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IBM 360 AND IBM 1800 VERSIONS
OF THE SHAPE AND AREA ANALYSIS PROGRAMS OF
S. E. ATTA AND J. A. HARVEY

by

W. KOLAR

1972



Joint Nuclear Research Centre
Geel Establishment - Belgium

Central Bureau for Nuclear Measurements - CBNM

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ABSTRACT

The two computer codes originally written in FORTRAN II have been rewritten in FORTRAN IV for the IBM 360 and the IBM 1800 computers. Some modifications have been made to increase the flexibility.

KEYWORDS

IBM 360	SCATTERING
FORTTRAN	CROSS SECTIONS
RESONANCE	QUANTITATIVE ANALYSIS
MATHEMATICS	SPECTRA
SHAPES	DOPPLER EFFECT
INTERACTIONS	

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IBM 360 and IBM 1800 Versions of the Shape and Area Analysis
Programs of S. E. Atta and J. A. Harvey

1. INTRODUCTION

The shape and area analysis programs of S. E. Atta and J. A. Harvey [1], [2] are often used to calculate the resonance parameters of transmission data. The shape program determines from the form of a resonance with the method of least squares the best values of the resonance parameters E_0 , Γ , $fg\Gamma_n^0$, while in the area program the area under a transmission dip is used to calculate the best value of $fg\Gamma_n^0$ for an assumed value of Γ . For further, more detailed information, it is referred to references [1] and [2].

The original versions of the programs were written in FORTRAN II, containing some subroutines in the machine language FAP, a language, which becomes more and more obsolete. The present work describes FORTRAN IV versions of the programs to be executed at an IBM 360/65 or an IBM 1800 computer. The IBM 360 version of the shape analysis program needs a memory capacity of about 220 K bytes, including the plot programs, the area program about 100K. The IBM 1800 versions are both organized for a memory capacity of 32K words, each word of 16 bits length.

Some modifications of the program structure compared to the original versions have been made.

- 1) The shape analysis programs describe the number of resonances by a variable N (total number of resonances) and a variable M (resonances to be iterated).
These two integer variables allow to distinguish the resonances to be iterated and the resonances which should rest unchanged. The fixed resonances may be outside or inside the energy range to be analysed.
- 2) If the value of M is greater than the maximum number of resonances to be iterated at once, the shape analysis programs calculate the doppler- and resolution broadened cross section, using the resonance parameters as given on the input cards and perform a plot of the experimental data together with the calculated results.
- 3) An option has been included in the area program, to skip the calculation of the plot.
- 4) In both codes (shape and area program) the original plot programs have been replaced by new ones using the routines described in reference [3] and [4].

Table I shows the limitations of the different program versions. Three examples two of the shape program and one of the area program are shown in Appendix A. Appendix B gives the FORTRAN listing of the different program versions.

TABLE I

Limitations of the programs

Program	Program Version	Maximum data points	Maximum number of resonances	Maximum number of resonances to be iterated at once
Shape	360/65	1000	35	10
Shape	1800	1000	35	5
Area	360/65	1000	20	20
Area	1800	1000	15	15

2. Shape Analysis Programs for the IBM 360/65 and the IBM 1800

Both versions of the shape analysis program can handle up to 1000 data points at once. A maximum of 35 resonances may be treated within one input card deck. Up to 10 resonances can be iterated if one uses an IBM 360/65 and 5 resonances if one uses an IBM 1800. The convergence criteria for the resonance parameters as defined in ref. [1] and [2] have not been changed. The programs permit to execute several input card decks in one run. The different card decks, each prepared in the order as described in chapter 5, are put one after the other. At the end of a run a blank card has to be added to terminate the job correctly.

INPUT

The sequence of the input data is the same for the two program versions. The detailed list is given in chapter 5. Due to the modifications of the program structure the input differs slightly from the original version.

The first card (I6, 2A8) is used for the problem identification. If one analyses with different sets of resonance parameters the same range of experimental data points (IMN), one may choose the same value of L1 for different input card decks (see chapt. 5). In this case one can omit for the second and the following card decks, the cards (N+4), (N+5) as defined in chapter 5 and the data cards. The cards for the plot are necessary.

The second card (7I5, 2E12. 5) contains information as the number of experimental data points (IMN), the first (IO) and the last (IM) channel of the region to be analysed, the total number of resonances (N), the number of resonances to be iterated (M), the interval factor (KI), the maximum number of iterations (ITMAX), the fractional abundance of the isotope (F) and the value for the spin (GI). If the value of the variable M is greater than the maximum number of resonances which can be iterated at once, the program calculates the doppler- and resolution broadened cross section of the given resonance parameters and performs a plot of the results.

The third card (3E12.5) with the coefficients (C0, C1, C2) of the polynom P(Ei) is the same as in reference [1].

The next N cards (3E12.5) are for the resonance parameters. For each resonance the total width Γ , the resonance energy E and the reduced neutron width $fg\Gamma_n^0$ are given. These values are initial guesses for the M resonances to be iterated. For the fixed resonances the cross section is calculated from the parameters as stated on the input cards. The order of the N cards is important. The M cards with the resonances to be iterated, have to be the first ones.

The cards (N+4) and (N+5) format (6E12.5) are the same as defined in reference [1]. Then follow the cards with the experimental data points (6E12.5). Each card contains two data channels with the corresponding values for the energy, the cross section, and its error.

The last two cards concern the plot of the results. The card (18A4) following the last data card is for the title of the plot. The next card determines the dimensions and the type (linear or logarithmic) of the axes.

If the program is run on an IBM 1800 a third card for the plot is needed. This card defines the magnetic tape unit on which the plot is written. It is only necessary in the first input card deck of a run. In all other card decks of the same run the card has to be omitted.

OUTPUT

After each cycle the iterated resonances are listed in the table 'Iterated resonances', the fixed ones are printed under the heading 'Set of resonances'. New is also the table 'Relative accuracy (per cent) of the solution of the normal equations'. It has the following meaning. The method of least squares leads to a system of linear equations (normal equations).

$$A_{ij} \cdot X_j = B_j$$

where A_{ij} is the coefficient matrix, X_j the solution vector and B_j the right hand vector. The solutions of the system of linear equations is found by multiplication of the inverse matrix of A_{ij} with the vector B_j

$$X_j = (A_{ij})^{-1} \cdot B_j$$

If one inserts the vector X_j in the system of equations one gets a vector B_j' . The difference $B_j - B_j' = C_j$ (per cent) is listed in the table and may serve as a check for the accuracy of the solution vector X_j .

The output ends with the listing of the input data and a table of the analysed energy range. For each data channel the energy value, the experimental cross section, the cross section calculated from the last estimates of the parameters and the difference (per cent) of the two cross section values are printed.

3. Area Analysis Programs for the IBM 360/65 and the IBM 1800

Both versions can analyse as many as 1000 data points at once. The IBM 360/65 version allows to handle up to 20 resonances per input card deck, the IBM 1800 version 15 resonances. The convergence criterium is the same as defined in ref. [1] resp. [2]. The two program versions allow the execution of several input card decks in one run. The card decks, each prepared in the order as described in chapter 6, are put one after the other. At the end of the whole run a blank card has to be added, to terminate the program correctly.

INPUT

Both program versions have the same input card sequence. A detailed description is given in chapter 6. One new variable L4 has been introduced, which allows to suppress the calculation of the plot. All other symbols have the same meaning as already discussed in chapter 2 or ref. [1].

In the IBM 360/65 version the plot program is included in the main program. No cards for the plot are necessary. In the IBM 1800 version one needs a card (15) to define the magnetic tape unit on which the data, needed to calculate the plot, are written. The plot itself is calculated with the program ARPLO (see chapter 4). The card for the definition of the magnetic tape unit is only necessary, when for the first time a plot is demanded. For example, if one wants to execute 5 input card decks and one demands a plot of the results of the second and fourth deck, then the card for the plot has to be included in the second card deck.

OUTPUT

In addition to the original version of the program, the output prints for each iteration the calculated values of the reduced neutron widths ($fg\Gamma_n^0$). After the listing of the last estimates of the resonance parameters, the table 'Relative accuracy of the solution of the normal equations' is given. Its significance has been explained in chapter 2. The output ends with a list of the input data and a table of the analysed energy range. For each data channel the observed and calculated values of the transmission are printed. The third column headed 'Basis' contains the product of the value of the polynomial $P(E_i)$ (see ref. [1]) and the value of the transmission of the potential scattering cross section.

4. Program Restrictions with the Teleprocessing Terminal IBM 2780

If the programs are used together with a teleprocessing terminal IBM 2780, the plot programs as shown in Appendix B cannot be used, because there is no possibility to transmit magnetic tape records. In this case the data which are necessary as input for the plot are punched on cards. The plots are then calculated using the cards and the program SHAPL if one has results of the shape analysis program or the program ARPLO if one has results of the area analysis program. The program ARPLO is also used to calculate the plot of the results of the IBM 1800 version of the area analysis program.

Program SHAPL

Program SHAPL needs one control card (Format $\star\star I$; $I = 1, 2$) to define the magnetic tape unit on which the plot has to be written. The card has to be placed after the cards, containing the results of the first input card deck. Further cases may be added.

Program ARPLO

Program ARPLO needs two control cards. The first card (Format 2I5) contains the variables KOPT and KUNIT. KOPT specifies in which form the input data exist. If one has analysed with the IBM 1800 version of the area program the input data for the plot are written on tape, if one has used the IBM 360 version of the area program the input data are on cards. KUNIT defines in the first case the magnetic tape unit of the input data. If the input data are on cards KUNIT rests blank. The second control card (Format $\star\star I$; $I = 1, 2$) defines the magnetic tape unit on which the plot has to be written. The tape unit for the plot has to be different from the tape unit containing the input data. In the case that the input data for the plot are recorded on tape the two control cards constitute the whole input deck; if the input data are on cards, the cards containing the results of the first input card deck are placed between the first and second control card. Further cases may be added.

The input card sequence of the programs SHAPL and ARPLO is given in chapter 7.

5. Input Cards Sequence of the Shape Analysis Programs
ATSHA (IBM 360/65 and IBM 1800)

Card 1 Format (I6, 2A8)

Column	Format	Symbol	Remarks
1- 6	I6	L1	Integer > 0*
7-15	A8	F2A	Run identification (ex. 30-50eV)
16-24	A8	FE	Isotope

* see chapter 2.

Card 2 Format (7I5, 2E12.5)

Column	Format	Symbol	Remarks
1- 5	I5	IMN	Number of data points
6-10	I5	IO	Number of first channel of analysis region
11-15	I5	IM	Number of last channel of analysis region
16-20	I5	N	Total number of resonances
21-25	I5	M	Number of resonances to be iterated
26-30	I5	KI	Interval factor for integration If K=0, program calculates the value Ki
31-35	I5	ITMAX	Maximum number of iterations
36-47	E12.5	F	Fractional abundance of isotope under consideration
48-59	E12.5	G1	Value of g (spin factor)

Card 3 Format (3 E12.5)

Column	Format	Symbol	Remarks
1-12	E12.5	C0	C0, C1, C2 are the coefficients of the polynom P(E). They have to be determined by the area program. (see ORNL-3205)
13-24	E12.5	C1	
25-36	E12.5	C2	

Card 4 to (N+3) Format 3E12.5

Column	Format	Symbol	Remarks
1-12	E12.5	G(J)	Total width in eV of the J th resonance
13-24	E12.5	EN(J)	Resonance energy in eV of the J th resonance
25-36	E12.5	GN(J)	reduced neutron width ($fg\Gamma_n^0$) of the J th resonance (J=1, N).

The cards have to be arranged so, that the M cards with the resonances to be iterated, are first.

Card (N+4) Format (6E12.5)

Column	Format	Symbol	Remarks
1-12	E12.5	A	Potential scattering radius units of 10^{-12} cm of the isotope under consideration.
13-24	E12.5	ON	Sample thickness in atoms/barn
25-36	E12.5	AW	Atomic weight
37-48	E12.5	R	Potential scattering radius in units of 10^{-12} cm of all the isotope of the sample
49-60	E12.5	DIST	Neutron flightpath in meters
61-72	E12.5	T1	Analyser channel width in μ sec

Card (N+5) Format (5E12.5)

Column	Format	Symbol	Remarks
1-12	E12.5	DELAY	Delay in μ sec
13-24	E12.5	HO	Doppler constant (see ORNL- 3205)
25-36	E12.5	RO	The resolution is expressed in terms of the channel width
37-48	E12.5	R1	$R=R_0+R_1 \times I$ (I=channel width) $R_0=R_0$ is the resolution FWHM at channel zero, $R_1=R_1$ is the change per channel.
49-60	E12.5	PSA	Percent statistical accuracy of the transmission values.

