61        1100 CONTINUE                                                                     PRI01660
62        1200 CONTINUE                                                                     PRI01670
63          WRITE(MW,7050)                                                                  PRI01680
64          CALL WOT( TRUNV, IGM, ISCT, 1, H(2,4), H(3,4), H(4,4),                          PRI01690
           1                  IIM, JJM, 1, MW )                                           PRI01700
      C           SUM OF ENERGY                                                             PRI01710
65          NCOL = 1
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  56

ISN   ST-NO                SOURCE PROGRAM     ( PRINT  )                                  SEQUENCE
 66           IMJM = IM*JM                                                                PR101720
 67           DO 1500 J= 1, JM                                                            PR101730
 68           DO 1500 I= 1, IM                                                            PR101740
 69           IC   = 0                                                                    PR101750
 70           DO 1400 L= 1, ISCT                                                          PR101760
 71           LL = L + 1                                                                  PR101770
 72           TRUNE(L,NCOL) = 0.0                                                         PR101780
 73           DO 1300 K= 1, IGM                                                           PR101790
 74           TRUNE(L,NCOL) = TRUNE(L,NCOL) + TRUNC(LL,K,I,J)                             PR101800
 75    1300 CONTINUE                                                                      PR101810
 76           IF( TRUNE(L,NCOL) .NE. 0.0 ) IC = 1                                         PR101820
 77    1400 CONTINUE                                                                      PR101830
 78           IF( IC .EQ. 0 )                                    GO TO 1500               PR101840
 79           I(M(NCOL) = I                                                               PR101850
 80           JJM(NCOL) = J                                                               PR101860
 81           NCOL = NCOL + 1                                                             PR101870
 82    1500 CONTINUE                                                                      PR101880
 83           NCOL = NCOL - 1                                                             PR101890
 84           IF( NCOL .LE. 0 )                                  GO TO 1900               PR101900
 85           WRITE(MW,7060)                                                              PR101910
 86           CALL WDT( TRUNE, NCOL, ISCT, 1, M(2,5), M(3,5), M(4,5),                     PR101920
     *                  IIM, JJM, 2, MW )                                                PR101930
 87    1900 CONTINUE                                                                      PR101940
      C                                                                                   PR101950
      C******** PRINT SENSITIVITY MATRIX                                                  PR101960
      C                                                                                   PR101970
 88           IF( IPMTX .EQ. 0 )                                 GO TO 3500               PR101980
 89           IV = 0                                                                      PR101990
 90           DO 3000 J= 1, JM                                                            PR102000
 91           CALL REED(MF3, 0, PMX(1,1,1,1), ITEMP, 3 )                                  PR102010
 92           IF( IPMTV .NE. 0 )                                 GO TO 2400               PR102020
 93           GO TO ( 2100, 2200, 2300),   IPMTX                                          PR102030
      C            SCALAR MATRIX SUM IN VOLUME                                         PR102040
 94    2100 CONTINUE                                                                      PR102050
 95           DO 2150 K= 1, IGM                                                           PR102060
 96           DO 2150 L= 1, IMT                                                           PR102070
 97           IF( J .EQ. 1 )      PMXO(L,K,1) = 0.0                                       PR102080
 98           DO 2130 I= 1, IM                                                            PR102090
 99           PMXO(L,K,1) = PMXO(L,K,1) + PMX(1,L,K,I)                                    PR102100
100    2130 CONTINUE                                                                      PR102110
101    2150 CONTINUE                                                                      PR102120
102           GO TO 3000                                                                  PR102130
      C            SCALAR + SCATTERING MATRIX(FOR EACH PL)                             PR102140
103    2200 CONTINUE                                                                      PR102150
104           DO 2250 K= 1, IGM                                                           PR102160
105           DO 2250 L= 1, IMM                                                           PR102170
106           DO 2250 IS= 1, ISCS                                                         PR102180
107           IF( J .EQ. 1 )      PMXS(L,K,IS,1) = 0.0                                    PR102190
108           DO 2230 I= 1, IM                                                            PR102200
109           PMXS(L,K,IS,1) = PMXS(L,K,IS,1) + PMX(IS,L,K,I)                             PR102210
110    2230 CONTINUE                                                                      PR102220
111    2250 CONTINUE                                                                      PR102230
      C            SCALAR + SCATTERING MATRIX(SUM OF PL)                               PR102240
112    2300 CONTINUE                                                                      PR102250
113           DO 2350 K= 1, IGM                                                           PR102260
114           DO 2350 L= 1, IMM                                                           PR102270
115           IF( J .EQ. 1 )      PMXL(L,K,1) = 0.0                                       PR102280

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  57

ISN   ST-NO                SOURCE PROGRAM     ( PRINT  )                                  SEQUENCE
116           DO 2330 I= 1, IM                                                            PR102290
117           DO 2330 IS= 1, ISCS                                                         PR102300
118           PMXL(L,K,1) = PMXL(L,K,1) + PMX(IS,L,K,I)                                   PR102310
119    2330 CONTINUE                                                                      PR102320
120    2350 CONTINUE                                                                      PR102330
121           GO TO 3000                                                                  PR102340
      C                                                                                   PR102350
      C                                                                                   PR102360
122    2400 CONTINUE                                                                      PR102370
123           DO 2900 I= 1, IM                                                            PR102380
124           IF( IPMTV .LT. 0 )                                 GO TO 2550               PR102390
125           DO 2500 IC=1, IPMTV                                                         PR102400
126           IF( IPTV(1,IC),EQ,I .AND. IPTV(2,IC),EQ,J ) GO TO 2550                      PR102410
127    2500 CONTINUE                                                                      PR102420
128           GO TO 2900                                                                  PR102430
      C                                                                                   PR102440
129    2550 CONTINUE                                                                      PR102450
130           IF( IPMTV .LT. 0 )   IV = IV + 1                                            PR102460
131           IF( IPMTV .GT. 0 )   IV = IC                                                PR102470
132           GO TO ( 2600, 2700, 2800 ),  IPMTX                                          PR102480
      C            SCALER IN COARSE MESH                                               PR102490
133    2600 CONTINUE                                                                      PR102500
134           DO 2650 K= 1, IGM                                                           PR102510
135           DO 2650 L= 1, IMT                                                           PR102520
136           PMXO(L,K,IV) = PMX(1,L,K,I)                                                 PR102530
137    2650 CONTINUE                                                                      PR102540
138           GO TO 2900                                                                  PR102550
      C            SCALAR + SCATTERING MATRIX(FOR EACH PL) IN COARSE MESH              PR102560
139    2700 CONTINUE                                                                      PR102570
140           DO 2750 K= 1, IGM                                                           PR102580
141           DO 2750 L= 1, IMM                                                           PR102590
142           DO 2750 IS=1, ISCS                                                          PR102600
143           PMXS(L,K,IS,IV) = PMX(IS,L,K,I)                                             PR102610
144    2750 CONTINUE                                                                      PR102620
      C            SCALAR + SCATTERING MATRIX(SUM OF PL) IN COARSE MESH                PR102630
145    2800 CONTINUE                                                                      PR102640
146           DO 2850 K= 1, IGM                                                           PR102650
147           DO 2850 L= 1, IMM                                                           PR102660
148           PMXL(L,K,IV) = 0.0                                                          PR102670
149           DO 2830 IS=1, ISCS                                                          PR102680
150           PMXL(L,K,IV) = PMXL(L,K,IV) + PMX(IS,L,K,I)                                 PR102690
151    2830 CONTINUE                                                                      PR102700
152    2850 CONTINUE                                                                      PR102710
153    2900 CONTINUE                                                                      PR102720
      C                                                                                   PR102730
154    3000 CONTINUE                                                                      PR102740
      C                                                                                   PR102750
      C                                                                                   PR102760
155           IF( IPMTV .GT. 0 )       IV = IPMTV                                         PR102770
156           IF( IPMTV .EW. 0 )       IV = 1                                             PR102780
157           IF( IV .EQ. 0 )                                    GO TO 3500               PR102790
158           WRITE(MW,7000)                                                              PR102800
159           WRITE(MW,7070)                                                              PR102810
160           GO TO ( 3010, 3100, 3200 ),   IPMTX                                         PR102820
161    3010 CONTINUE                                                                      PR102830
162           WRITE(MW,7075)                                                              PR102840
163           DO 3050 IC = 1, IV                                                          PR102850
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  58