Data cards Format (6E12.5) (IMN data points)

Column	Format	Symbol	Remarks
1-12	E12.5	E(I)	Energy of channel I
13-24	E12.5	S(I)	Observed total neutron cross section of channel I
25-36	E12.5	DS(I)	Error of total cross section of channel I (not used in this program)
37-48	E12.5	E(I+1)	Energy of channel I+1
49-60	E12.5	S(I+1)	Observed total neutron cross section of channel I+1
61-72	E12.5	DS(I+1)	Error of total cross section of channel I+1 (not used in this program)

CARDS FOR THE PLOT

Card Format (18A4)

Column	Format	Symbol	Remarks
1-72	18A4	TITEL	Title of the plot

Card Format (2F10.0, 2I5)

Column	Format	Symbol	Remarks
1-10	F10.0	SIZX	Length of x-axis of the plot
11-20	F10.0	SIZY	Length of y-axis of the plot
21-25	I5	IX	IX=0 x-axis linear IX=1 x-axis logarithmic
26-30	I5	IY	IY=0 y-axis linear IY=1 y-axis logarithmic

ONLY VALID FOR THE IBM 1800

Card **I (column 1-3)

This card defines the magnetic tape unit, on which the plot should be written. I may be 1, 2.

It has only to be used in the first input card deck. In all others it has to be omitted.

NOTE

At the end of the whole input a blank card has to be added, otherwise the program will not terminate correctly.

6. Input Cards Sequence of the Area Analysis Programs AREAT
(IBM 360/65 and IBM 1800)

Card 1 Format (2I6, 2A8)

Column	Format	Symbol	Remarks
1- 6	I6	L1	Integer > 0*
7-12	I6	L4	L4 = 0; no plot demanded L4 > 0: plot demanded
13-20	A8	F2A	Run identification (ex. 130-50eV)
21-28	A8	FE	Isotope

* see chapter 2.

Card 2 Format (7I5, 3E12.5)

Column	Format	Symbol	Remarks
1- 5	I5	IMN	Number of channels
6-10	I5	IO	Number of first channel of analysis region
11-15	I5	IM	Number of last channel analysis region
16-20	I5	M	Number of resonances
21-25	I5	KI	Interval factor for integration. If K=0, program calculates the value KI.
26-30	I5	ITMAX	Maximal number of iterations
31-35	I5	IC	Number of coefficients of P(EI) (see ORNL-3205)
36-47	E12.5	F	Fractional abundance of isotope under consideration
48-59	E12.5	G1	Value of spin (G1)
60-71	E12.5	G2	Value of spin (G2)

Card 3 Format (3E12.5)

Column	Format	Symbol	Remarks
1-12	E12.5	ZTT(I)	ZTT(I) are the coefficients C0, C1, C2, of the polynom P(EI)
13-24	E12.5	ZTT(2)	
25-36	E12.5	ZTT(3)	Note: If IC=0, then this card has to be omitted.

The next M cards contain the guesses of the resonance parameters .
If GN(J) is zero the program calculates a guess.

Card 4 to (M+3) Format (2I5, 3E12. 5)

Column	Format	Symbol	Remarks
1- 5	I5	IRO(J)	First channel of the J th resonance
6-10	I5	IRN(J)	Last channel of the J th resonance
11-22	E12. 5	G(J)	Total width in eV of the J th resonance
23-24	E12. 5	EL(J)	Resonance energy in eV of the J th resonance
35-46	E12. 5	GN(J)	Reduced neutron width ($fg\Gamma_n^0$) in eV of the J th resonance (J=1, M)

Card (M+4) Format (6E12. 5)

Column	Format	Symbol	Remarks
1-12	E12. 5	A	Potential scattering radius in units of 10^{-12} cm of the isotope under consideration
12-24	E12. 5	ON	Sample thickness in atoms/barn
25-36	E12. 5	AW	Atomic weight
37-48	E12. 5	R	Potential scattering radius in units of 10^{-12} cm of all isotopes, of the sample
49-60	E12. 5	DIST	Neutron flightpath in meters
61-72	E12. 5	T1	Analyser channel width in μ sec

Card (M+5) Format (5E12. 5)

Column	Format	Symbol	Remarks
1-12	E12. 5	DELAY	Delay in μ sec
13-24	E12. 5	H0	Doppler constant (see ORNL-3205)
25-36	E12. 5	R0	The resolution is expressed in units of the channel width $R=R_0+R_i$ (i = channel width) $R_0=R_0$ is the resolution FWHM at channel zero, $R_1=R_1$ is the change per channel
49-60	E12. 5	PSA	Percent statistical accuracy of the transmission

<u>Data cards</u>	<u>Format (6E12.5) (IMN data points)</u>		
Column	Format	Symbol	Remarks
1-12	E12.5	E(I)	Energy of channel I
13-24	E12.5	S(I)	Observed total neutron cross section of channel I
25-36	E12.5	DS(I)	Error of total neutron cross section of channel I (not used in this program)
37-48	E12.5	E(I+1)	Energy of channel I+1
49-60	E12.5	S(I+1)	Observed total neutron cross section of channel I+1
61-72	E12.5	DS(I+1)	Error of total neutron cross section of channel I+1 (not used in this program)

ONLY VALID FOR THE IBM 1800

<u>Card</u>	<u>Format (I5)</u>		
Column	Format	Symbol	Remarks
1-5	I5	KUNIT	KUNIT)= 8 magn. tape unit 1 KUNIT)= 9 magn. tape unit 2

KUNIT defines the magnetic tape unit on which the data, necessary to calculate the plot, are written.

The card is only necessary in the first input card deck for which a plot is demanded (see also chapter 3).

NOTE: The plot is calculated with program ARPLO.

NOTE

At the end of the whole input a blank card has to be added, otherwise the program will not terminate correctly.

7. Input Card Sequence of the Programs SHAPL and ARPLO

Program SHAPL

Input card sequence

Card **I (Column 1-3) I=1, 2 Magnetic tape unit on which the plot is written

The card has to be placed once after the first card deck (see also chapter 4).

NOTE: Further card decks may be added. A blank card has to be put as last card of the whole input.

Program ARPLO

Input card sequence

Card 1 Format (215)

Column	Format	Symbol	Remarks
1- 5	I5	KOPT	KOPT=1 input data for plot on tape KOPT=2 input data for plot on cards
6-10	I5	KUNIT	KUNIT=8 input data on tape unit 1 KUNIT=9 input data on tape unit 2

If KOPT=1; the card Card2 follows immediately.

If KOPT=2; the cards containing the data for the first plot follow.

Card 2 **I (Column 1-3) I=1, 2 magnetic tape unit on which the plot is written. (see also chapter 4).

The card has to be placed once after the first card deck (see also chapter 4).

NOTE: Further card decks may be added. A blank card has to be put as last card of the whole input.

REFERENCES

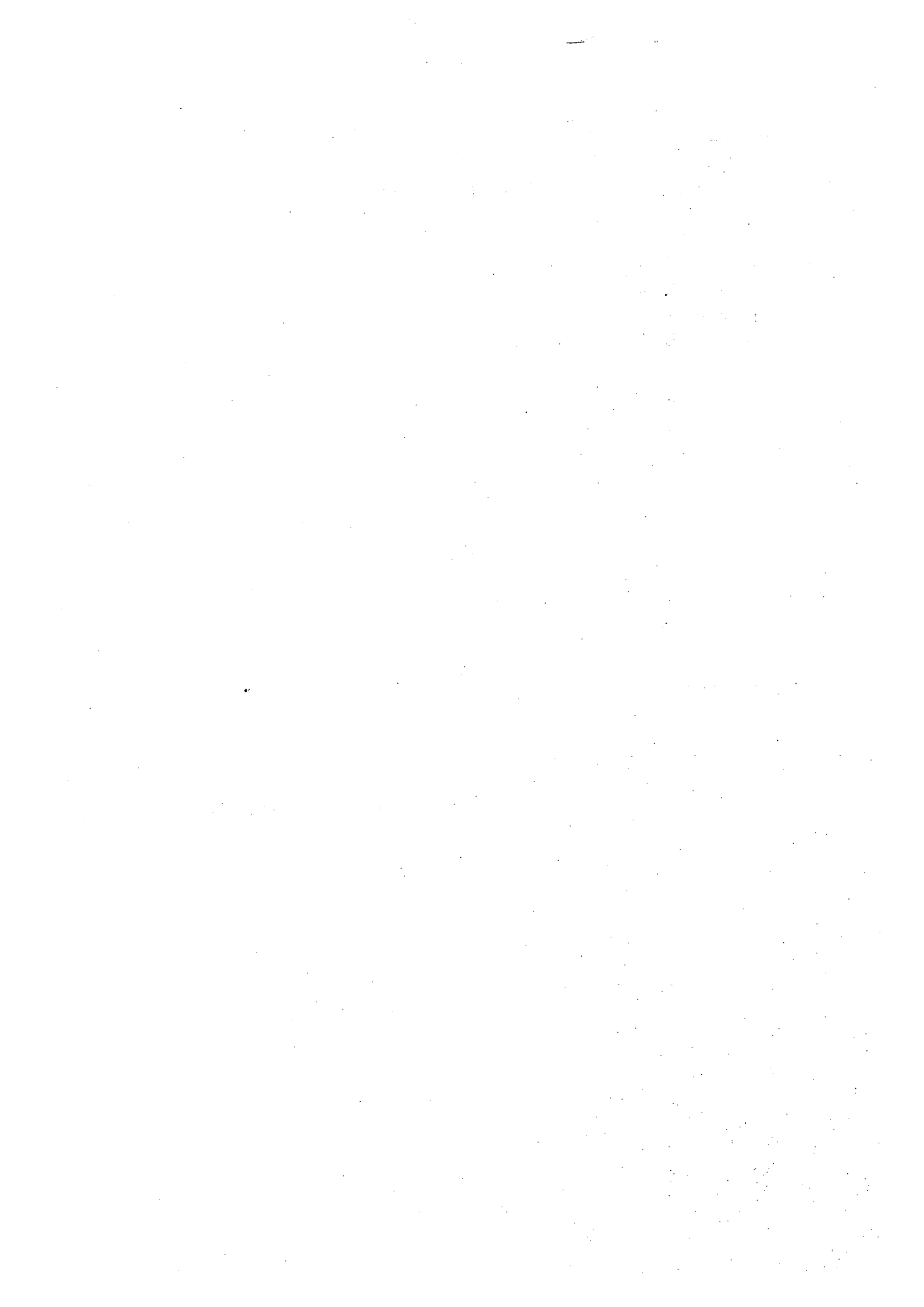
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- [2] S. E. ATTA and J. A. HARVEY, Addendum to ORNL-3205 (1963).
- [3] P. MOINIL, J. PIRE, Programmation Relative au Calcomp EUR 2280. f (1965).
- [4] H. SCHMID, An IBM 1800 Program Package for On-line and Off-line Operation of a Calcomp digital incremental Plotter EUR 4225. e (1969).

APPENDIX A

Examples of the Shape and Area Analysis Programs

(The examples have been calculated using the IBM 360 versions of the programs).

- Example 1 The first example shows the output list and the plot of the shape analysis program 'ATSHA' if the resonance parameters of 4 resonances are iterated. (The parameter of the second 4 resonances rest unchanged).
- Example 2 The second example shows the output list and the plot of the shape analysis program 'ATSHA' if the doppler- and resolution broadened cross section of a given set of resonances is calculated.
- Example 3 The third example shows the output list and the plot of the area analysis program.



EXAMPLE 1

SHAPE ANALYSIS OF TRANSMISSION DATA

JOB 1910

RUN 46-50EV

ELEMENT NP-237

NUMBER OF ITERATIONS 0

ITERATED RESONANCES

E0	GAMMA	FGXGAMMA N O
0.504000E 02	0.500000E-01	0.500000E-03
0.498100E 02	0.500000E-01	0.397000E-03
0.473000E 02	0.500000E-01	0.140000E-03
0.463100E 02	0.500000E-01	0.240000E-03

SET OF RESONANCES

E0	GAMMA	FGXGAMMA N O
0.487600E 02	0.500000E-01	0.350000E-04
0.484000E 02	0.500000E-01	0.900000E-05
0.460100E 02	0.500000E-01	0.520000E-04
0.456700E 02	0.500000E-01	0.270000E-04

NUMBER OF ITERATIONS 1

ITERATED RESONANCES

E0	GAMMA	FGXGAMMA N D
0.503910E 02	0.582483E-01	0.467819E-03
0.498100E 02	0.719981E-01	0.273612E-03
0.473181E 02	0.379456E-01	0.134540E-03
0.463420E 02	0.583849E-01	0.168026E-03

SET OF RESONANCES

E0	GAMMA	FGXGAMMA N D
0.487600E 02	0.500000E-01	0.350000E-04
0.484000E 02	0.500000E-01	0.900000E-05
0.460100E 02	0.500000E-01	0.520000E-04
0.456700E 02	0.500000E-01	0.270000E-04

NUMBER OF ITERATIONS 2

ITERATED RESONANCES

EO	GAMMA	FGXGAMMA N D
0.503903E 02	0.586517E-01	0.470430E-03
0.498096E 02	0.737738E-01	0.286331E-03
0.473176E 02	0.346845E-01	0.134753E-03
0.463513E 02	0.445391E-01	0.172793E-03

SET OF RESONANCES

EO	GAMMA	FGXGAMMA N D
0.487600E 02	0.500000E-01	0.350000E-04
0.484000E 02	0.500000E-01	0.900000E-05
0.460100E 02	0.500000E-01	0.520000E-04
0.456700E 02	0.500000E-01	0.270000E-04

NUMBER OF ITERATIONS 3

ITERATED RESONANCES

EO	GAMMA	FGXGAMMA N O
0.503902E 02	0.586242E-01	0.470420E-03
0.498097E 02	0.737612E-01	0.286469E-03
0.473177E 02	0.345909E-01	0.134701E-03
0.463505E 02	0.462966E-01	0.173584E-03

SET OF RESONANCES

EO	GAMMA	FGXGAMMA N O
0.487600E 02	0.500000E-01	0.350000E-04
0.484000E 02	0.500000E-01	0.900000E-05
0.460100E 02	0.500000E-01	0.520000E-04
0.456700E 02	0.500000E-01	0.270000E-04

NUMBER OF ITERATIONS 4

E0	S.D. E0	GAMMA	S.D. G	FGXGNO	GNO	S.D. GNO	COV.(G,GNO)	GN
0.50390E 02	0.18D-02	0.5863E-01	0.54D-02	0.4704E-03	0.9408E-03	0.15D-04	0.37226D-07	0.6679E-02
0.49810E 02	0.26D-02	0.7376E-01	0.81D-02	0.2865E-03	0.5729E-03	0.13D-04	0.69586D-07	0.4044E-02
0.47318E 02	0.33D-02	0.3462E-01	0.10D-01	0.1347E-03	0.2694E-03	0.83D-05	0.56749D-07	0.1853E-02
0.46351E 02	0.28D-02	0.4611E-01	0.84D-02	0.1735E-03	0.3470E-03	0.87D-05	0.48405D-07	0.2363E-02

RELATIVE ACCURACY (PER CENT) OF THE SOLUTION OF THE NORMAL EQUATIONS

-0.4564743D-13
0.0
-0.2425776D-13
-0.1228046D-12
-0.4083818D-13
0.8010905D-13
-0.7464520D-12
-0.1785194D-13
0.0
0.2826149D-11
0.3203204D-13
-0.2631550D-13

A= 0.98000E 00
N= 0.13740E-02
AW= 0.23705E 03
R= 0.98000E 00
DIST= 0.31893E 02
T= 0.16000E 00
T DELAY= 0.32057E 03
DO= 0.31800E 00
BO= 0.22690E-04
B1= 0.87339E-03
CN= 162
CF= 1
CL= 162
NO= 4
I.F.= 2
IM= 5
RO=0.172900E 01
R1= 0.72710E-03

K0= 0.873718E 00
K1= 0.854766E 00
K2= 0.0

F= 0.100000E 01
G= 0.500000E 00
FG= 0.500000E 00

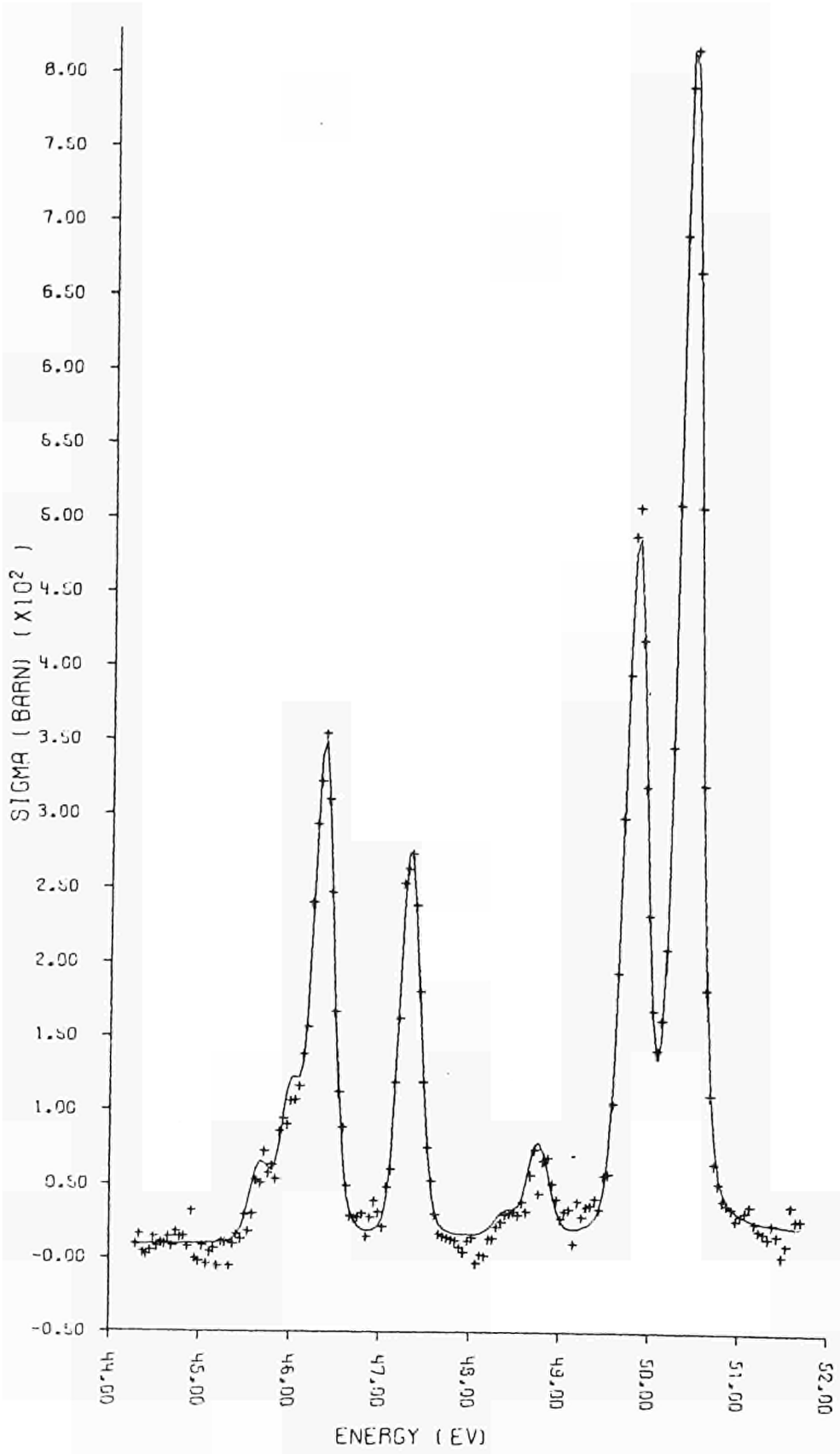
CHI SQUARE= 0.1199E 03
DEGREES OF FREEDOM= 149
PSA= 0.150000E 01

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
1	51.6900	28.0130	23.0553	-17.6978			
2	51.6380	27.5760	23.2972	-15.5164			
3	51.5870	37.4450	23.5629	-37.0734			
4	51.5360	10.6330	23.8816	124.5988			
5	51.4840	3.1732	24.2115	662.9980			
6	51.4330	17.4010	24.6054	41.4022			
7	51.3820	25.1090	25.0581	-0.2027			
8	51.3310	15.5090	25.5831	64.9567			
9	51.2800	19.0460	26.1941	37.5307			
10	51.2290	20.7130	26.9109	29.9226			
11	51.1780	25.8580	27.7576	7.3463			
12	51.1270	37.3790	28.7838	-22.9948			
13	51.0770	33.3770	30.0396	-9.9992			
14	51.0260	30.6470	31.6061	3.1296			
15	50.9750	27.6850	33.6176	21.4290			
16	50.9250	35.9310	36.2884	0.9947			
17	50.8750	38.0780	40.0727	5.2386			
18	50.8240	40.8000	45.9208	12.5510			
19	50.7740	52.3500	56.1156	7.1931			
20	50.7240	65.4870	75.9669	16.0031			
21	50.6740	111.5700	115.6201	3.6301			
22	50.6240	183.4800	190.3689	3.7546			
23	50.5740	321.1499	314.6079	-2.0371			
24	50.5240	508.7400	486.6816	-4.3359			
25	50.4740	667.0198	673.7891	1.0149			
26	50.4240	816.8599	807.1699	-1.1862			
27	50.3750	791.8899	817.3521	3.2154			
28	50.3250	691.4199	698.1147	0.9683			
29	50.2760	510.5000	514.1011	0.7054			
30	50.2260	346.6799	338.9978	-2.2159			
31	50.1770	210.4200	213.9052	1.6563			
32	50.1270	162.3200	148.1441	-8.7333			
33	50.0780	141.6300	134.8240	-4.8055			
34	50.0290	168.8200	166.4207	-1.4212			
35	49.9800	233.2800	236.8534	1.5318			
36	49.9310	320.2100	334.2004	4.3692			
37	49.8820	419.1099	431.4038	2.9333			
38	49.8330	508.6399	488.8372	-3.8933			
39	49.7840	489.5898	477.2168	-2.5272			
40	49.7360	395.7500	401.0100	1.3291			
41	49.6870	298.6299	294.3245	-1.4417			
42	49.6390	194.3000	193.5951	-0.3628			
43	49.5900	105.4800	119.0833	12.8965			
44	49.5420	58.2600	72.8209	24.9929			
45	49.4930	57.1680	47.5957	-16.7442			
46	49.4450	34.4390	34.8556	1.2097			
47	49.3970	41.7170	28.4022	-31.9170			
48	49.3490	37.0960	24.9187	-32.8266			
49	49.3010	36.1930	22.8806	-36.7816			
50	49.2530	29.2350	21.6325	-26.0046			
51	49.2050	39.8610	20.9148	-47.5306			
52	49.1570	10.8800	20.6908	90.1726			
53	49.1090	34.5770	21.1373	-38.8689			
54	49.0610	32.6710	22.7879	-30.2505			
55	49.0140	27.8230	26.6244	-4.3081			