ISN   ST-NO                  SOURCE PROGRAM      ( PRINT  )                                                    SEWUENCE

                                                                                                               PR102860
164           IF( IPMTV .NE. 0 )                                                                               PR102870
             **RITE(MW,7100)  IPTV(1,IC), IPTV(2,IC)                                                           PR102880
165           CALL WOT( PMXO(1,1,IC), IGM, IHT, 1, H(2,6), H(3,6), H(4,6),                                     PR102890
             *                 IIM, JJM, 1, MW)                                                               PR102900
166          3050 CONTINUE                                                                                     PR102910
167               GO TO 3300                                                                                   PR102920
168          3100 CONTINUE                                                                                     PR102930
             C                                                                                                 PR102940
169               WRITE(MW,7080)                                                                               PR102950
170               DO 3150 IC= 1, IV                                                                            PR102960
171               IF( IPMTV .NE. 0 )                                                                           PR102970
                 **RITE(MW,7100)  IPTV(1,IC), IPTV(2,IC)                                                       PR102980
172               DO 3130 IS= 1, ISCS                                                                          PR102990
173               ID = IS - 1                                                                                  PR103000
174               WRITE(MW,7120)     ID                                                                        PR103010
175               CALL WOT( PMXS(1,1,IS,IC), IGM, IHM, 1, H(2,7), H(3,7), H(4,7),                              PR103020
             *                 IIM, JJM, 1, MW )                                                              PR103030
176          3130 CONTINUE                                                                                     PR103040
177          3150 CONTINUE                                                                                     PR103050
178          3200 CONTINUE                                                                                     PR103060
             C                                                                                                 PR103070
179               IF( IPMTX .EW. 2 )          WRITE(MW,7000)                                                   PR103080
180               WRITE(MW,7090)                                                                               PR103090
181               DO 3250 IC= 1, IV                                                                            PR103100
182               IF( IPMTV .NE. 0 )                                                                           PR103110
                 **RITE(MW,7100)  IPTV(1,IC), IPTV(2,IC)                                                       PR103120
183               CALL WOT( PMXL(1,1,IC), IGM, IHM, 1, H(2,8), H(3,8), H(4,8),                                 PR103130
             *                 IIM, JJM, 1, MW)                                                               PR103140
184          3250 CONTINUE                                                                                     PR103150
185          3300 CONTINUE                                                                                     PR103160
186          3500 CONTINUE                                                                                     PR103170
             C                                                                                                 PR103180
             C******** PRINT SENSITIVITY SPECTRA                                                               PR103190
             C                                                                                                 PR103200
187               DO 4000 J= 1, JM                                                                             PR103210
188               CALL REED( MF3, 0, WORK, ITEMP, 3 )                                                          PR103220
189               DO 4000 I= 1, IM                                                                             PR103230
190               DO 4000 K= 1, 2                                                                              PR103240
191               DO 4000 L= 1, IGM                                                                            PR103250
192               P(L,I,J,K) = WORK(L+(K-1)*IGM+(I-1)*IGM*2)                                                   PR103260
193          4000 CONTINUE                                                                                     PR103270
             C                                                                                                 PR103280
             C          SUM OF ENERGY                                                                          PR103290
194               IV = 1                                                                                       PR103300
195               DO 4100 J= 1, JM                                                                             PR103310
196               DO 4100 I= 1, IM                                                                             PR103320
197               IP = 0                                                                                       PR103330
198               DO 4020 K= 1, 2                                                                              PR103340
199               PE(IV,K) = 0.0                                                                               PR103350
200               DO 4020 L= 1, IGM                                                                            PR103360
201               PE(IV,K) = PE(IV,K) + P(L,I,J,K)                                                             PR103370
202          4020 CONTINUE                                                                                     PR103380
203               IF( PE(IV,1) .EQ. 0.0 )                          GO TO 4100                                  PR103390
204               IIM(IV) = I                                                                                  PR103400
205               JJM(IV) = J                                                                                  PR103410
206               IV = IV + 1                                                                                  PR103420
207          4100 CONTINUE

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  59

ISN   ST-NO                  SOURCE PROGRAM      ( PRINT  )                                                    SEWUENCE

                                                                                                               PR103430
208               IV = IV - 1                                                                                  PR103440
209               IF( IV .LE. 0 )                                  GO TO 5000                                  PR103450
             C                                                                                                 PR103460
             C          SUM OF VOLUME                                                                          PR103470
210               DO 4200 K= 1, 2                                                                              PR103480
211               PVV(K) = 0.0                                                                                 PR103490
212               DO 4200 L= 1, IGM                                                                            PR103500
213               PV(L,K) = 0.0                                                                                PR103510
214               DO 4150 IC= 1, IV                                                                            PR103520
215               PV(L,K) = PV(L,K) + P(L,IIM(IC),JJM(IC),K)                                                   PR103530
216          4150 CONTINUE                                                                                     PR103540
217               PVV(K) = PVV(K) + PV(L,K)                                                                    PR103550
218          4200 CONTINUE                                                                                     PR103560
             C                                                                                                 PR103570
             C                                                                                                 PR103580
219               DO 4300 K= 1, 2                                                                              PR103590
220               DO 4300 IC=1, IV                                                                             PR103600
221               DO 4300 L= 1, IGM                                                                            PR103610
222               PM(L,IC,K) = P(L,IIM(IC),JJM(IC),K)                                                          PR103620
223          4300 CONTINUE                                                                                     PR103630
224               IF( IRESP.NE.1 )                                 GO TO 4500                                  PR103640
225               DO 4400 IC= 1, IV                                                                            PR103650
226               IF( PE(IC,2) .NE. 0.0 ) PE(IC,1) = PE(IC,2)                                                  PR103660
227               DO 4400 L = 1, IGM                                                                           PR103670
228               IF( PM(L,IC,2),NE, 0,0) PM(L,IC,1) = PM(L,IC,2)                                              PR103680
229          4400 CONTINUE                                                                                     PR103690
230          4500 CONTINUE                                                                                     PR103700
231               WRITE(MW,7000)                                                                               PR103710
232               WRITE(MW,7200)                                                                               PR103720
233               KK = 1                                                                                       PR103730
234               IF( IRESP.EQ.2 )   KK = 2                                                                    PR103740
235               DO 4700 K= 1, KK                                                                             PR103750
236               IF( K.EQ.1 .AND. IRESP.NE.1 )  WRITE(MW,7210)                                                PR103760
237               IF( K.EQ.1 .AND. IRESP.EQ.1 )  WRITE(MW,7220)                                                PR103770
238               IF( K.EQ.2 .AND. IRESP.EQ.2 )  WRITE(MW,7230)                                                PR103780
239               IFF = 0                                                                                      PR103790
240          4550 CONTINUE                                                                                     PR103800
241               IS = 1                                                                                       PR103810
242          4600 CONTINUE                                                                                     PR103820
243               IE = IS + 7                                                                                  PR103830
244               IE = MINO(IE,IV)                                                                             PR103840
245               IO3= IE - IS + 1                                                                             PR103850
246               CALL WOT( PM(1,IS,K), IO3, IGM, 1, H(2,9), H(3,9), H(4,9),                                   PR103860
             *                 IIM(IS), JJM(IS), 2, MW )                                                      PR103865
247               IF( IFF .EQ. 1) GO TO 4690                                                                   PR103870
248               WRITE(MW,7250)                                                                               PR103880
249               CALL WOT( PE(IS,K), IO3, 1, 1, H(2,10), H(3,10), H(4,10),                                    PR103890
             *                 IIM(IS), JJM(IS), 3, MW )                                                      PR103900
250               IS = IS + 8                                                                                  PR103910
251               IF( IS .LE. IV )                                 GO TO 4600                                  PR103920
252               CALL WOT( PV(1,K), 1, IGM, 1, H(2,11), H(3,11), H(4,11),                                     PR103930
             1                 IIM, JJM, 1, MW )                                                              PR103940
253               WRITE(MW,7300)    PVV(K)                                                                     PR103960
254               IFF = 1                                                                                      PR103970
255               DO 4620 J= 1, IV                                                                             PR103980
256               PE(J,K) = 0.0                                                                                PR103990
257               DO 4620 I= 1, IGM
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  60