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
56	48.9660	41.	2220	33.	9409	-17.	6630
57	48.9180	51.	6230	45.	3918	-12.	0706
58	48.8710	69.	2060	59.	7454	-13.	6702
59	48.8240	67.	1760	73.	0572	8.	7549
60	48.7760	44.	8980	80.	0716	78.	3412
61	48.7290	74.	7740	77.	6522	3.	8492
62	48.6820	57.	5900	67.	1376	16.	5786
63	48.6350	32.	6410	53.	5881	64.	1743
64	48.5880	39.	2570	42.	2724	7.	6811
65	48.5410	30.	2250	35.	8660	18.	6635
66	48.4940	32.	6920	33.	9075	3.	7179
67	48.4470	31.	4620	34.	0198	8.	1299
68	48.4000	30.	6980	33.	6737	9.	6934
69	48.3540	25.	5310	31.	5868	23.	7194
70	48.3070	22.	0810	28.	0034	26.	8214
71	48.2600	14.	2570	24.	0530	68.	7101
72	48.2140	13.	9950	20.	7897	48.	5506
73	48.1680	2.	2707	18.	6307	720.	4827
74	48.1210	3.	1441	17.	4725	455.	7246
75	48.0750	-2.	6783	16.	9773	-733.	8818
76	48.0290	14.	8030	16.	8544	13.	8580
77	47.9820	12.	9330	16.	9291	30.	8984
78	47.9360	4.	7743	17.	1274	258.	7417
79	47.8900	8.	3551	17.	4320	108.	6392
80	47.8440	12.	8520	17.	8642	38.	9997
81	47.7990	13.	7040	18.	4952	34.	9618
82	47.7530	14.	7590	19.	4449	31.	7494
83	47.7070	15.	6760	21.	1070	34.	6454
84	47.6610	17.	2480	24.	4550	41.	7846
85	47.6160	30.	5090	31.	6068	3.	5982
86	47.5700	53.	1070	46.	5597	-12.	3285
87	47.5250	75.	7270	74.	6877	-1.	3724
88	47.4790	119.	4600	119.	7689	0.	2586
89	47.4340	181.	1400	179.	0477	-1.	1550
90	47.3880	239.	1200	238.	4134	-0.	2955
91	47.3430	274.	1699	276.	0200	0.	6748
92	47.2980	263.	4800	274.	4780	4.	1741
93	47.2530	254.	0900	234.	2156	-7.	8218
94	47.2080	162.	9100	173.	3405	6.	4026
95	47.1630	119.	0100	113.	7819	-4.	3930
96	47.1180	60.	7860	69.	1628	13.	7808
97	47.0730	48.	8790	41.	9623	-14.	1507
98	47.0280	21.	8120	28.	0720	28.	6996
99	46.9840	31.	9350	22.	0265	-31.	0270
100	46.9390	39.	5770	19.	8093	-49.	9474
101	46.8940	28.	4640	19.	2861	-32.	2439
102	46.8500	15.	2400	19.	5930	28.	5628
103	46.8050	31.	0040	20.	5249	-33.	7992
104	46.7610	28.	8790	22.	2613	-22.	9152
105	46.7170	28.	3040	25.	5153	-9.	8527
106	46.6720	29.	5410	31.	9599	8.	1882
107	46.6280	49.	5120	44.	9367	-9.	2408
108	46.5840	88.	9300	69.	7516	-21.	5657
109	46.5400	112.	7700	112.	1482	-0.	5514
110	46.4960	167.	3700	174.	1228	4.	0347

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
111	46.4520	247.	6400	248.	3226	0.	2756
112	46.4080	310.	4500	315.	5356	1.	6382
113	46.3640	354.	7100	350.	5691	-1.	1674
114	46.3200	322.	5098	338.	7561	-5.	0375
115	46.2770	293.	7998	287.	4729	-2.	1535
116	46.2330	240.	6600	221.	3513	-8.	0232
117	46.1890	156.	8700	165.	3688	5.	4178
118	46.1460	138.	3600	132.	8142	-4.	0082
119	46.1020	116.	4800	122.	2859	4.	9845
120	46.0590	107.	3800	123.	0402	14.	5839
121	46.0160	106.	4700	122.	5244	15.	0789
122	45.9720	90.	2980	113.	4268	25.	6138
123	45.9290	94.	4900	96.	5024	2.	1298
124	45.8860	85.	8440	78.	1410	-8.	9732
125	45.8430	54.	1330	65.	0095	20.	0921
126	45.8000	63.	4640	60.	2041	-5.	1366
127	45.7570	57.	8230	62.	0663	7.	3385
128	45.7140	72.	8160	65.	7941	-9.	6434
129	45.6710	51.	0180	66.	2662	29.	8879
130	45.6280	53.	0050	60.	9240	14.	9401
131	45.5850	30.	3850	50.	6934	66.	8371
132	45.5430	18.	4570	38.	7412	109.	9000
133	45.5000	29.	6140	28.	1614	-4.	9051
134	45.4580	13.	1580	20.	5115	55.	8860
135	45.4150	16.	5060	15.	8176	-4.	1703
136	45.3730	9.	8107	13.	2615	35.	1737
137	45.3300	-4.	8689	11.	9607	-345.	6541
138	45.2880	11.	2730	11.	2844	0.	1013
139	45.2460	11.	9650	10.	9034	-8.	8728
140	45.2030	-5.	0363	10.	6563	-311.	5903
141	45.1610	6.	9796	10.	4832	50.	1980
142	45.1190	4.	3813	10.	3511	136.	2556
143	45.0770	-3.	6244	10.	2314	-382.	2908
144	45.0350	8.	6754	10.	1397	16.	8784
145	44.9930	-1.	8340	10.	0627	-648.	6772
146	44.9510	0.	1819	9.	9852	5387.	8555
147	44.9100	32.	6410	9.	9277	-69.	5851
148	44.8680	8.	1004	9.	8744	21.	8999
149	44.8260	15.	3630	9.	8136	-36.	1218
150	44.7850	14.	6940	9.	7615	-33.	5684
151	44.7430	18.	2380	9.	7061	-46.	7810
152	44.7020	8.	4133	9.	6676	14.	9091
153	44.6600	14.	7810	9.	6249	-34.	8832
154	44.6190	10.	2620	9.	5818	-6.	6288
155	44.5770	11.	1130	9.	5343	-14.	2056
156	44.5360	8.	0203	9.	5019	18.	4730
157	44.4950	14.	6870	9.	4625	-35.	5722
158	44.4540	5.	3202	9.	4090	76.	8540
159	44.4130	2.	6273	9.	3809	257.	0547
160	44.3720	4.	2139	9.	3496	121.	8757
161	44.3310	16.	4840	9.	3070	-43.	5389
162	44.2900	9.	7671	9.	2785	-5.	0022

NP-237 TOTAL 46-50 EV



EXAMPLE 2

SHAPE ANALYSIS OF TRANSMISSION DATA

JOB 1910

RUN 45-70EV

ELEMENT PU-241

T OF RESONANCES

EO	GAMMA	FGXGAMMA N O
0.465200E 02	0.280000E 00	0.125000E-03
0.473000E 02	0.100000E 01	0.660000E-04
0.480200E 02	0.345000E 00	0.290000E-03
0.484500E 02	0.940000E 00	0.152000E-03
0.502100E 02	0.435000E 00	0.600000E-04
0.520000E 02	0.200000E 00	0.200000E-04
0.526000E 02	0.200000E 00	0.200000E-04
0.533800E 02	0.150000E 00	0.150000E-03
0.542200E 02	0.500000E 00	0.300000E-04
0.557000E 02	0.300000E 00	0.250000E-04
0.582400E 02	0.616000E 00	0.125000E-03
0.591800E 02	0.500000E 00	0.140000E-03
0.604500E 02	0.200000E 00	0.260000E-03
0.621400E 02	0.322000E 00	0.155000E-03
0.625000E 02	0.800000E 00	0.200000E-03
0.634000E 02	0.800000E 00	0.110000E-03
0.645000E 02	0.600000E 00	0.400000E-04
0.656100E 02	0.367000E 00	0.350000E-03
0.665100E 02	0.225000E 00	0.415000E-03
0.676000E 02	0.400000E 00	0.250000E-04
0.681200E 02	0.190000E 00	0.900000E-04
0.691000E 02	0.156000E 00	0.790000E-04
0.699000E 02	0.650000E 00	0.300000E-04
0.722700E 02	0.300000E 00	0.100000E-03

A= 0.91400E 00
 N= 0.16620E-02
 AW= 0.24100E 03
 R= 0.91400E 00
 DIST= 0.10001E 03
 T= 0.32000E 00
 T DELAY= 0.86209E 03

K0= 0.100000E 01
 K1= 0.0
 K2= 0.0
 F= 0.100000E 01
 G= 0.100000E 01
 FG= 0.100000E 01

DU= 0.31900E 00
BO= 0.52044E-04
B1= 0.49489E-04
CN= 648
CF= 1
CL= 648
NO= 24
I.F.= 3
IM= 0
RO=0.109000E 01
R1= 0.41200E-04

CHI SQUARE= 0.1828E 00
DEGREES OF FREEDOM= 575
PSA= 0.100000E 01

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
1	70.3490	32.2410	32.2410	22.8203	22.8203	-29.2195	
2	70.2960	37.2250	37.2250	23.9887	23.9887	-35.5576	
3	70.2440	27.6640	27.6640	25.2533	25.2533	-8.7143	
4	70.1920	24.1590	24.1590	26.5610	26.5610	9.9425	
5	70.1400	33.9200	33.9200	27.8320	27.8320	-17.9482	
6	70.0880	30.0070	30.0070	28.9525	28.9525	-3.5141	
7	70.0360	22.6200	22.6200	29.8299	29.8299	31.8741	
8	69.9840	22.9240	22.9240	30.3794	30.3794	32.5221	
9	69.9330	29.9470	29.9470	30.5866	30.5866	2.1357	
10	69.8810	18.4020	18.4020	30.4847	30.4847	65.6599	
11	69.8290	26.4860	26.4860	30.1767	30.1767	13.9347	
12	69.7780	32.8750	32.8750	29.7967	29.7967	-9.3637	
13	69.7260	24.3920	24.3920	29.5238	29.5238	21.0389	
14	69.6740	17.7230	17.7230	29.5761	29.5761	66.8800	
15	69.6230	33.0110	33.0110	30.2159	30.2159	-8.4671	
16	69.5720	30.1490	30.1490	31.8418	31.8418	5.6149	
17	69.5200	28.9100	28.9100	35.0399	35.0399	21.2033	
18	69.4690	47.2580	47.2580	40.5905	40.5905	-14.1086	
19	69.4180	50.0930	50.0930	49.2433	49.2433	-1.6962	
20	69.3670	65.6220	65.6220	61.2142	61.2142	-6.7169	
21	69.3160	69.7520	69.7520	75.4306	75.4306	8.1412	
22	69.2640	88.7710	88.7710	89.1885	89.1885	0.4703	
23	69.2130	100.8700	100.8700	98.8021	98.8021	-2.0501	
24	69.1630	101.4000	101.4000	101.0945	101.0945	-0.3012	
25	69.1120	100.9400	100.9400	95.2412	95.2412	-5.6458	
26	69.0610	84.4370	84.4370	83.1822	83.1822	-1.4861	
27	69.0100	74.3040	74.3040	68.5969	68.5969	-7.6807	
28	68.9590	75.9450	75.9450	54.9434	54.9434	-27.6537	
29	68.9090	51.3370	51.3370	44.2905	44.2905	-13.7259	
30	68.8580	44.9140	44.9140	37.1064	37.1064	-17.3834	
31	68.8080	29.0580	29.0580	32.8736	32.8736	13.1308	
32	68.7570	31.1310	31.1310	30.8170	30.8170	-1.0085	
33	68.7070	25.9630	25.9630	30.3067	30.3067	16.7304	
34	68.6560	37.1380	37.1380	31.0403	31.0403	-16.4189	
35	68.6060	28.4730	28.4730	33.0397	33.0397	16.0388	
36	68.5560	36.9120	36.9120	36.6121	36.6121	-0.8123	
37	68.5050	39.1490	39.1490	42.3208	42.3208	8.1019	
38	68.4550	42.9300	42.9300	50.8052	50.8052	18.3443	
39	68.4050	59.1120	59.1120	62.3462	62.3462	5.4713	
40	68.3550	86.5410	86.5410	76.3456	76.3456	-11.7810	
41	68.3050	88.5790	88.5790	90.9459	90.9459	2.6721	
42	68.2550	108.5900	108.5900	102.9402	102.9402	-5.2028	
43	68.2050	111.8600	111.8600	109.3809	109.3809	-2.2163	
44	68.1550	99.3810	99.3810	108.1481	108.1481	8.8217	
45	68.1060	100.7600	100.7600	100.2449	100.2449	-0.5112	
46	68.0560	96.8650	96.8650	87.8705	87.8705	-9.2856	
47	68.0060	81.5770	81.5770	74.8234	74.8234	-8.2788	
48	67.9570	59.4810	59.4810	63.5084	63.5084	6.7709	
49	67.9070	36.1800	36.1800	55.4233	55.4233	53.1877	
50	67.8580	43.6220	43.6220	50.4831	50.4831	15.7286	
51	67.8080	45.4510	45.4510	47.9917	47.9917	5.5901	
52	67.7590	34.6520	34.6520	46.9651	46.9651	35.5336	
53	67.7090	41.6340	41.6340	46.5577	46.5577	11.8263	
54	67.6600	58.8010	58.8010	46.1690	46.1690	-21.4826	
55	67.6110	45.2930	45.2930	45.5224	45.5224	0.5064	