ISN   ST-NO                SOURCE PROGRAM     ( PRINT  )                                    SEQUENCE

238         PM(I,J,K) = PM(I,J,K) / ENERGY(I)                                              PRI04000
239         PE(J,K)   = PE(J,K) + PM(I,J,K)                                                PRI04010
260       4620 CONTINUE                                                                    PRI04020
                                                                                           PRI04030
      C                                                                                    PRI04040
261         PVV(K) = 0.0                                                                   PRI04050
262         DO 4640 I= 1, IGM                                                              PRI04060
263         PV(I,K) = 0.0                                                                  PRI04070
264         DO 4630 J= 1, IV                                                               PRI04080
265         PV(I,K) = PV(I,K) + PM(I,J,K)                                                  PRI04090
266       4630 CONTINUE                                                                    PRI04100
267         PVV(K)  = PVV(K) + PV(I,K)                                                     PRI04110
268       4640 CONTINUE                                                                    PRI04120
269         WRITE(MW,7240)                                                                 PRI04130
270         GO TO 4550                                                                     PRI04140
271       4690 CONTINUE                                                                    PRI04150
      C                                                                                    PRI04160
      C******** PLOT SENSITIVITY SPECTRA                                                  PRI04170
      C                                                                                    PRI04180
272         IF( IPLOT .NE. 1 )                          GO TO 4700                         PRI04190
273         CALL PLOTER( PM(1,1,K), PV(1,K), D(LENGY), MATNO(N), IIM, JJM,                 PRI04200
                1              WORK(1),  WORK(102), WORK(203), IGM, IV, IGM1,              PRI04210
                2              LD(32), N, NE, IPTV, IPMTV )                                PRI04220
274       4700 CONTINUE                                                                    PRI04230
275       5000 CONTINUE                                                                    PRI04240
      C                                                                                    PRI04250
276       9000 CONTINUE                                                                    PRI04260
      C                                                                                    PRI04270
277         RETURN                                                                         PRI04280
278       7000 FORMAT(1H1)                                                                 PRI04290
279       7005 FORMAT(/1HO,10X,'MIXTURE NUMBER   MIXTURE COMMAND   ',                     PRI04300
                1                 'MATERIAL ATOMIC DENCITY'/                             PRI04310
                2    ,(/1H+,5X,I4, 7X, I5, 13X, I5, 10X, 1PE15.7 ) )                     PRI04320
280       7010 FORMAT(1H1, 100('*') //25X,                                                 PRI04330
              *'REACTION RATE FOR EACH GROUP  AND  COARSE MESH'                            PRI04340
              *//1X, 100('*') / )                                                          PRI04350
281       7020 FORMAT(/1HO, '***  ', 3A8, '=', 1PE12.5, '  ***' )                        PRI04360
282       7030 FORMAT(1H1, 100('*') //25X,                                                 PRI04370
              *'SENSITIVITY ANALYSIS FOR MATERIAL NUMBER = ', I5,                          PRI04380
              *//1X, 100('*') / )                                                          PRI04390
283       7040 FORMAT(/1HO, '***  1.  ANALYSIS OF PL EFFECT  ***' / 10X,                  PRI04400
              *'( PL-ORDER N MEANS THE EFFECT FOR CALCULATING BY THE P-(N+1) CROSPRI04410
              -S SECTIOT SETS )' )                                                         PRI04420
284       7050 FORMAT(/1HO, '==   PL-EFFECT FOR EACH GROUP   ==' )                        PRI04430
285       7060 FORMAT(/1HO, '==   PL-EFFECT FOR EACH COARSE MESH   ==' )                  PRI04440
286       7070 FORMAT(/1HO, '***  2.  SENSITIVITY MATRIX  ***' / 10X,                     PRI04450
              *'( FOR EACH COARSE MESH )' )                                                PRI04460
287       7075 FORMAT(/1HO, '==   SCALAR MATRIX   ==' )                                   PRI04470
288       7080 FORMAT(/1HO, '==   SCALAR + SCATTERING MATRIX ',                           PRI04480
              -'(FOR EACH PL EFFECT)   ==' )                                               PRI04490
289       7090 FORMAT(/1HO, '==   SCALAR + SCATTERING MATRIX ',                           PRI04500
              *'(SUM OF PL EFFECT)   ==' )                                                 PRI04510
290       7100 FORMAT(/1HO,2X'COARSE MESH =  ', '(', I3, ':', I3, ')' )                   PRI04520
291       7120 FORMAT(/1HO, 2X, 'SCATTERING ORDER =', I4 )                                PRI04530
292       7200 FORMAT(/1HO, '***  3.  SENSITIVITY COEFFICIENTS  ***' /10X,                PRI04540
              *'( FOR EACH COARSE MESH AND SUM OF ENERGY GROUP AND VOLUME )')              PRI04550
293       7210 FORMAT(/1HO, '==   NOT CONSIDER THE EFFECT OF DETECTOR CROSS ',            PRI04560
              1                 'SECTION CHANGE   ==')

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  61

ISN   ST-NO                SOURCE PROGRAM     ( PRINT  )                                    SEQUENCE

294       7220 FORMAT(/1HO, '==   CONSIDER THE EFFECT OF DETECTOR CROSS ',                PRI04570
              1                 'SECTION CHANGE   ==')                                     PRI04580
295       7230 FORMAT(/1HO, '==   THE EFFECT OF DETECTOR CROSS ',                         PRI04590
              1                 'SECTION CHANGE   ==')                                     PRI04600
296       7240 FORMAT(/1HO, '==   SENSITIVITY COEFFICIENT PER LETHARGY   ==')             PRI04610
297       7250 FORMAT(1HO, 2X, 'SUM OF ENERGY' )                                           PRI04620
298       7300 FORMAT(//1HO,'** SUM OF ENERGY AND VOLUME = ',1PE12.5, ' **')               PRI04630
299         END                                                                            PRI04640
```

```
FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  62

ISN  ST-NO                SOURCE PROGRAM                                                    SEWUENCE
  1          SUBROUTINE REED (N,IREC,VECP,NWDS,MODE)                                      REE00010
     C                                                    -- 1.1.3 --                     REE00020
     C       PERFORMS BINARY READ OPERATIONS                                              REE00030
     C                                                                                    REE00040
  2          DIMENSION IREC(1), VECP(1)                                                   REE00050
     C                                                                                    REE00060
     C       MODE IS OPERATION INDICATOR ( 1/2/3/4/5/6/7/8/9/10/11=                       REE00070
     C       LCM TO CORE/BINARY READ/BINARY READ WITH COUNT/REWIND/                       REE00080
     C       BINARY INTEGER READ/BINARY INTEGER READ WITH COUNT/                          REE00090
     C       SKIP RECORDS FORWARD/SKIP WORDS WITHIN A RECORD PRIOR TO                     REE00100
     C       INFORMATION TRANSFER/BINARY READ OF EIGHT BYTE WORDS/BINARY READ             REE00110
     C       OF EIGHT BYTE WORDS EXCEPT LAST WORD/BINARY READ OF FIRST EIGHT               REE00120
     C       BYTE WORD AND REMAINDER AS FOUR BYTE WORDS )                                 REE00130
     C                                                                                    REE00140
  3          GO TO (100,110,120,130,140,150,160,180,190,200,210), MODE                    REE00150
     C                                                                                    REE00160
     C       TRANSFERS INFORMATION FROM LCM TO CORE                                       REE00170
     C                                                                                    REE00180
     C       N NOT USED                                                                   REE00190
     C       IREC LCM POINTER                                                             REE00200
     C       VECP CORE VECTOR                                                             REE00210
     C       NWDS NUMBER OF WORDS TO TRANSFER                                             REE00220
     C                                                                                    REE00230
  4    100 CONTINUE                                                                       REE00240
  5          CALL ECRD (VECP,IREC,NWDS,IEREC)                                             REE00250
  6          RETURN                                                                       REE00260
     C                                                                                    REE00270
     C       READS BINARY RECORD                                                          REE00280
     C                                                                                    REE00290
     C       N IS UNIT NUMBER                                                             REE00300
     C       IREC NOT USED                                                                REE00310
     C       VECP IS CORE VECTOR                                                          REE00320
     C       NWDS IS NUMBER OF WORDS                                                      REE00330
     C                                                                                    REE00340
  7    110 CONTINUE                                                                       REE00350
  8          READ (N)(VECP(I),I=1,NWDS)                                                   REE00360
  9          RETURN                                                                       REE00370
     C                                                                                    REE00380
     C       READS BINARY RECORD USING FIRST WORD AS REMAINING RECORD LENGTH              REE00390
     C                                                                                    REE00400
     C       N IS UNIT NUMBER                                                             REE00410
     C       IREC NOT USED                                                                REE00420
     C       VECP IS CORE VECTOR                                                          REE00430
     C       NWDS UPON RETURN CONTAINS FIRST WORD OF RECORD                               REE00440
     C                                                                                    REE00450
 10    120 CONTINUE                                                                       REE00460
 11          READ (N)NWDS,(VECP(I),I=1,NWDS)                                              REE00470
 12          RETURN                                                                       REE00480
     C                                                                                    REE00490
     C       REWINDS UNIT                                                                 REE00500
     C                                                                                    REE00510
     C       N IS UNIT NUMBER                                                             REE00520
     C       IREC NOT USED                                                                REE00530
     C       VECP NOT USED                                                                REE00540
     C       NWDS NOT USED                                                                REE00550
     C                                                                                    REE00560
 13    130 CONTINUE                                                                       REE00570

FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  63

ISN  ST-NO                SOURCE PROGRAM     ( REED   )                                    SEWUENCE
 14          REWIND N                                                                     REE00580
 15          RETURN                                                                       REE00590
     C                                                                                    REE00600
     C       READS BINARY INTEGER RECORD                                                  REE00610
     C                                                                                    REE00620
     C       N IS UNIT NUMBER                                                             REE00630
     C       IREC IS INTEGER CORE VECTOR                                                  REE00640
     C       VECP NOT USED                                                                REE00650
     C       NWDS IS NUMBER OF WORDS                                                      REE00660
     C                                                                                    REE00670
 16    140 CONTINUE                                                                       REE00680
 17          READ (N)(IREC(I),I=1,NWDS)                                                   REE00690
 18          RETURN                                                                       REE00700
     C                                                                                    REE00710
     C       READS BINARY INTEGER RECORD USING FIRST WORD AS REMAINING                    REE00720
     C       RECORD LENGTH                                                                REE00730
     C                                                                                    REE00740
     C       N IS UNIT NUMBER                                                             REE00750
     C       IREC IS INTEGER CORE VECTOR                                                  REE00760
     C       VECP NOT USED                                                                REE00770
     C       NWDS UPON RETURN CONTAINS THE FIRST WORD OF RECORD                           REE00780
     C                                                                                    REE00790
 19    150 CONTINUE                                                                       REE00800
 20          READ (N)NWDS,(IREC(I),I=1,NWDS)                                              REE00810
 21          RETURN                                                                       REE00820
     C                                                                                    REE00830
     C       SKIPS FORWARD NWDS RECORDS WITH OPTIONAL REWIND                              REE00840
     C                                                                                    REE00850
     C       N IS UNIT NUMBER                                                             REE00860
     C       IREC IS PRIOR REWIND INDICATOR ( 0/1=NO/YES )                                REE00870
     C       VECP NOT USED                                                                REE00880
     C       NWDS IS THE NUMBER OF RECORDS TO SKIP FORWARD                                REE00890
     C                                                                                    REE00900
 22    160 CONTINUE                                                                       REE00910
 23          IF (IREC(1).NE.0) REWIND N                                                   REE00920
 24          DO 170 IDX=1,NWDS                                                            REE00930
 25          READ (N)                                                                     REE00940
 26    170 CONTINUE                                                                       REE00950
 27          RETURN                                                                       REE00960
     C                                                                                    REE00970
     C       READS RECORD SKIPPING FIRST WORDS                                            REE00980
     C                                                                                    REE00990
     C       N IS UNIT NUMBER                                                             REE01000
     C       IREC IS NUMBER OF WORDS TO SKIP                                              REE01010
     C       VECP IS CORE                                                                 REE01020
     C       NWDS IS NUMBER OF WORDS                                                      REE01030
     C                                                                                    REE01040
 28    180 CONTINUE                                                                       REE01050
 29          IDX=IREC(1)                                                                  REE01060
 30          READ (N)(TEMP,I=1,IDX),(VECP(I),I=1,NWDS)                                    REE01070
 31          RETURN                                                                       REE01080
     C                                                                                    REE01090
     C       READS  BINARY RECORD IN EIGHT BYTE WORDS                                     REE01100
     C                                                                                    REE01110
     C       N IS UNIT NUMBER                                                             REE01120
     C       IREC NOT USED                                                                REE01130
     C       VECP IS CORE                                                                 REE01140
```

```
FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  64

ISN  ST-NO                SOURCE PROGRAM     ( REED   )                          SEQUENCE

     C     NWDS IS NUMBER OF EIGHT BYTE WORDS                                    REED1150
     C                                                                           REED1160
32     190 CONTINUE                                                              REED1170
33         IDX = 2 * NWDS                                                        REED1180
34         READ (N)(VECP(I),I=1,IDX)                                             REED1190
35         RETURN                                                                REED1200
     C                                                                           REED1210
     C     READS BINARY EIGHT BYTE WORDS EXCEPT FOR LAST WORD WHICH IS           REED1220
     C     FOUR BYTES                                                            REED1230
     C                                                                           REED1240
     C     N IS UNIT NUMBER                                                      REED1250
     C     IREC IS CORE FOR LAST WORD OF RECORD ( FOUR BYTE )                    REED1260
     C     VECP IS CORE FOR EIGHT BYTE WORDS                                     REED1270
     C     NWDS IS NUMBER OF WORDS INCLUDING FOUR BYTE                           REED1280
     C                                                                           REED1290
36     200 CONTINUE                                                              REED1300
37         IDX = 2 * ( NWDS - 1 )                                                REED1310
38         IDY=1                                                                 REED1320
39         READ (N)(VECP(I),I=1,IDX),(IREC(I),I=1,IDY)                           REED1330
40         RETURN                                                                REED1340
     C                                                                           REED1350
     C     READS FIRST WORD OF RECORD AS EIGHT BYTE WORD AND REMAINDER           REED1360
     C     OF WORDS AS FOUR BYTE                                                 REED1370
     C                                                                           REED1380
     C     N IS UNIT NUMBER                                                      REED1390
     C     IREC IS CORE FOR EIGHT BYTE FIRST WORD                                REED1400
     C     VECP IS CORE FOR FOUR BYTE WORDS                                      REED1410
     C     NWDS IS NUMBER OF WORDS INCLUDING EIGHT BYTE                          REED1420
     C                                                                           REED1430
41     210 CONTINUE                                                              REED1440
42         IDX=NWDS-1                                                            REED1450
43         IDY = 2                                                               REED1460
44         READ (N)(IREC(I),I=1,IDY),(VECP(I),I=1,IDX)                           REED1470
45         RETURN                                                                REED1480
46         END                                                                   REED1490
```

```
FACOM 230-75 MT FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  65

ISN  ST-NO                SOURCE PROGRAM                                        SEQUENCE

 1         SUBROUTINE RITE (N,IREC,VECP,NWDS,MODE)                             RITE0010
     C                                                  -- 1.6.3 --            RITE0020
     C     PERFORMS BINARY WRITE OPERATIONS                                      RITE0030
     C                                                                           RITE0040
 2         DIMENSION IREC(1), VECP(1)                                          RITE0050
     C                                                                           RITE0060
     C     MODE IS OPERATION INDICATOR ( 1/2/3/4/5/6/7/8/9=                      RITE0070
     C     CORE TO LCM/BINARY WRITE/BINARY WRITE WITH COUNT/                     RITE0080
     C     END FILE AND REWIND/BINARY INTEGER WRITE/BINARY                       RITE0090
     C     INTEGER WRITE WITH COUNT/NOT USED/NOT USED/BINARY WRITE OF            RITE0100
     C     EIGHT BYTE WORDS )                                                    RITE0110
     C                                                                           RITE0120
 3         GO TO (100,110,120,130,140,150,160,170,180), MODE                   RITE0130
     C                                                                           RITE0140
     C     TRANSFERS INFORMATION FROM CORE TO LCM                                RITE0150
     C                                                                           RITE0160
     C     N NOT USED                                                            RITE0170
     C     IREC LCM POINTER                                                      RITE0180
     C     VECP CORE VECTOR                                                      RITE0190
     C     NWDS NUMBER OF WORDS TO TRANSFER                                      RITE0200
     C                                                                           RITE0210
 4     100 CONTINUE                                                            RITE0220
 5         CALL ECWR (VECP,IREC,NWDS,IEREC)                                    RITE0230
 6         RETURN                                                              RITE0240
     C                                                                           RITE0250
     C     WRITES BINARY RECORD                                                  RITE0260
     C                                                                           RITE0270
     C     N IS UNIT NUMBER                                                      RITE0280
     C     IREC NOT USED                                                         RITE0290
     C     VECP IS CORE VECTOR                                                   RITE0300
     C     NWDS IS NUMBER OF WORDS                                               RITE0310
     C                                                                           RITE0320
 7     110 CONTINUE                                                            RITE0330
 8         WRITE (N) (VECP(I),I=1,NWDS)                                        RITE0340
 9         RETURN                                                              RITE0350
     C                                                                           RITE0360
     C     WRITES BINARY RECORD WITH FIRST WORD AS BLOCK COUNT                   RITE0370
     C                                                                           RITE0380
     C     N IS UNIT NUMBER                                                      RITE0390
     C     IREC NOT USED                                                         RITE0400
     C     VECP IS CORE VECTOR                                                   RITE0410
     C     NWDS IS THE NUMBER OF WORDS IN THE CORE VECTOR                        RITE0420
     C                                                                           RITE0430
10     120 CONTINUE                                                            RITE0440
11         WRITE (N) NWDS,(VECP(I),I=1,NWDS)                                   RITE0450
12         RETURN                                                              RITE0460
     C                                                                           RITE0470
     C     WRITES AN END OF FILE AND REWINDS THE UNIT                            RITE0480
     C                                                                           RITE0490
     C     N IS UNIT NUMBER                                                      RITE0500
     C     IREC NOT USED                                                         RITE0510
     C     VECP NOT USED                                                         RITE0520
     C     NWDS NOT USED                                                         RITE0530
     C                                                                           RITE0540
13     130 CONTINUE                                                            RITE0550
14         END FILE N                                                          RITE0560
15         REWIND N                                                            RITE0570
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  66

ISN   ST-NO                SOURCE PROGRAM     ( RITE   )                          SEQUENCE

 16         RETURN                                                                RIT00580
      C                                                                           RIT00590
      C     WRITES BINARY INTEGER RECORD                                          RIT00600
      C                                                                           RIT00610
      C     N IS UNIT NUMBER                                                      RIT00620
      C     IREC IS INTEGER CORE VECTOR                                           RIT00630
      C     VECP NOT USED                                                         RIT00640
      C     NWDS IS NUMBER OF WORDS                                               RIT00650
      C                                                                           RIT00660
 17     140 CONTINUE                                                             RIT00670
 18         WRITE (N) (IREC(I),I=1,NWDS)                                         RIT00680
 19         RETURN                                                               RIT00690
      C                                                                           RIT00700
      C     WRITES BINARY INTEGER RECORD WITH FIRST WORD AS BLOCK COUNT           RIT00710
      C                                                                           RIT00720
      C     N IS UNIT NUMBER                                                      RIT00730
      C     IREC IS INTEGER CORE VECTOR                                           RIT00740
      C     VECP NOT USED                                                         RIT00750
      C     NWDS IS NUMBER WORDS IN THE INTEGER CORE VECTOR                       RIT00760
      C                                                                           RIT00770
 20     150 CONTINUE                                                             RIT00780
 21         WRITE (N) NWDS,(IREC(I),I=1,NWDS)                                    RIT00790
 22         RETURN                                                               RIT00800
      C                                                                           RIT00810
      C     NOT USED                                                              RIT00820
      C                                                                           RIT00830
 23     160 CONTINUE                                                             RIT00840
 24         RETURN                                                               RIT00850
      C                                                                           RIT00860
      C     NOT USED                                                              RIT00870
      C                                                                           RIT00880
 25     170 CONTINUE                                                             RIT00890
 26         RETURN                                                               RIT00900
      C                                                                           RIT00910
      C     WRITES BINARY RECORD OF EIGHT BYTE WORDS                              RIT00920
      C                                                                           RIT00930
      C     N IS UNIT NUMBER                                                      RIT00940
      C     IREC NOT USED                                                         RIT00950
      C     VECP IS CORE                                                          RIT00960
      C     NWDS IS NUMBER OF EIGHT BYTE WORDS                                    RIT00970
      C                                                                           RIT00980
 27     180 CONTINUE                                                             RIT00990
 28         IDX = 2 * NWDS                                                       RIT01000
 29         WRITE ( N ) ( VECP ( I ), I = 1, IDX )                               RIT01010
 30         RETURN                                                               RIT01020
 31         END                                                                  RIT01030
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  67