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
56	67.5620	54.	9720	44.	5999	-18.	8679
57	67.5130	34.	8240	43.	5580	25.	0805
58	67.4640	50.	3800	42.	6506	-15.	3421
59	67.4150	43.	4610	42.	1278	-3.	0675
60	67.3660	38.	5340	42.	1749	9.	4485
61	67.3170	47.	4710	42.	9098	-9.	6083
62	67.2680	41.	9950	44.	4409	5.	8243
63	67.2190	37.	1400	46.	9045	26.	2910
64	67.1700	56.	7490	50.	4724	-11.	0602
65	67.1220	63.	1680	55.	4886	-12.	1571
66	67.0730	62.	0000	62.	4989	0.	8046
67	67.0240	60.	0000	72.	3924	20.	6540
68	66.9760	74.	0000	86.	5389	16.	9445
69	66.9270	85.	0000	106.	8754	25.	7357
70	66.8790	110.	0000	135.	6797	23.	3452
71	66.8300	150.	0000	174.	8429	16.	5619
72	66.7820	200.	0000	224.	5473	12.	2737
73	66.7340	258.	0000	281.	3047	9.	0328
74	66.6860	328.	0000	337.	5771	2.	9199
75	66.6370	370.	0000	381.	6362	3.	1449
76	66.5890	390.	0000	403.	2708	3.	4028
77	66.5410	390.	0000	395.	9387	1.	5227
78	66.4930	375.	0000	362.	6770	-3.	2861
79	66.4450	340.	0000	312.	1399	-8.	1941
80	66.3970	270.	0000	256.	6265	-4.	9532
81	66.3490	210.	0000	205.	7801	-2.	0095
82	66.3020	160.	0000	165.	4728	3.	4205
83	66.2540	143.	6100	137.	1391	-4.	5059
84	66.2060	125.	2800	119.	7316	-4.	4288
85	66.1590	115.	5100	111.	3322	-3.	6169
86	66.1110	98.	2750	110.	2550	12.	1902
87	66.0630	112.	8600	115.	4557	2.	2999
88	66.0160	127.	6800	126.	4634	-0.	9528
89	65.9680	145.	5000	143.	0028	-1.	7163
90	65.9210	145.	4300	164.	5651	13.	1576
91	65.8740	179.	6500	189.	8442	5.	6745
92	65.8260	232.	1900	216.	2864	-6.	8494
93	65.7790	245.	6100	240.	1715	-2.	2143
94	65.7320	269.	2500	257.	3396	-4.	4235
95	65.6850	268.	5498	264.	2163	-1.	6137
96	65.6380	273.	9600	259.	1030	-5.	4230
97	65.5910	264.	5000	242.	8402	-8.	1890
98	65.5440	248.	5200	218.	3752	-12.	1297
99	65.4970	213.	1800	189.	8139	-10.	9607
100	65.4500	178.	8800	161.	0499	-9.	9676
101	65.4030	149.	2200	134.	8550	-9.	6267
102	65.3560	115.	2900	112.	7192	-2.	2299
103	65.3090	86.	6730	94.	9544	9.	5548
104	65.2630	80.	9190	81.	2383	0.	3947
105	65.2160	74.	3880	70.	8404	-4.	7690
106	65.1700	58.	4320	63.	0831	7.	9599
107	65.1230	45.	7710	57.	3499	25.	2975
108	65.0760	49.	1910	53.	1854	8.	1203
109	65.0300	40.	2930	50.	2370	24.	6793
110	64.9840	45.	5930	48.	2632	5.	8567

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
111	64.9370	37.3920		47.0911		25.9389	
112	64.8910	34.1300		46.5650		36.4342	
113	64.8450	42.4580		46.5771		9.7017	
114	64.7990	53.5100		46.9839		-12.1960	
115	64.7520	38.3710		47.6490		24.1797	
116	64.7060	46.5700		48.4119		3.9551	
117	64.6600	27.7300		49.0934		77.0408	
118	64.6140	41.0110		49.5390		20.7946	
119	64.5680	22.0760		49.6432		124.8741	
120	64.5220	54.8620		49.3578		-10.0327	
121	64.4770	51.2370		48.7013		-4.9490	
122	64.4310	55.8560		47.7654		-14.4847	
123	64.3850	48.4880		46.6729		-3.7435	
124	64.3390	36.2290		45.5771		25.8029	
125	64.2940	47.0750		44.6113		-5.2336	
126	64.2480	30.8160		43.8791		42.3907	
127	64.2030	35.2170		43.4469		23.3690	
128	64.1570	49.1160		43.3766		-11.6853	
129	64.1120	31.1670		43.6639		40.0966	
130	64.0660	48.9030		44.3390		-9.3328	
131	64.0210	44.5090		45.3965		1.9939	
132	63.9750	49.4260		46.8305		-5.2513	
133	63.9300	42.1150		48.6460		15.5076	
134	63.8850	45.1540		50.8104		12.5268	
135	63.8400	49.6800		53.3213		7.3296	
136	63.7950	65.9550		56.1137		-14.9212	
137	63.7500	58.3710		59.1385		1.3149	
138	63.7050	66.5100		62.2851		-6.3523	
139	63.6600	74.9750		65.4225		-12.7409	
140	63.6150	74.3520		68.4083		-7.9940	
141	63.5700	61.7820		71.0886		15.0635	
142	63.5250	65.2820		73.3414		12.3455	
143	63.4800	67.7690		75.0494		10.7429	
144	63.4350	75.4970		76.1871		0.9141	
145	63.3910	78.2420		76.7824		-1.8654	
146	63.3460	79.1660		76.9267		-2.8286	
147	63.3010	59.0650		76.7816		29.9950	
148	63.2570	51.4760		76.5241		48.6597	
149	63.2120	47.6480		76.3541		60.2462	
150	63.1680	82.9580		76.4625		-7.8299	
151	63.1240	63.4670		77.0107		21.3397	
152	63.0790	77.7460		78.1199		0.4809	
153	63.0350	70.9590		79.8921		12.5891	
154	62.9910	71.1070		82.3805		15.8543	
155	62.9460	85.8730		85.5962		-0.3223	
156	62.9020	84.3170		89.5239		6.1754	
157	62.8580	94.4740		94.0955		-0.4006	
158	62.8140	87.7080		99.1816		13.0816	
159	62.7700	90.3860		104.6632		15.7958	
160	62.7260	111.1600		110.3854		-0.6968	
161	62.6820	112.3100		116.2256		3.4864	
162	62.6380	110.2400		122.1351		10.7902	
163	62.5940	127.6000		128.1864		0.4596	
164	62.5500	129.4800		134.5751		3.9351	
165	62.5070	147.4300		141.5867		-3.9634	

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
166	62.4630	153.6900	153.6900	149.5421	149.5421	-2.6989	-2.6989
167	62.4190	151.0900	151.0900	158.4660	158.4660	4.8819	4.8819
168	62.3760	160.1600	160.1600	167.9606	167.9606	4.8705	4.8705
169	62.3320	170.3600	170.3600	177.0046	177.0046	3.9004	3.9004
170	62.2880	170.3200	170.3200	184.0275	184.0275	8.0481	8.0481
171	62.2450	184.3300	184.3300	187.2656	187.2656	1.5926	1.5926
172	62.2020	187.8700	187.8700	185.2923	185.2923	-1.3721	-1.3721
173	62.1580	169.0600	169.0600	177.6072	177.6072	-5.0557	-5.0557
174	62.1150	171.0900	171.0900	164.8369	164.8369	-3.6549	-3.6549
175	62.0710	139.6700	139.6700	148.5819	148.5819	6.3807	6.3807
176	62.0280	150.1000	150.1000	130.8064	130.8064	-12.8538	-12.8538
177	61.9850	123.6700	123.6700	113.3945	113.3945	-8.3088	-8.3088
178	61.9420	101.0000	101.0000	97.6883	97.6883	-3.2789	-3.2789
179	61.8990	85.1460	85.1460	84.3393	84.3393	-0.9474	-0.9474
180	61.8560	91.7470	91.7470	73.4629	73.4629	-19.9288	-19.9288
181	61.8130	74.6320	74.6320	64.8186	64.8186	-13.1491	-13.1491
182	61.7700	63.9950	63.9950	58.0371	58.0371	-9.3100	-9.3100
183	61.7270	64.2880	64.2880	52.7410	52.7410	-17.9613	-17.9613
184	61.6840	57.3190	57.3190	48.5691	48.5691	-15.2653	-15.2653
185	61.6410	41.7850	41.7850	45.2813	45.2813	8.3673	8.3673
186	61.5980	56.9320	56.9320	42.6792	42.6792	-25.0348	-25.0348
187	61.5550	49.0890	49.0890	40.6013	40.6013	-17.2904	-17.2904
188	61.5130	23.9020	23.9020	38.9671	38.9671	63.0289	63.0289
189	61.4700	44.5100	44.5100	37.7019	37.7019	-15.2957	-15.2957
190	61.4270	31.8450	31.8450	36.7493	36.7493	15.4005	15.4005
191	61.3850	41.9060	41.9060	36.0891	36.0891	-13.8808	-13.8808
192	61.3420	31.1320	31.1320	35.6911	35.6911	14.6446	14.6446
193	61.3000	27.0610	27.0610	35.5560	35.5560	31.3921	31.3921
194	61.2570	35.0520	35.0520	35.6907	35.6907	1.8222	1.8222
195	61.2150	47.1450	47.1450	36.1311	36.1311	-23.3616	-23.3616
196	61.1720	30.6970	30.6970	36.8959	36.8959	20.1939	20.1939
197	61.1300	31.4970	31.4970	38.0719	38.0719	20.8748	20.8748
198	61.0880	37.6860	37.6860	39.7426	39.7426	5.4573	5.4573
199	61.0460	31.1160	31.1160	42.0678	42.0678	35.1966	35.1966
200	61.0030	48.6350	48.6350	45.2975	45.2975	-6.8622	-6.8622
201	60.9610	51.2410	51.2410	49.7905	49.7905	-2.8307	-2.8307
202	60.9190	72.9890	72.9890	56.1277	56.1277	-23.1012	-23.1012
203	60.8770	72.3010	72.3010	65.1700	65.1700	-9.8629	-9.8629
204	60.8350	100.4700	100.4700	78.0453	78.0453	-22.3198	-22.3198
205	60.7930	110.3200	110.3200	96.1348	96.1348	-12.8582	-12.8582
206	60.7510	132.9900	132.9900	120.5874	120.5874	-9.3260	-9.3260
207	60.7090	173.0300	173.0300	151.7684	151.7684	-12.2878	-12.2878
208	60.6670	197.1400	197.1400	188.1954	188.1954	-4.5372	-4.5372
209	60.6260	237.5800	237.5800	226.0788	226.0788	-4.8410	-4.8410
210	60.5840	279.6699	279.6699	259.8035	259.8035	-7.1035	-7.1035
211	60.5420	293.6699	293.6699	281.8882	281.8882	-4.0119	-4.0119
212	60.5000	295.6199	295.6199	288.3506	288.3506	-2.4590	-2.4590
213	60.4590	294.2898	294.2898	276.1140	276.1140	-6.1762	-6.1762
214	60.4170	279.3699	279.3699	249.4998	249.4998	-10.6920	-10.6920
215	60.3760	248.1900	248.1900	213.0906	213.0906	-14.1422	-14.1422
216	60.3340	225.9300	225.9300	174.5887	174.5887	-22.7244	-22.7244
217	60.2930	157.1600	157.1600	138.9107	138.9107	-11.6119	-11.6119
218	60.2510	135.5600	135.5600	109.5014	109.5014	-19.2229	-19.2229
219	60.2100	105.1500	105.1500	87.0406	87.0406	-17.2225	-17.2225
220	60.1690	77.4780	77.4780	70.8934	70.8934	-8.4987	-8.4987

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
221	60.1270	70.	5740	59.	7480	-15.	3399
222	60.0860	58.	4290	52.	2298	-10.	6098
223	60.0450	48.	0900	47.	2421	-1.	7631
224	60.0040	51.	6100	44.	0156	-14.	7149
225	59.9630	43.	0740	42.	0229	-2.	4401
226	59.9210	37.	3410	40.	9630	9.	6997
227	59.8800	31.	7920	40.	6521	27.	8690
228	59.8390	41.	4900	40.	9880	-1.	2098
229	59.7980	47.	4360	41.	9234	-11.	6211
230	59.7580	38.	7440	43.	4576	12.	1661
231	59.7170	63.	4450	45.	6247	-28.	0877
232	59.6760	54.	1740	48.	4711	-10.	5269
233	59.6350	56.	0690	52.	0685	-7.	1349
234	59.5940	50.	4090	56.	4584	12.	0007
235	59.5540	68.	5580	61.	6853	-10.	0247
236	59.5130	69.	7210	67.	6714	-2.	9397
237	59.4720	79.	4420	74.	2974	-6.	4759
238	59.4320	99.	5760	81.	2725	-18.	3814
239	59.3910	98.	1890	88.	1528	-10.	2213
240	59.3510	105.	1400	94.	4073	-10.	2080
241	59.3100	100.	0500	99.	4275	-0.	6222
242	59.2700	100.	6900	102.	6861	1.	9824
243	59.2300	105.	0900	103.	8089	-1.	2190
244	59.1890	102.	4100	102.	7019	0.	2850
245	59.1490	96.	1510	99.	5683	3.	5541
246	59.1090	108.	7000	94.	8105	-12.	7778
247	59.0680	91.	5320	89.	0547	-2.	7065
248	59.0280	96.	1770	82.	8757	-13.	8300
249	58.9880	80.	1410	76.	8554	-4.	0997
250	58.9480	92.	9650	71.	3815	-23.	2168
251	58.9080	78.	8160	66.	7523	-15.	3062
252	58.8680	91.	9160	63.	0846	-31.	3671
253	58.8280	80.	4000	60.	4331	-24.	8345
254	58.7880	82.	9850	58.	7896	-29.	1563
255	58.7480	74.	6530	58.	0993	-22.	1741
256	58.7080	57.	6610	58.	3163	1.	1366
257	58.6690	60.	9920	59.	3695	-2.	6601
258	58.6290	66.	1230	61.	1798	-7.	4757
259	58.5890	78.	8950	63.	6221	-19.	3585
260	58.5500	81.	6240	66.	5681	-18.	4454
261	58.5100	76.	9160	69.	8192	-9.	2266
262	58.4700	87.	7150	73.	1342	-16.	6229
263	58.4310	88.	4120	76.	2059	-13.	8059
264	58.3910	78.	8180	78.	7268	-0.	1157
265	58.3520	79.	0650	80.	4055	1.	6955
266	58.3120	81.	2870	81.	0021	-0.	3505
267	58.2730	93.	3760	80.	3878	-13.	9095
268	58.2340	82.	2250	78.	5529	-4.	4659
269	58.1940	74.	0880	75.	6110	2.	0556
270	58.1550	84.	6380	71.	7827	-15.	1886
271	58.1160	68.	9460	67.	3515	-2.	3126
272	58.0770	67.	1050	62.	5896	-6.	7288
273	58.0370	64.	3410	57.	7686	-10.	2149
274	57.9980	43.	0520	53.	0877	23.	3108
275	57.9590	58.	0680	48.	7222	-16.	0946

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
276	57.9200	50.	3660	44.	7216	-11.	2067
277	57.8810	70.	1040	41.	1359	-41.	3216
278	57.8420	52.	0120	37.	9710	-26.	9957
279	57.8030	36.	4130	35.	1995	-3.	3325
280	57.7640	37.	5200	32.	7814	-12.	6295
281	57.7260	25.	9530	30.	6816	18.	2198
282	57.6870	36.	6610	28.	8550	-21.	2923
283	57.6480	41.	4770	27.	2805	-34.	2274
284	57.6090	25.	1140	25.	8931	3.	1024
285	57.5710	29.	5680	24.	6877	-16.	5055
286	57.5320	32.	4930	23.	6352	-27.	2607
287	57.4930	44.	3060	22.	7070	-48.	7497
288	57.4550	14.	2480	21.	8834	53.	5895
289	57.4160	26.	7150	21.	1556	-20.	8100
290	57.3780	28.	6140	20.	5115	-28.	3166
291	57.3390	34.	7380	19.	9286	-42.	6316
292	57.3010	22.	3840	19.	4326	-13.	1855
293	57.2630	19.	2570	18.	9727	-1.	4761
294	57.2240	27.	3770	18.	5600	-32.	2057
295	57.1860	23.	0160	18.	1938	-20.	9515
296	57.1480	20.	8840	17.	8581	-14.	4888
297	57.1090	27.	8830	17.	5621	-37.	0151
298	57.0710	19.	9000	17.	2950	-13.	0905
299	57.0330	21.	6460	17.	0504	-21.	2308
300	56.9950	34.	9950	16.	8367	-51.	8881
301	56.9570	15.	7980	16.	6481	5.	3808
302	56.9190	35.	1580	16.	4738	-53.	1435
303	56.8810	28.	3550	16.	3216	-42.	4384
304	56.8430	28.	9080	16.	1922	-43.	9870
305	56.8050	12.	0520	16.	0798	33.	4205
306	56.7670	21.	2390	15.	9748	-24.	7855
307	56.7290	34.	4680	15.	8945	-53.	8861
308	56.6920	37.	2980	15.	8343	-57.	5465
309	56.6540	16.	1190	15.	7900	-2.	0413
310	56.6160	23.	8950	15.	7652	-34.	0229
311	56.5780	10.	4340	15.	7604	51.	0487
312	56.5410	22.	5650	15.	7690	-30.	1174
313	56.5030	29.	6850	15.	8080	-46.	7474
314	56.4660	39.	5890	15.	8682	-59.	9177
315	56.4280	29.	8420	15.	9602	-46.	5176
316	56.3910	24.	6230	16.	0847	-34.	6759
317	56.3530	35.	8280	16.	2549	-54.	6307
318	56.3160	26.	1990	16.	4763	-37.	1110
319	56.2780	22.	4200	16.	7608	-25.	2419
320	56.2410	35.	1050	17.	1242	-51.	2202
321	56.2040	20.	4820	17.	5955	-14.	0930
322	56.1660	25.	3520	18.	1985	-28.	2168
323	56.1290	33.	4880	18.	9817	-43.	3178
324	56.0920	29.	9320	19.	9849	-33.	2323
325	56.0550	33.	9220	21.	2515	-37.	3520
326	56.0180	11.	5580	22.	8282	97.	5099
327	55.9800	20.	0520	24.	7161	23.	2602
328	55.9430	34.	0920	26.	8886	-21.	1292
329	55.9060	26.	6330	29.	2189	9.	7094
330	55.8690	29.	3040	31.	5226	7.	5711

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
331	55.8320	33.0890	33.5502	33.5502	1.3937		
332	55.7960	35.7920	35.0229	35.0229	-2.1488		
333	55.7590	29.8100	35.7237	35.7237	19.8381		
334	55.7220	22.3240	35.5403	35.5403	59.2022		
335	55.6850	28.3890	34.4954	34.4954	21.5096		
336	55.6480	35.3500	32.7613	32.7613	-7.3229		
337	55.6120	25.5370	30.5742	30.5742	19.7253		
338	55.5750	28.6190	28.2309	28.2309	-1.3560		
339	55.5380	14.9410	25.9474	25.9474	73.6660		
340	55.5020	19.7210	23.8950	23.8950	21.1652		
341	55.4650	18.9830	22.1554	22.1554	16.7121		
342	55.4280	10.0100	20.7415	20.7415	107.2075		
343	55.3920	25.9870	19.6394	19.6394	-24.4260		
344	55.3560	21.7040	18.7965	18.7965	-13.3959		
345	55.3190	21.2350	18.1637	18.1637	-14.4634		
346	55.2830	20.2910	17.6958	17.6958	-12.7898		
347	55.2460	18.8070	17.3604	17.3604	-7.6918		
348	55.2100	25.4730	17.1336	17.1336	-32.7383		
349	55.1740	21.7290	16.9859	16.9859	-21.8285		
350	55.1370	21.2590	16.9096	16.9096	-20.4592		
351	55.1010	29.3340	16.8941	16.8941	-42.4078		
352	55.0650	15.1150	16.9362	16.9362	12.0489		
353	55.0290	31.9020	17.0258	17.0258	-46.6310		
354	54.9930	18.2240	17.1613	17.1613	-5.8311		
355	54.9570	28.1900	17.3432	17.3432	-38.4773		
356	54.9210	14.3160	17.5901	17.5901	22.8702		
357	54.8850	29.7180	17.8931	17.8931	-39.7903		
358	54.8490	26.2820	18.2502	18.2502	-30.5600		
359	54.8130	36.6780	18.6853	18.6853	-49.0559		
360	54.7770	19.2590	19.1959	19.1959	-0.3277		
361	54.7410	23.4190	19.8073	19.8073	-15.4219		
362	54.7050	11.9710	20.5233	20.5233	71.4416		
363	54.6690	21.5140	21.3638	21.3638	-0.6981		
364	54.6340	27.2070	22.3323	22.3323	-17.9171		
365	54.5980	24.5310	23.4433	23.4433	-4.4340		
366	54.5620	20.1590	24.6974	24.6974	22.5133		
367	54.5260	24.0590	26.0928	26.0928	8.4533		
368	54.4910	32.7000	27.6012	27.6012	-15.5928		
369	54.4550	28.4740	29.1303	29.1303	2.3051		
370	54.4200	34.2460	30.6627	30.6627	-10.4633		
371	54.3840	32.0220	32.0923	32.0923	0.2197		
372	54.3490	24.0760	33.3298	33.3298	38.4357		
373	54.3130	24.0790	34.3008	34.3008	42.4509		
374	54.2780	30.9260	34.8890	34.8890	12.8145		
375	54.2430	36.8020	35.1154	35.1154	-4.5828		
376	54.2070	33.1660	34.9799	34.9799	5.4692		
377	54.1720	23.4030	34.5382	34.5382	47.5804		
378	54.1370	26.7150	33.8931	33.8931	26.8691		
379	54.1010	30.1160	33.0984	33.0984	9.9029		
380	54.0660	32.7690	32.3273	32.3273	-1.3480		
381	54.0310	38.8850	31.6741	31.6741	-18.5441		
382	53.9960	28.8770	31.2487	31.2487	8.2130		
383	53.9610	27.7710	31.1126	31.1126	12.0327		
384	53.9260	28.0510	31.3983	31.3983	11.9331		
385	53.8910	31.6760	32.2152	32.2152	1.7022		

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
386	53.8560	30.	7030	33.	7304	9.	8603
387	53.8210	46.	1140	36.	2037	-21.	4908
388	53.7860	21.	8420	39.	9708	82.	9997
389	53.7510	32.	3230	45.	6523	41.	2379
390	53.7160	50.	4550	53.	9652	6.	9570
391	53.6810	49.	3110	65.	7632	33.	3641
392	53.6460	85.	3360	81.	7557	-4.	1955
393	53.6120	83.	2180	102.	2667	22.	8902
394	53.5770	113.	3600	126.	6387	11.	7138
395	53.5420	145.	5300	152.	8937	5.	0599
396	53.5080	171.	4400	177.	7257	3.	6664
397	53.4730	171.	8500	197.	1505	14.	7224
398	53.4380	200.	1800	207.	4912	3.	6523
399	53.4040	195.	5300	206.	5272	5.	6243
400	53.3690	180.	7600	194.	4172	7.	5554
401	53.3350	169.	3200	173.	4627	2.	4467
402	53.3000	129.	5000	147.	2779	13.	7281
403	53.2660	125.	2600	121.	0417	-3.	3676
404	53.2310	91.	9270	96.	3209	4.	7798
405	53.1970	67.	7390	75.	8499	11.	9738
406	53.1630	52.	2780	60.	0808	14.	9256
407	53.1280	46.	4940	48.	4799	4.	2713
408	53.0940	34.	7910	40.	4438	16.	2481
409	53.0600	25.	4590	35.	0039	37.	4911
410	53.0260	18.	6710	31.	4342	68.	3587
411	52.9920	29.	5160	29.	2566	-0.	8788
412	52.9570	24.	7640	28.	1230	13.	5640
413	52.9230	28.	3980	27.	8220	-2.	0284
414	52.8890	22.	4690	28.	2865	25.	8911
415	52.8550	34.	1780	29.	4375	-13.	8699
416	52.8210	21.	6360	31.	1714	44.	0722
417	52.7870	24.	0680	33.	3347	38.	5023
418	52.7530	24.	8340	35.	6535	43.	5672
419	52.7200	37.	8870	37.	8200	-0.	1769
420	52.6860	48.	2540	39.	3320	-18.	4897
421	52.6520	42.	7680	40.	0461	-6.	3644
422	52.6180	41.	0490	39.	6927	-3.	3040
423	52.5840	50.	3870	38.	3058	-23.	9769
424	52.5510	34.	6290	36.	1956	4.	5241
425	52.5170	24.	6230	33.	6328	36.	5912
426	52.4830	44.	6000	30.	9926	-30.	5099
427	52.4500	27.	6370	28.	6487	3.	6607
428	52.4160	25.	6020	26.	8070	4.	7067
429	52.3820	30.	2470	25.	5493	-15.	5312
430	52.3490	14.	5530	25.	0045	71.	8167
431	52.3150	13.	7920	25.	1309	82.	2135
432	52.2820	42.	3220	25.	9440	-38.	6985
433	52.2480	37.	5820	27.	4046	-27.	0804
434	52.2150	30.	3940	29.	3916	-3.	2981
435	52.1820	23.	9160	31.	7514	32.	7621
436	52.1480	36.	1600	34.	2069	-5.	4011
437	52.1150	37.	6670	36.	3982	-3.	3685
438	52.0820	27.	7810	37.	9514	36.	6093
439	52.0480	23.	9110	38.	6237	61.	5311
440	52.0150	29.	1240	38.	1987	31.	1589