ISN   ST-NO                SOURCE PROGRAM                                        SEQUENCE

  1        SUBROUTINE  SUB1                                                     SUB00010
      C*****************************************************************      *SUB00020
      C     SUB1                      -- 1.0 --                                *SUB00030
      C                                                                        *SUB00040
      C      1. SUBROUTINE                                                     *SUB00050
      C          (1) MAINE CONTROUL ROUTINE                                    *SUB00060
      C                                                                        *SUB00070
      C      2. CALLED BY      (MAIN)                                          *SUB00080
      C                                                                        *SUB00090
      C      3. CALLS          (INPUT1, INPUT2, INPUT3, INPUT4,                *SUB00100
      C                         CMPUT1, CMPUT2, PRINT)                         *SUB00110
      C                                                                        *SUB00120
      C                                                                        *SUB00130
      C*****************************************************************      *SUB00140
      C                                                                        SUB00150
  2        COMMON /IONO  / MR, MW,  MFF, MFA, MFC, MFR, MF1, MF2, MF3,        SUB00160
     *                    MF4, MF5                                            SUB00170
  3        COMMON /CNTRL / IRR, IR1, IR2                                       SUB00180
  4        COMMON   IB(100), D(1)                                              SUB00190
  5        DIMENSION LD(500)                                                   SUB00200
  6        EQUIVALENCE ( D(1),LD(1) )                                          SUB00210
  7        EQUIVALENCE (LD( 27),ITAPE), (LD( 31),IPLOT), (LD( 32),IPLTZ),     SUB00220
     1              (LD( 33),IPMTV), (LD( 23),NE    )                        SUB00230
  8        EQUIVALENCE (IB( 2),LMAX  ), (IB( 3),LOPTN ), (IB( 4),LMATE ),     SUB00240
     1              (IB( 5),LENGY ), (IB( 6),LIPMTV), (IB( 7),LIPARM),     SUB00250
     2              (IB( 8),LIDUSE), (IB( 9),LIA   ), (IB(10),LMIXNM),     SUB00260
     3              (IB(11),LMIXCM), (IB(12),LMIXDN), (IB(13),LIDCS ),     SUB00270
     4              (IB(14),LIMX  ), (IB(15),LIMY  ), (IB(16),LXR   ),     SUB00280
     5              (IB(17),LYR   ), (IB(18),LFL   ), (IB(19),LSUM  ),     SUB00290
     6              (IB(20),LWORK )                                        SUB00300
  9        EQUIVALENCE (IB(23),NORDM ), (IB(26),LAST  ), (IB(27),LASTEC),     SUB00310
     1              (IB(28),LTSO  ), (IB(29),LTFX  ), (IB(30),LTXS  ),     SUB00320
     2              (IB(31),LTBS  )                                        SUB00330
 10        EQUIVALENCE (IB(34),ISCT  ), (IB(35),ISCS  ), (IB(36),IGM   ),     SUB00340
     1              (IB(37),IGM1  ), (IB(38),IM    ), (IB(39),JM    ),     SUB00350
     2              (IB(40),MT    ), (IB(41),MS    ), (IB(42),IMT   ),     SUB00360
     3              (IB(43),IMS   ), (IB(44),IMM   ), (IB(45),IMC   ),     SUB00370
     4              (IB(46),JMC   ), (IB(47),NM    ), (IB(48),NMB   ),     SUB00380
     5              (IB(49),IT    ), (IB(50),JT    ), (IB(51),LIMXT ),     SUB00390
     6              (IB(52),LIMYT ), (IB(53),LA5   ), (IB(54),LDC   ),     SUB00400
     7              (IB(55),LYM   ), (IB(56),LMN   ), (IB(57),LMC   ),     SUB00410
     8              (IB(58),LMD   ), (IB(59),LXRAD ), (IB(60),LYRAD ),     SUB00420
     9              (IB(61),MM    )                                        SUB00430
 11        EQUIVALENCE (IB(63),LNGR  ), (IB(64),LNG1  ), (IB(65),LNG2  ),     SUB00440
     1              (IB(66),KIB   ), (IB(67),KD    )                        SUB00450
 12        EQUIVALENCE (IB(68),KVL   ), (IB(69),KCR   ), (IB(70),KRT   ),     SUB00460
     1              (IB(71),KFL   ), (IB(72),NFL   ), (IB(73),NRT   ),     SUB00470
     2              (IB(74),KFF   ), (IB(75),NFF   )                       SUB00480
 13        EQUIVALENCE (IB(77),KFA   ), (IB(78),NFA   ), (IB(79),KBS   ),     SUB00490
     1              (IB(80),NBS   ),                                       SUB00500
     2              (IB(83),N01   ), (IB(84),N02   ),                      SUB00510
     3              (IB(86),LM    ), (IB(87),LP1   ), (IB(88),LP2   ),     SUB00520
     4              (IB(89),LP3   ), (IB(90),LP4   )                       SUB00530
      C                                                                        SUB00540
      C******** READ CARD DATA, IT'S CHECK, WRITE CAPTION,                     SUB00550
      C          AND READ PARAMETER FROM FORWARD FILE                         SUB00560
      C                                                                        SUB00570
```

```
FACOM 230-75 MT FORTRAN-IV M COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79,06,22/09:32    PAGE  68

ISN  ST-NO                SOURCE PROGRAM     ( SUB1   )                          SEQUENCE
 14        CALL INPUT1 ( KER )                                                   SUB00580
 15        IF( KER .GE. 2 )                              GO TO 8000              SUB00590
           C                                                                     SUB00600
 16        IF( ITAPE .EQ. 1 )                            GO TO 1000              SUB00610
           C                                                                     SUB00620
           C******** READ FORWARD FILE, WRITE RESTART AND SCRATCH FILE            SUB00630
           C                                                                     SUB00640
 17        LWK2 = LWORK + LAST*(NORDM+1)                                         SUB00650
 18        MWORK= LMAX  - LWK2                                                   SUB00660
 19        WRITE(MW,7000)     LMAX, LWORK, LWK2, LAST, MWORK                     SUB00670
           C                                                                     SUB00680
 20        N1 = IM*JM                                                            SUB00690
 21        N2 = IT*JT                                                            SUB00700
 22        N3 = IHM*IGM*MT                                                       SUB00710
 23        NMX= MAX ( N1, N2, N3 )                                               SUB00720
 24        LWK2 = LWORK + NMX                                                    SUB00730
 25        MWORK = LMAX - LWK2                                                   SUB00740
           C                                                                     SUB00750
           C                                                                     SUB00760
 26        CALL INPUT2( D(LWORK), D(LWORK), D(LWORK), D(LWK2),                   SUB00770
          *             IM, JM, IT, JT, IHM, IGM, MT, MWORK, KER )               SUB00780
 27        IF( KER .GE. 2 )                              GO TO 8000              SUB00790
           C                                                                     SUB00800
           C******** READ ADJOINT FILE AND WRITE SCRATCH FILE                     SUB00810
           C                                                                     SUB00820
 28        NMX = NG2*IT*JT                                                       SUB00830
 29        LWK2 = LWORK + NMX                                                    SUB00840
 30        MWORK= LMAX  - LWK2                                                   SUB00850
 31        CALL INPUT3( D(LWORK), D(LWORK), D(LWK2),                             SUB00860
          *             IT,JT, NG1, NG2, MWORK, KER )                          SUB00870
 32        IF( KER .GE. 2 )                              GO TO 8000              SUB00880
           C                                                                     SUB00890
           C******** COMPUTE REACTION RATE AND FLUX*FLUX MATRIX                   SUB00900
           C                                                                     SUB00910
 33        CALL CMPUT1 ( KER )                                                   SUB00920
           C                                                                     SUB00930
 34        IRR = KIB                                                             SUB00940
 35        WRITE(MFR,IRR)    IB                                                  SUB00950
 36        WRITE(MFR,IRR)    (D(I),I=1,LWORK)                                    SUB00960
           C                                                                     SUB00970
           C                                                                     SUB00980
 37        IF( ITAPE .EQ. 2 )                            GO TO 5000              SUB00990
 38        GO TO 2000                                                            SUB01000
           C                                                                     SUB01010
           C******** READ RESTART FILE AND DATA SET                               SUB01020
           C                                                                     SUB01030
 39   1000 CONTINUE                                                             SUB01040
 40        CALL INPUT4 ( KER )                                                   SUB01050
 41        IF( KER .GE. 2 )                              GO TO 8000              SUB01060
           C                                                                     SUB01070
           C---      WRITE WORK AREA                                             SUB01080
 42        N1 = ISCS*IHM*IGM*IM + ISCS*IGM*IM + IGM*IM*2 + IHM*IGM*MT +          SUB01090
          1     IM*IGM + ISCS*IGM*IGM + MT + MT + IM*JM                        SUB01100
           C                                                                     SUB01110
 43        N2 = IM*JM + IM*JM + ISCS*IGM*IM*JM + ISCT*IGM + ISCT*IM*JM          SUB01120
           C                                                                     SUB01130
 44        N3 = ISCS*IHM*IGM*IM + IHT*IGM*IM*JM + IHM*IGM*ISCS*IM*JM +          SUB01140