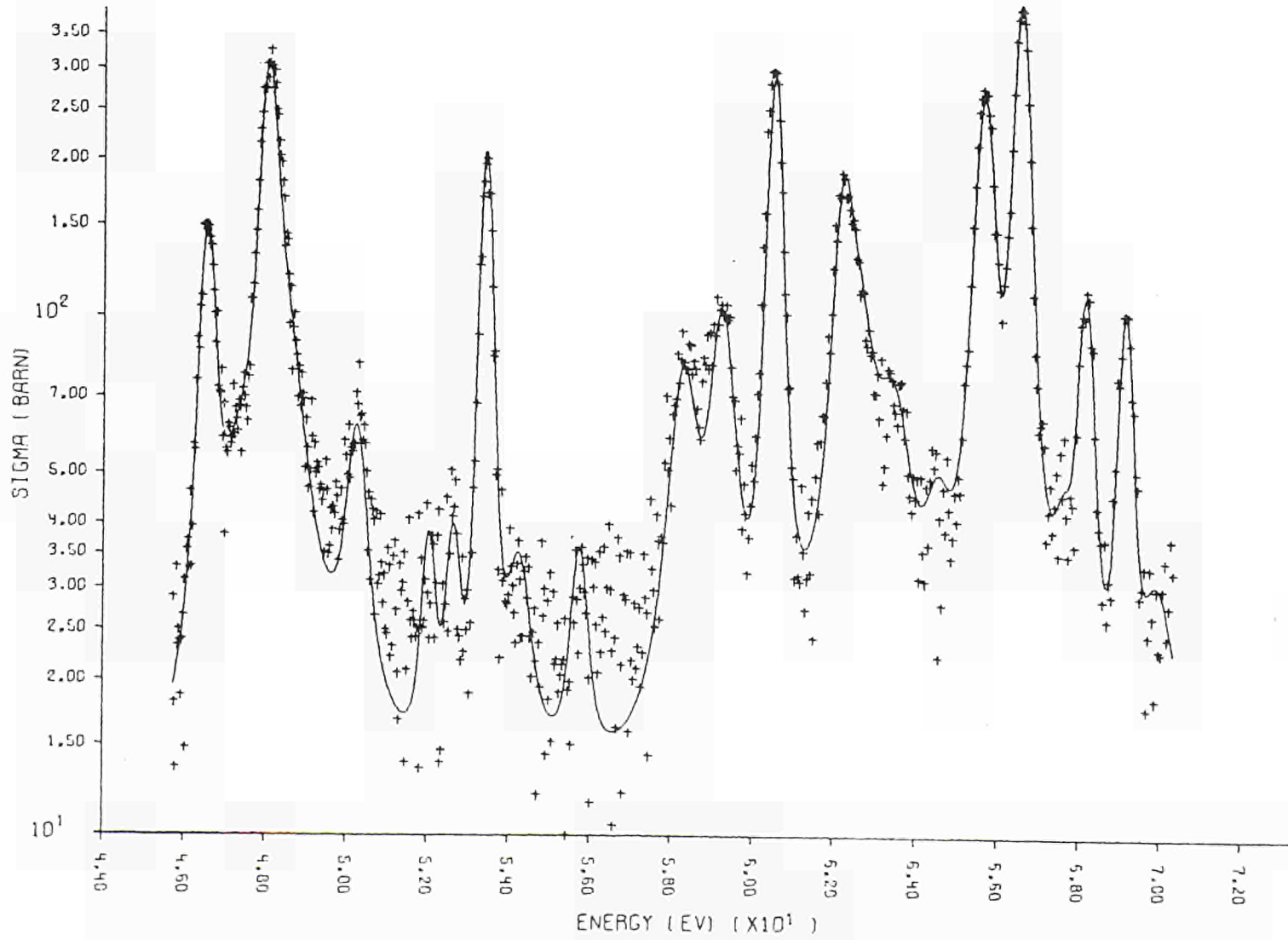
CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
441	51.9820	43.	4520	36.	7749	-15.	3667
442	51.9490	30.	8980	34.	5527	11.	8285
443	51.9160	25.	7350	31.	8409	23.	7262
444	51.8830	24.	9600	29.	0377	16.	3371
445	51.8500	33.	9660	26.	3552	-22.	4070
446	51.8160	13.	4500	24.	0530	78.	8330
447	51.7830	41.	5970	22.	1544	-46.	7404
448	51.7510	25.	0270	20.	6854	-17.	3475
449	51.7180	24.	0390	19.	5835	-18.	5346
450	51.6850	25.	8010	18.	7848	-27.	1934
451	51.6520	26.	8600	18.	2210	-32.	1630
452	51.6190	23.	9650	17.	8028	-25.	7133
453	51.5860	25.	7990	17.	5279	-32.	0598
454	51.5530	40.	6850	17.	3342	-57.	3941
455	51.5210	28.	0650	17.	2126	-38.	6686
456	51.4880	20.	7940	17.	1591	-17.	4805
457	51.4550	13.	8150	17.	1301	23.	9964
458	51.4230	34.	9250	17.	1510	-50.	8919
459	51.3900	30.	4860	17.	1901	-43.	6130
460	51.3570	29.	4170	17.	2629	-41.	3166
461	51.3250	33.	2080	17.	3644	-47.	7102
462	51.2920	16.	7180	17.	4882	4.	6073
463	51.2600	20.	5680	17.	6346	-14.	2619
464	51.2270	27.	0690	17.	8049	-34.	2238
465	51.1950	36.	7450	18.	0070	-50.	9948
466	51.1620	34.	3670	18.	2246	-46.	9705
467	51.1300	23.	0980	18.	4809	-19.	9892
468	51.0980	22.	0370	18.	7559	-14.	8891
469	51.0650	32.	9350	19.	0670	-42.	1070
470	51.0330	35.	6030	19.	4197	-45.	4548
471	51.0010	24.	3680	19.	8130	-18.	6925
472	50.9690	24.	8640	20.	2445	-18.	5790
473	50.9360	31.	7200	20.	7407	-34.	6132
474	50.9040	27.	9250	21.	2968	-23.	7356
475	50.8720	33.	3070	21.	9225	-34.	1804
476	50.8400	41.	3650	22.	6380	-45.	2725
477	50.8080	31.	4390	23.	4450	-25.	4271
478	50.7760	30.	2910	24.	3763	-19.	5264
479	50.7440	41.	9650	25.	4453	-39.	3653
480	50.7120	26.	4280	26.	6793	0.	9509
481	50.6800	40.	4390	28.	0988	-30.	5156
482	50.6480	42.	3480	29.	7585	-29.	7285
483	50.6160	44.	1160	31.	6561	-28.	2434
484	50.5840	30.	8030	33.	8544	9.	9063
485	50.5530	45.	5290	36.	3553	-20.	1492
486	50.5210	35.	1440	39.	1569	11.	4185
487	50.4890	50.	0640	42.	2489	-15.	6102
488	50.4570	56.	5820	45.	5626	-19.	4751
489	50.4250	61.	3530	48.	9819	-20.	1638
490	50.3940	57.	5080	52.	3641	-8.	9447
491	50.3620	64.	4210	55.	5070	-13.	8371
492	50.3310	63.	8250	58.	2094	-8.	7984
493	50.2990	80.	8560	60.	2470	-25.	4884
494	50.2670	67.	2180	61.	4654	-8.	5581
495	50.2360	70.	9280	61.	7654	-12.	9181

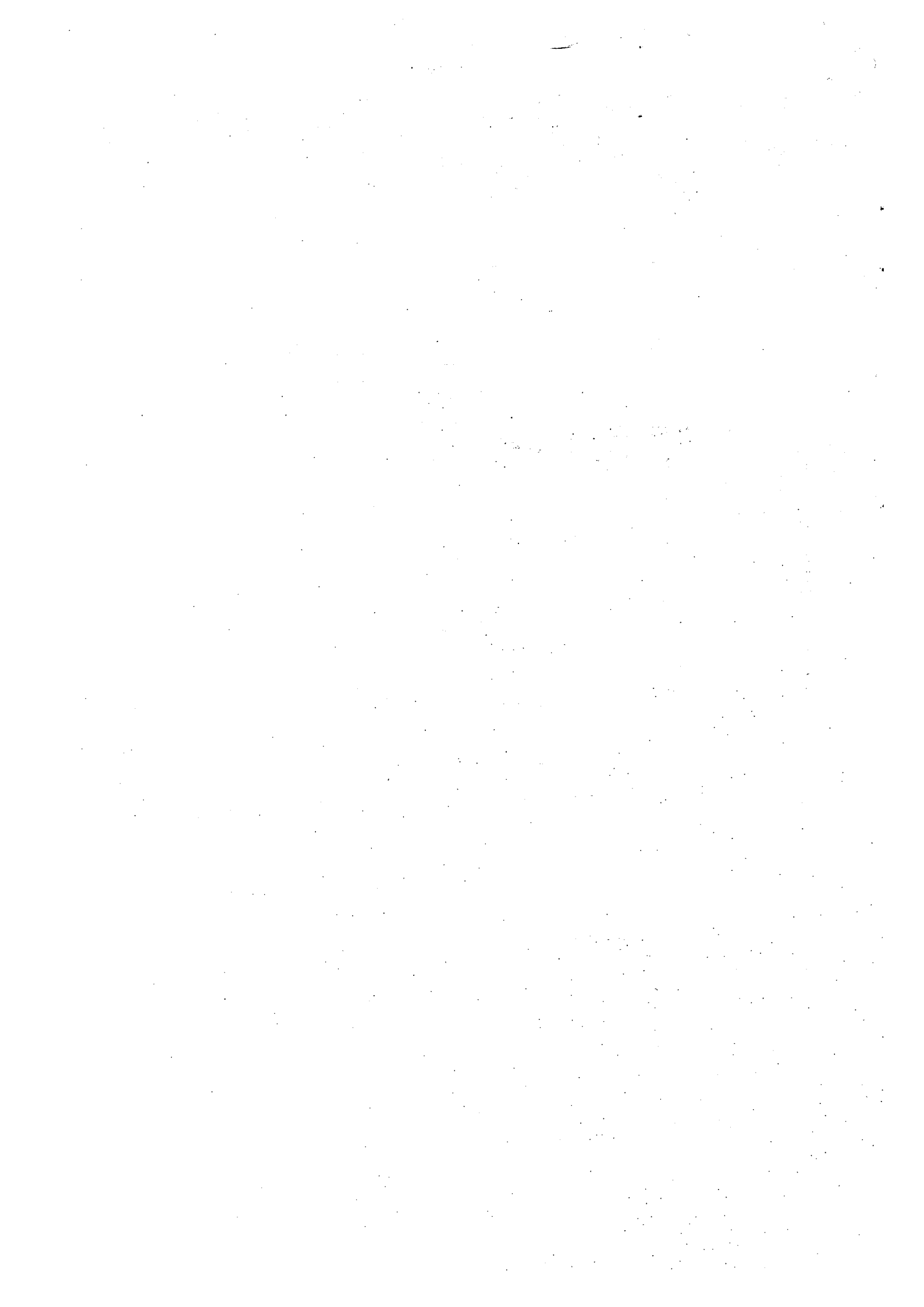
CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
496	50.2040	56.	5940	61.	1366	8.	0266
497	50.1730	56.	3040	59.	6577	5.	9564
498	50.1410	54.	6580	57.	4863	5.	1746
499	50.1100	55.	4220	54.	8134	-1.	0980
500	50.0790	48.	5370	51.	8644	6.	8554
501	50.0470	61.	4310	48.	8474	-20.	4842
502	50.0160	49.	2270	45.	9123	-6.	7335
503	49.9850	53.	6580	43.	2006	-19.	4890
504	49.9530	57.	4440	40.	7778	-29.	0129
505	49.9220	39.	5440	38.	6721	-2.	2049
506	49.8910	40.	2860	36.	9017	-8.	4006
507	49.8600	46.	2910	35.	4523	-23.	4143
508	49.8290	38.	5340	34.	2775	-11.	0461
509	49.7980	33.	7810	33.	3636	-1.	2354
510	49.7660	44.	7550	32.	6741	-26.	9934
511	49.7350	47.	5940	32.	1803	-32.	3858
512	49.7040	41.	5100	31.	8588	-23.	2504
513	49.6730	42.	9250	31.	6807	-26.	1952
514	49.6420	38.	6470	31.	6454	-18.	1167
515	49.6110	42.	4960	31.	7235	-25.	3493
516	49.5810	35.	8670	31.	9176	-11.	0111
517	49.5500	34.	7740	32.	2058	-7.	3852
518	49.5190	46.	1690	32.	6007	-29.	3884
519	49.4880	52.	5610	33.	0779	-37.	0677
520	49.4570	35.	0120	33.	6587	-3.	8652
521	49.4260	45.	8260	34.	3239	-25.	0994
522	49.3960	43.	9710	35.	0778	-20.	2251
523	49.3650	47.	0430	35.	9737	-23.	5302
524	49.3340	46.	1560	36.	8716	-20.	1152
525	49.3040	50.	8240	37.	9202	-25.	3891
526	49.2730	51.	8180	39.	0766	-24.	5887
527	49.2420	49.	7180	40.	3366	-18.	8692
528	49.2120	56.	7790	41.	7172	-26.	5271
529	49.1810	41.	7310	43.	2192	3.	5663
530	49.1510	58.	3370	44.	8593	-23.	1031
531	49.1200	68.	4600	46.	6341	-31.	8812
532	49.0900	50.	4610	48.	5566	-3.	7740
533	49.0590	46.	5570	50.	6729	8.	8406
534	49.0290	55.	5740	52.	8896	-4.	8302
535	48.9990	63.	1860	55.	3103	-12.	4644
536	48.9680	50.	8930	57.	9131	13.	7939
537	48.9380	68.	8910	60.	7082	-11.	8779
538	48.9080	70.	5520	63.	7262	-9.	6748
539	48.8770	77.	0270	66.	8743	-13.	1806
540	48.8470	66.	6140	70.	2410	5.	4448
541	48.8170	79.	5340	73.	8074	-7.	2002
542	48.7870	69.	3850	77.	5451	11.	7606
543	48.7570	83.	6560	81.	5175	-2.	5563
544	48.7270	88.	9950	85.	5629	-3.	8565
545	48.6960	100.	9400	89.	8101	-11.	0263
546	48.6660	94.	4980	94.	2576	-0.	2544
547	48.6360	78.	1740	98.	8126	26.	4009
548	48.6060	113.	3900	103.	5877	-8.	6448
549	48.5760	96.	2290	108.	6240	12.	8807
550	48.5460	119.	3200	113.	9181	-4.	5273