FACOM 230-75 MT FORTRAN-IV M COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79,06,22/09:32    PAGE  69

ISN  ST-NO                SOURCE PROGRAM     ( SUB1   )                          SEQUENCE
          1     IHM*IGM*IM*JM                                                  SUB01150
           C                                                                     SUB01160
 45        N4 =(IGM*IM*JM + IM*JM + IGM + IGM*IM*JM) * 2                         SUB01170
           C                                                                     SUB01180
 46        N2 = MAX0( N2, N3, N4 ) + MAX0(IM*JM, IGM*IM*2 )                      SUB01190
 47        N3 = LWORK + N2                                                       SUB01200
 48        N4 = LMAX - N3                                                        SUB01210
 49        WRITE(MW,7000)     LMAX, LWORK, N2, N3, N4                            SUB01220
           C                                                                     SUB01230
           C******** COMPUTE SENSITIVITY MATRIX AND ITS CHANGE FOR CROSS SECTION  SUB01240
           C                                                                     SUB01250
 50   2000 CONTINUE                                                             SUB01260
 51        IPMX = ISCS*IHM*IGM*IM                                                SUB01270
 52        ITRNC= ISCS*IGM*IM                                                    SUB01280
 53        IP   = IGM*IM*2                                                       SUB01290
 54        IC   = IHM*IGM*MT                                                     SUB01300
 55        IRATE= IM*IGM                                                         SUB01310
 56        IFLMT= ISCS*IGM*IGM                                                   SUB01320
 57        LPMX   = LWORK                                                        SUB01330
 58        LTRUNC = LPMX  + IPMX                                                 SUB01340
 59        LP     = LTRUNC+ ITRNC                                                SUB01350
 60        LC     = LP + IP                                                      SUB01360
 61        LRATE  = LC + IC                                                      SUB01370
 62        LFLMT  = LRATE + IRATE                                                SUB01380
 63        LMAST  = LFLMT + IFLMT                                                SUB01390
 64        LRW    = LMAST + MT                                                   SUB01400
 65        LWK    = LRW   + MT                                                   SUB01410
 66        IWK    = LMAX - LWK                                                   SUB01420
 67        CALL CMPUT2( D(LPMX), D(LTRUNC), D(LP), D(LC), D(LRATE), D(LFLMT),    SUB01430
          1     LD(LMAST) ,D(LRW), D(LWK), LD(LM|XNM), LD(LM|XCM),  D(LM|XDN),  SUB01440
          2             LD(LIDCS), LD(LMATE),                                   SUB01450
          3             ISCS, IHM, IGM, IM, JM, MT, MS, NE, IWK, 2,             SUB01460
          4                                                  KER )               SUB01470
 68        IF( KER .GE. 2 )                              GO TO 8000              SUB01480
           C                                                                     SUB01490
           C******** WRITE CALCULATED DAT( PMX, TRUNC, P )                        SUB01500
           C                                                                     SUB01510
 69   5000 CONTINUE                                                             SUB01520
 70        LC = LWORK                                                            SUB01530
 71        N1 = LC + IHM*IGM*MT                                                  SUB01540
           C                                                                     SUB01550
 72        LRA = LWORK                                                           SUB01560
 73        N2  = LRA + JM*IM*IGM                                                 SUB01570
           C                                                                     SUB01580
 74        LIIM = LWORK                                                          SUB01590
 75        LJJM = LIIM + IM*JM                                                   SUB01600
 76        LTRC = LJJM + IM*JM                                                   SUB01610
 77        LTRV = LTRC + ISCS*IGM*IM*JM                                          SUB01620
 78        LTRE = LTRV + ISCT*IGM                                                SUB01630
 79        N3   = LTRE + ISCT*IM*JM                                              SUB01640
           C                                                                     SUB01650
 80        LPMX = LWORK                                                          SUB01660
 81        LPXO = LPMX + ISCS*IHM*IGM*IM                                         SUB01670
 82        LPXS = LPXO + IHT*IGM*IM*JM                                           SUB01680
 83        LPXL = LPXS + IHM*IGM*ISCS*IM*JM                                      SUB01690
 84        N4   = LPXL + IHM*IGM*IM*JM                                           SUB01700
           C                                                                     SUB01710
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  70

ISN   ST-NO                SOURCE PROGRAM      ( SUB1    )                    SEQUENCE

 85         LP   = LTRC                                                      SUB01720
 86         LPE  = LP  + IGM*IM*JM*2                                         SUB01730
 87         LPV  = LPE + IM*JM*2                                             SUB01740
 88         LPM  = LPV + IGM*2                                               SUB01750
 89         N5   = LPM + IGM*IM*JM*2                                         SUB01760
 90         L*K  = MAX0( N3, N4, N5 )                                        SUB01770
 91         MWORK= LMAX - L*K                                                SUB01780
 92         IMJM = IM*JM                                                     SUB01790
 93         CALL PRINT( D(LC), D(LRA), LD(LI(IM), LD(LJJM), D(LTRC), D(LTRV),SUB01800
                        D(LTRE), D(LPMX), D(LPXO), D(LPXS), D(LPXL),        SUB01810
           1            D(LP), D(LPE), D(LPV), D(LPM), D(L*K), LD(LIPMTV),  SUB01820
           2          IPMTV, LD(LMATE), NE, IMJM,                           SUB01830
           3           IM, JM, IHM, IHT, IGM, MT, ISCT, ISCS,MWORK, KER )   SUB01840
           4                                                                 SUB01850
 94         IF( KER .GE. 2 )                          GO TO 8000             SUB01860
 95         GO TO 9000                                                       SUB01870
      C                                                                     SUB01880
      C******** ERROR STOP                                                  SUB01890
      C                                                                     SUB01900
 96    8000 CONTINUE                                                       SUB01910
 97         CALL ERROR(2,5,'SUB1=1 ** TRACE      ')                       SUB01920
      C                                                                     SUB01930
 98    9000 CONTINUE                                                       SUB01940
 99         RETURN                                                         SUB01950
100    7000 FORMAT(1H0,5X,'MAX. AREA IS              ', I10                SUB01960
           1          /6X,'PARAMETER AREA IS        ', I10                SUB01970
           2          /6X,'MAX. WORK AREA IS        ', I10                SUB01980
           3          /6X,'MAX. UNIT OF I/O AREA IS ', I10                SUB01990
           4          /6X,'REMAINING AREA IS        ', I10)               SUB02000
101        END

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  71

ISN   ST-NO                SOURCE PROGRAM                                    SEQUENCE

  1        SUBROUTINE  SUMUP( SUM, V, A, B, NM, NN, N1, N2, I1, I1, I2,      SUM00010
           1                  JJ, J1, J2, KER )                              SUM00020
      C*****************************************************************SUM00030
      C     SUMUP                                        -- 1.4.1.1 --     *SUM00040
      C                                                                     *SUM00050
      C                                                                     *SUM00060
      C      1, FUNCTION                                                    *SUM00070
      C           SUM(N) = V(I,J) * A(N,I,J) * B(N,I,J)                     *SUM00080
      C                    FOR I=I1,I2 ; J=J1,J2 ; N=N1,N2                  *SUM00090
      C                                                                     *SUM00100
      C      2, INPUT                                                       *SUM00110
      C          (1) V (II,JJ)      = VOLUME                               *SUM00120
      C          (2) A (NN,II,JJ)   = RESPONCE FUNCTION OR FD,FLUX         *SUM00130
      C          (3) B (NN,II,JJ)   = FD,FLUX OR AD,FLUX                   *SUM00140
      C                                                                     *SUM00150
      C          (4) NN  =ORDER                                            *SUM00160
      C          (5) N1  =START ORDER                                      *SUM00170
      C          (6) N2  =END ORDER                                        *SUM00180
      C                                                                     *SUM00190
      C          (7) II  =X-DIRECTION LENGTH IN COARSE MESH                *SUM00200
      C          (8) I1  =START POSITION                                   *SUM00210
      C          (9) I2  =END POSITION                                     *SUM00220
      C                                                                     *SUM00230
      C         (10) JJ  =Y-DIRECTION LENGTH IN COARSE MESH                *SUM00240
      C         (11) J1  =START POSITION                                   *SUM00250
      C         (12) J2  =END POSITION                                     *SUM00260
      C                                                                     *SUM00270
      C      3, OUTPUT                                                      *SUM00280
      C          (1) SUM (NN)       = REACTION RATE OR FLUX MATRIX         *SUM00290
      C                                                                     *SUM00300
      C          (2) KER =RETURN CORD                                       *SUM00310
      C                                                                     *SUM00320
      C      4, LOCAL VARIABLE                                              *SUM00330
      C          (1) SU  =TEMPORARY RESERVE                                 *SUM00340
      C                                                                      SUM00350
      C      5, CALLED BY      (CMPUTR,CMPUTF)                             *SUM00360
      C                                                                     *SUM00370
      C*****************************************************************SUM00380
  2         DIMENSION  SUM(NN), V(II,JJ), A(NM,II,JJ), B(NM,II,JJ)          SUM00390
  3         KER = 0                                                         SUM00400
      C                                                                     SUM00410
      C******** COMPUTE                                                     SUM00420
      C                                                                     SUM00430
  4         NK = 0                                                          SUM00440
  5         DO 1000 N= N1, N2                                               SUM00450
  6         SUM(N) = 0.0                                                    SUM00460
  7         DO 1000 K= 1, N                                                 SUM00470
  8         NK =NK + 1                                                      SUM00480
  9         SU = 0.0                                                        SUM00490
      C---      SUMMATION IN SPACE                                          SUM00500
 10         DO 100 J= J1, J2                                                SUM00510
 11         DO 100 I= I1, I2                                                SUM00520
 12         SU = SU + V(I,J) * A(NK,I,J) * B(NK,I,J)                        SUM00530
 13   100 CONTINUE                                                          SUM00540
 14         SUM(N) = SUM(N) + SU                                            SUM00550
 15   1000 CONTINUE                                                         SUM00560
 16         RETURN                                                          SUM00570
 17         END
```

```
FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  72

ISN  ST-NO                SOURCE PROGRAM                                          SEQUENCE
  1        SUBROUTINE  TRUNCP( TRUNC, P, PMX, RATE, SUM, MICR, MATR, IREPS,      TRU00010
          1            ISCS, IHM, IHT, IHS, IGM, IP, KER )                      TRU00020
       C*****************************************************************      *TRU00030
       C     TRUNCP                                                             *TRU00040
       C                                          -- 1.6.2 --                    *TRU00050
       C      1. SUBROUTINE                                                     *TRU00060
       C           (1) CALCULATE THUNCATION ERROR (TRUNC)                       *TRU00070
       C           (2) CALCULATE SENSITIVITY COEFFICIENT (P)                    *TRU00080
       C                                                                        *TRU00090
       C      2. INPUT                                                          *TRU00100
       C           (1) PMX(ISCS,IHM,IGM) SENSITIVITY MATRIX                     *TRU00110
       C           (2) RATE(IGM)         REACTION RATE                          *TRU00120
       C           (3) SUM               SUM OF REACTION RATE                   *TRU00130
       C           (4) ISCS              ISCT + 1                               *TRU00140
       C           (5) IHM                CROSS SECTION TABLE LENGTH            *TRU00150
       C           (6) IHT                POSITION IN TABLE OF TOTAL CROSS      *TRU00160
       C                                  SECTION                               *TRU00170
       C           (7) IHS                POSITION IN TABLE OF SELF-SCATTER     *TRU00180
       C                                  CROSS SECTION                         *TRU00190
       C           (8) IGM                NUMBER OF GROUP                       *TRU00200
       C           (9) IP    = 2                                                *TRU00210
       C                                                                        *TRU00220
       C      3. OUTPUT                                                         *TRU00230
       C           (1) TRUNC(ISCS,IGM)   TRUNCATION ERROR                       *TRU00240
       C           (2) P(IGM,IP)         SENSITIVITY SPECTORA                   *TRU00250
       C           (3) KER               RETURN CODE                            *TRU00260
       C                                                                        *TRU00270
       C      4. CALLED BY      (CMPUT2)                                        *TRU00280
       C                                                                        *TRU00290
       C*****************************************************************      *TRU00300
  2        DIMENSION  TRUNC(ISCS,IGM), P(IGM,IP), PMX(ISCS,IHM,IGM),           TRU00310
          1           RATE(IGM)                                                 TRU00320
  3        KER = 0                                                             TRU00330
       C                                                                       TRU00340
       C******** CALCULATE TRUNCATION ERROR                                     TRU00350
       C                                                                       TRU00360
  4        DO 200  K= 1, ISCS                                                  TRU00370
  5        DO 200  L= 1, IGM                                                   TRU00380
  6        LL = IGM - L + 1                                                    TRU00390
  7        DO 100  N= K, ISCS                                                  TRU00400
  8        DO 100  M= 1, LL                                                    TRU00410
  9        MM = M + L - 1                                                      TRU00420
 10        NN = IHS -1 + M                                                     TRU00430
 11        TRUNC(K,L) = TRUNC(K,L) + PMX(N,NN,MM)                              TRU00440
 12    100 CONTINUE                                                            TRU00450
 13    200 CONTINUE                                                            TRU00460
       C                                                                       TRU00470
       C******** CALCULATE SENSITIVITY COEFFICIENT                              TRU00480
       C                                                                       TRU00490
 14        DO 500  IG= 1, IGM                                                  TRU00500
 15        P(IG,1) = PMX(1,IHT,IG) + TRUNC(1,IG)                               TRU00510
 16    500 CONTINUE                                                            TRU00520
 17        IF( MICR.NE.MATR .OR. IREPS.EQ.0 )          GO TO 700               TRU00530
 18        DO 600  IG= 1, IGM                                                  TRU00540
 19        P(IG,2) = P(IG,1) + RATE(IG)/SUM                                    TRU00550
 20    600 CONTINUE                                                            TRU00560
 21    700 CONTINUE                                                            TRU00570

FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  73

ISN  ST-NO                SOURCE PROGRAM      ( TRUNCP )                        SEQUENCE
 22        RETURN                                                              TRU00580
 23        END                                                                 TRU00590
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  74

ISN   ST-NO                  SOURCE PROGRAM                                                                  SEQUENCE
  1         SUBROUTINE  WOT(X,NCOL,LTBL,LG,TOP1,TOP2,TOP3,IIM,JJM,LC,NW)                                    WOT00010
      C*****************************************************************************************          *WOT00020
      C     WOT                                        -- 1.7.3 --                                        *WOT00030
      C      1. SUBROUTINE                                                                                 *WOT00040
      C                                                                                                    *WOT00050
      C      2. INPUT                                                                                      *WOT00060
      C          (1) X(LTBL,NCOL,LG)  WRITE OUT VALUES                                                     *WOT00070
      C          (2) NCOL             NUMBER OF 1D ARRAY                                                   *WOT00080
      C          (3) LTBL             NUMBER OF 2D ARRAY                                                   *WOT00090
      C          (4) LG               NUMBER OF 3D ARRAY                                                   *WOT00100
      C          (5) TOP1             CAPTION 1                                                            *WOT00110
      C          (6) TOP2             CAPTION 2                                                            *WOT00120
      C          (7) TOTP3            CAPTION 3                                                            *WOT00130
      C          (8) NW               UNIT NUMBER                                                          *WOT00140
      C          (9) IIM(NCOL)        RADIAL-POSITION OF COARSE MESH                                       *WOT00150
      C         (10) JJM(NCOL)        AXIAL -POSITION OF COARSE MESH                                       *WOT00160
      C                                                                                                    *WOT00170
      C      3. CALLED BY       (PRINT)                                                                    *WOT00180
      C                                                                                                    *WOT00190
      C*****************************************************************************************          *WOT00200
  2         DIMENSION  X(LTBL,NCOL,LG), IIM(NCOL), JJM(NCOL)                                               WOT00210
  3         DATA M1, M2, M3 / '(', ',', ')' /                                                              WOT00220
  4         REAL*8  TOP1, TOP2, TOP3                                                                       WOT00230
      C                                                                                                    WOT00240
  5         DO 300 L= 1, LG                                                                                WOT00250
  6         IO2 = 0                                                                                        WOT00260
  7         IO3 = (NCOL+7)/8                                                                               WOT00270
  8         IF(LG.GT.1 )              WRITE(NW,7000) TOP3, L                                               WOT00280
      C                                                                                                    WOT00290
  9         DO 200 I= 1, IO3                                                                               WOT00300
 10         IO1 = IO2 + 1                                                                                  WOT00310
 11         IO2 = MIN0(IO1+7,NCOL)                                                                         WOT00320
 12         IF( LC .EQ. 1 )                                                                                WOT00330
           *WRITE(NW,7100) TOP1, (TOP2,J,J=IO1,IO2)                                                        WOT00340
 13         IF( LC .EQ. 2 )                                                                                WOT00350
           *WRITE(NW,7150) TOP1, (M1, IIM(J), M2, JJM(J), M3, J= IO1, IO2)                                 WOT00360
      C                                                                                                    WOT00370
 14         DO 100 K= 1, LTBL                                                                              WOT00380
 15         IF( K.EQ.1 )                                          GO TO 30                                 WOT00390
      C                                                                                                    WOT00400
 16         DO 10 J= IO1, IO2                                                                              WOT00410
 17         IF( X(K,J,L) .NE. X(K-1,J,L) )                        GO TO 40                                 WOT00420
 18    10 CONTINUE                                                                                         WOT00430
      C                                                                                                    WOT00440
 19         IF( KE.EQ.KS )                                        GO TO 20                                 WOT00450
 20         KE = K                                                                                         WOT00460
      C                                                                                                    WOT00470
 21         IF( K.EQ.LTBL )                                       GO TO 40                                 WOT00480
 22         GO TO 100                                                                                      WOT00490
      C                                                                                                    WOT00500
 23    20 CONTINUE                                                                                         WOT00510
 24         IF( K.EQ.LTBL )                                       GO TO 50                                 WOT00520
      C                                                                                                    WOT00530
 25         DO  30 J= IO1, IO2                                                                             WOT00540
 26         IF( X(K,J,L) .NE. X(K+1,J,L) )                        GO TO 50                                 WOT00550
 27    30 CONTINUE                                                                                         WOT00560
      C                                                                                                    WOT00570

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  75

ISN   ST-NO                  SOURCE PROGRAM      ( WOT    )                                                 SEQUENCE
                                                                                                           WOT00580
 28         KE = KF + 1                                                                                    WOT00590
 29         GO TO 100                                                                                      WOT00600
      C                                                                                                    WOT00610
 30    40 CONTINUE                                                                                         WOT00620
 31         IF( KE .EQ. KS )                                      GO TO 50                                 WOT00630
 32         WRITE(NW,7200) TOP1, KS, TOP1, KE                                                              WOT00640
 33         IF( K.EQ.LTBL .AND. KE.EQ.K )                         GO TO 100                                WOT00650
 34    50 CONTINUE                                                                                         WOT00660
 35         WRITE(NW,7300) K, (X(K,J,L),J=IO1,IO2)                                                         WOT00670
 36         KS = K + 1                                                                                     WOT00680
 37         KE = KS                                                                                        WOT00690
 38    100 CONTINUE                                                                                        WOT00700
 39    200 CONTINUE                                                                                        WOT00710
 40    300 CONTINUE                                                                                        WOT00720
 41   7000 FORMAT(/1HO, 2X, A8, I5)                                                                        WOT00730
 42   7100 FORMAT(2HO , A8, 1X, A6, I3, 7(4X, A6, I3) )                                                    WOT00740
 43   7150 FORMAT(2HO , A8, 8(3X, A1, I2, A1, I2, A1, 3X) )                                                WOT00750
 44   7200 FORMAT(8X, A8, I5, 6H THRU , A8, I5, 14H SAME AS ABOVE)                                         WOT00760
 45   7300 FORMAT(I10, 1P8E13.5 )                                                                          WOT00770
 46         RETURN                                                                                         WOT00780
 47         END
```

```
      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  76

ISN   ST-NO                  SOURCE PROGRAM                                                    SEQUENCE

  1           SUBROUTINE WRITE (IOP,IF,ARRAY,IM,JM,KM,H1,H2,H3,H4)                           WRI00010
C                                                  -- 1.8.2 --                              *WRI00020
C     PRINT ARRAYS                                                                          WRI00030
C                                                                                           WRI00040
C     IOP=1/2/3/4/5   1D/2D/3D/FLUX OR W/PARTIAL 2D    IF=1/2  INT/FLOAT                    WRI00050
C                                                                                           WRI00060
C     COMMON /UNITS/ NINP,NOUT,NAFLUX,NDUMP1,NDUMP2,NEXTRA,NEDIT,IAFLUX,                   WRI00070
C    1ITFLUX,ISNCON,IFIXSR,ISOTXS                                                           WRI00080
  2           COMMON /IOND  / MR,  NOUT, MFF, MFA, MFC, MFN, MF1, MF2, MF3,                WRI00090
             1                  MF4, MF5                                                    WRI00100
C                                                                                           WRI00110
  3           DIMENSION ARRAY(IM,JM,KM)                                                     WRI00120
  4           DIMENSION HH1(1), IHH1(2)                                                     WRI00130
C                                                                                           WRI00140
  5           EQUIVALENCE (IHH1(1),HH1(1))                                                  WRI00150
C                                                                                           WRI00160
  6           REAL*8 H1,H2,H3,H4,HH1                                                        WRI00170
C                                                                                           WRI00180
  7            IF ((IOP.EQ.4).OR.(IOP.EQ.5)) IH1 = H1                                       WRI00190
C                                                                                           WRI00200
C     CHECK ARRAY FOR EQUAL ENTRIES                                                         WRI00210
  8           CALL ECHECK (ARRAY,IM*JM*KM,IEQ)                                              WRI00220
  9           IF (IEQ.EQ.0) GO TO 100                                                       WRI00230
C                                                                                           WRI00240
C     ALL ENTRIES ARE EQUAL                                                                 WRI00250
C                                                                                           WRI00260
 10           IF (IOP.EQ.5) WRITE (NOUT,340)H2,H3                                           WRI00270
 11           IF (IOP.NE.5) WRITE (NOUT,280)H1,H2,H3                                        WRI00280
 12           WRITE (NOUT,350)ARRAY(1,1,1)                                                  WRI00290
 13           RETURN                                                                        WRI00300
 14       100 CONTINUE                                                                      WRI00310
 15           GO TO (110,130,150,210,140), IOP                                              WRI00320
C                                                                                           WRI00330
C     1D ARRAYS                                                                             WRI00340
C                                                                                           WRI00350
 16       110 WRITE (NOUT,250)H1,H2,H3,H4                                                   WRI00360
 17           IF (IF.EQ.1) GO TO 120                                                        WRI00370
 18           WRITE (NOUT,260)(I,ARRAY(I,1,1),I=1,IM)                                       WRI00380
 19           RETURN                                                                        WRI00390
 20       120 WRITE (NOUT,270)(I,ARRAY(I,1,1),I=1,IM)                                       WRI00400
 21           RETURN                                                                        WRI00410
C                                                                                           WRI00420
C     2D ARRAYS                                                                             WRI00430
C                                                                                           WRI00440
 22       130 KA=1                                                                          WRI00450
 23           MA=1                                                                          WRI00460
 24           MB=8                                                                          WRI00470
 25           GO TO 160                                                                     WRI00480
C                                                                                           WRI00490
C     PARTIAL 2D ARRAY                                                                      WRI00500
C                                                                                           WRI00510
 26       140 KA=1                                                                          WRI00520
 27           MA=IH1                                                                        WRI00530
 28           MB=IH1+7                                                                      WRI00540
 29           GO TO 160                                                                     WRI00550
C                                                                                           WRI00560
C     3D ARRAYS                                                                             WRI00570

      FACOM 230-75 M7 FORTRAN-IV H COMPILER  (OPT2,CP)    SOURCE PROGRAM LIST  -780322-(V02,L12)  DATE  79.06.22/09:32    PAGE  77

ISN   ST-NO                  SOURCE PROGRAM     ( WRITE  )                                     SEQUENCE

C                                                                                           WRI00580
 30       150 KA=KM                                                                         WRI00590
 31       160 DO 200 K=1,KA                                                                 WRI00600
 32           IF (IOP.EQ.3) MA=1                                                            WRI00610
 33           IF (IOP.EQ.3) MB=8                                                            WRI00620
 34           IF (IOP.NE.5) WRITE (NOUT,280)H1,H2,H3,K                                      WRI00630
 35           IF (IOP.EQ.5) WRITE (NOUT,340)H2,H3                                           WRI00640
 36       170 MC=MINO(MB,JM)                                                                WRI00650
 37           WRITE (NOUT,300)                                                              WRI00660
 38           WRITE (NOUT,290)(M,L,L=MA,MC)                                                 WRI00670
 39           WRITE (NOUT,300)                                                              WRI00680
 40           DO 190 M=1,IM                                                                 WRI00690
 41           IF (IF.EQ.1) GO TO 180                                                        WRI00700
 42           WRITE (NOUT,310)M,(ARRAY(M,L,K),L=MA,MC)                                      WRI00710
 43           GO TO 190                                                                     WRI00720
 44       180 WRITE (NOUT,320)M,(ARRAY(M,L,K),L=MA,MC)                                      WRI00730
 45       190 CONTINUE                                                                      WRI00740
 46           MA=MA+8                                                                       WRI00750
 47           MB=MB+8                                                                       WRI00760
 48           IF (MA.LE.JM) GO TO 170                                                       WRI00770
 49       200 CONTINUE                                                                      WRI00780
 50           RETURN                                                                        WRI00790
C                                                                                           WRI00800
C     FLUX OR SOURCE ARRAYS                                                                 WRI00810
C                                                                                           WRI00820
 51       210 DO 240 N=1,IH1                                                                WRI00830
 52           WRITE (NOUT,330)N                                                             WRI00840
 53           MA=1                                                                          WRI00850
 54           MB=8                                                                          WRI00860
 55       220 MC=MINO(MB,JM)                                                                WRI00870
 56           WRITE (NOUT,300)                                                              WRI00880
 57           WRITE (NOUT,290)(M,L,L=MA,MC)                                                 WRI00890
 58           WRITE (NOUT,300)                                                              WRI00900
 59           DO 230 M=1,KM                                                                 WRI00910
 60           IDFB=KM+1-M                                                                   WRI00920
 61       230 WRITE (NOUT,310)IDFB,(ARRAY(N,L,IDFB),L=MA,MC)                                WRI00930
 62           MA=MA+8                                                                       WRI00940
 63           MB=MB+8                                                                       WRI00950
 64           IF (MA.LE.JM) GO TO 220                                                       WRI00960
 65       240 CONTINUE                                                                      WRI00970
 66           RETURN                                                                        WRI00980
C                                                                                           WRI00990
C                                                                                           WRI01000
 67       250 FORMAT (1H0,3A8//15X,A8)                                                      WRI01010
 68       260 FORMAT (1I10,1E16.8)                                                          WRI01020
 69       270 FORMAT (1I10,1I6)                                                             WRI01030
 70       280 FORMAT (1H0,3A8,I6)                                                           WRI01040
 71       290 FORMAT (8X,8(1X,A8,I4,1X))                                                    WRI01050
 72       300 FORMAT (1H )                                                                  WRI01060
 73       310 FORMAT (I6,8E14.6)                                                            WRI01070
 74       320 FORMAT (I6,8(2X,I10,2X))                                                      WRI01080
 75       330 FORMAT (17HOCOMPONENT NUMBER,I3//)                                            WRI01090
 76       340 FORMAT (1H0,2A8)                                                              WRI01100
 77       350 FORMAT (33HOALL ENTRIES OF THIS ARRAY EQUAL ,E12.5)                           WRI01110
 78           END                                                                           WRI01120
```