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
551	48.5160	139.	5500	119.	6903	-14.	2312
552	48.4870	143.	1400	125.	9278	-12.	0247
553	48.4570	135.	0800	132.	9708	-1.	5615
554	48.4270	168.	1600	141.	0345	-16.	1307
555	48.3970	180.	5600	150.	2888	-16.	7652
556	48.3670	196.	5300	161.	1174	-18.	0189
557	48.3370	202.	2600	173.	7585	-14.	0915
558	48.3080	215.	4200	188.	2399	-12.	6173
559	48.2780	242.	3600	204.	6655	-15.	5531
560	48.2480	248.	1400	222.	7473	-10.	2332
561	48.2190	278.	2100	241.	6942	-13.	1253
562	48.1890	295.	0398	260.	6836	-11.	6446
563	48.1590	271.	7898	278.	3560	2.	4159
564	48.1300	301.	7400	293.	1321	-2.	8528
565	48.1000	324.	5398	303.	6462	-6.	4379
566	48.0710	305.	4800	308.	6912	1.	0512
567	48.0410	284.	8398	307.	4805	7.	9485
568	48.0120	304.	1099	300.	0630	-1.	3307
569	47.9820	272.	3499	287.	0713	5.	4053
570	47.9530	272.	4600	269.	5559	-1.	0659
571	47.9240	271.	5798	249.	0499	-8.	2959
572	47.8940	244.	6800	227.	1668	-7.	1576
573	47.8650	227.	2800	205.	1501	-9.	7369
574	47.8360	214.	3600	184.	2430	-14.	0497
575	47.8060	180.	6200	165.	2083	-8.	5327
576	47.7770	158.	3800	148.	3066	-6.	3603
577	47.7480	145.	2900	133.	7326	-7.	9547
578	47.7190	130.	4600	121.	4713	-6.	8900
579	47.6900	114.	5200	111.	1644	-2.	9301
580	47.6610	107.	1800	102.	6453	-4.	2309
581	47.6310	107.	4800	95.	6921	-10.	9675
582	47.6020	79.	5810	89.	8637	12.	9210
583	47.5730	75.	8370	85.	0884	12.	1991
584	47.5440	62.	4020	81.	1340	30.	0183
585	47.5150	66.	2020	77.	8897	17.	6546
586	47.4860	69.	7110	75.	0986	7.	7285
587	47.4570	76.	7670	72.	7412	-5.	2442
588	47.4280	72.	0780	70.	7714	-1.	8128
589	47.3990	54.	2770	68.	9405	27.	0160
590	47.3710	66.	6620	67.	3316	1.	0045
591	47.3420	68.	4330	65.	8815	-3.	7285
592	47.3130	59.	9570	64.	6011	7.	7457
593	47.2840	62.	8860	63.	3400	0.	7220
594	47.2550	66.	1480	62.	1922	-5.	9803
595	47.2270	59.	0230	61.	1202	3.	5532
596	47.1980	73.	3730	60.	1993	-17.	9544
597	47.1690	57.	9070	59.	3224	2.	4444
598	47.1410	56.	5310	58.	6059	3.	6705
599	47.1120	60.	7820	58.	1251	-4.	3712
600	47.0830	61.	6760	57.	7363	-6.	3877
601	47.0550	54.	2790	57.	6352	6.	1832
602	47.0260	55.	2400	57.	8519	4.	7282
603	46.9980	37.	9220	58.	5365	54.	3604
604	46.9690	67.	5730	59.	5971	-11.	8033
605	46.9410	58.	1360	61.	2694	5.	3898

CH.	ENERGY	SIG.	OBS.	SIG.	CALC.	ERROR	PERCENT
606	46.9120	78.5570	78.5570	63.6814	63.6814	-18.9360	
607	46.8840	70.6240	70.6240	67.0432	67.0432	-5.0702	
608	46.8550	71.0590	71.0590	71.3381	71.3381	0.3927	
609	46.8270	72.6980	72.6980	76.8560	76.8560	5.7195	
610	46.7990	101.3600	101.3600	83.6774	83.6774	-17.4453	
611	46.7700	88.2360	88.2360	91.8562	91.8562	4.1029	
612	46.7420	100.9500	100.9500	101.2830	101.2830	0.3299	
613	46.7140	111.0200	111.0200	111.5498	111.5498	0.4772	
614	46.6860	124.4200	124.4200	122.2165	122.2165	-1.7710	
615	46.6570	135.9000	135.9000	132.4879	132.4879	-2.5107	
616	46.6290	136.3200	136.3200	141.5509	141.5509	3.8372	
617	46.6010	140.7800	140.7800	148.3193	148.3193	5.3554	
618	46.5730	148.1000	148.1000	152.1228	152.1228	2.7163	
619	46.5450	145.7100	145.7100	152.4466	152.4466	4.6233	
620	46.5170	149.7900	149.7900	149.1363	149.1363	-0.4364	
621	46.4890	148.2100	148.2100	142.5325	142.5325	-3.8307	
622	46.4600	149.0100	149.0100	133.1937	133.1937	-10.6142	
623	46.4320	108.8800	108.8800	122.0421	122.0421	12.0887	
624	46.4040	109.0200	109.0200	109.9972	109.9972	0.8963	
625	46.3760	103.8700	103.8700	97.9102	97.9102	-5.7378	
626	46.3490	85.9970	85.9970	86.4700	86.4700	0.5500	
627	46.3210	90.3500	90.3500	76.0528	76.0528	-15.8243	
628	46.2930	74.9580	74.9580	66.9161	66.9161	-10.7285	
629	46.2650	54.9770	54.9770	59.1181	59.1181	7.5325	
630	46.2370	56.3470	56.3470	52.5717	52.5717	-6.7000	
631	46.2090	39.2390	39.2390	47.1556	47.1556	20.1753	
632	46.1810	32.8760	32.8760	42.6590	42.6590	29.7573	
633	46.1540	45.9140	45.9140	38.9375	38.9375	-15.1947	
634	46.1260	32.7020	32.7020	35.8546	35.8546	9.6403	
635	46.0980	36.9860	36.9860	33.2842	33.2842	-10.0086	
636	46.0710	35.4900	35.4900	31.1577	31.1577	-12.2069	
637	46.0430	14.7160	14.7160	29.3025	29.3025	99.1200	
638	46.0150	30.9950	30.9950	27.7236	27.7236	-10.5546	
639	45.9880	26.5020	26.5020	26.3561	26.3561	-0.5504	
640	45.9600	23.8320	23.8320	25.1760	25.1760	5.6395	
641	45.9320	18.5720	18.5720	24.1345	24.1345	29.9508	
642	45.9050	23.6580	23.6580	23.2427	23.2427	-1.7553	
643	45.8770	24.8820	24.8820	22.4071	22.4071	-9.9467	
644	45.8500	23.1870	23.1870	21.6741	21.6741	-6.5248	
645	45.8220	32.8610	32.8610	21.0131	21.0131	-36.0546	
646	45.7950	13.5190	13.5190	20.4160	20.4160	51.0171	
647	45.7680	18.0500	18.0500	19.8755	19.8755	10.1138	
648	45.7400	28.7810	28.7810	19.4066	19.4066	-32.5716	

TOTAL CROSS SECTION 45-70EV





EXAMPLE 3

AREA ANALYSIS OF TRANSMISSION DATA

JOB 1910

RUNRUN 10

ELEMENT NP-237

NUMBER OF ITERATIONS 2

C1	C2	GAMMA	CO	E0	FGXGNO	GNO(FG1)	GNO(FG2)	O/O ERROR	GN(FG1)	GN(FG2)
8	33	0.5000E-01	0.26000E 02	0.50423E 02	0.4666E-03	0.9333E-03	0.9333E-03	0.22E 01	0.6627E-02	0.6627E-02
34	46	0.5000E-01	0.38000E 02	0.49832E 02	0.2884E-03	0.5768E-03	0.5768E-03	0.21E 01	0.4072E-02	0.4072E-02
48	65	0.5000E-01	0.61000E 02	0.48728E 02	0.4055E-04	0.8111E-04	0.8111E-04	0.10E 02	0.5662E-03	0.5662E-03
66	74	0.5000E-01	0.68000E 02	0.48399E 02	0.1242E-05	0.2485E-05	0.2485E-05	0.28E 03	0.1729E-04	0.1729E-04
80	99	0.5000E-01	0.92000E 02	0.47297E 02	0.1343E-03	0.2687E-03	0.2687E-03	0.37E 01	0.1848E-02	0.1848E-02
106	118	0.5000E-01	0.11400E 03	0.46319E 02	0.1822E-03	0.3645E-03	0.3645E-03	0.24E 01	0.2481E-02	0.2481E-02
119	126	0.5000E-01	0.12100E 03	0.46015E 02	0.4302E-04	0.8603E-04	0.8603E-04	0.73E 01	0.5836E-03	0.5836E-03
127	134	0.5000E-01	0.12900E 03	0.45670E 02	0.2075E-04	0.4150E-04	0.4150E-04	0.15E 02	0.2805E-03	0.2805E-03

RELATIVE ACCURACY (PER CENT) OF THE SOLUTION OF THE SYSTEM OF LINEAR EQUATIONS

0.0
 -0.3097928D-14
 0.5984264D-14
 -0.1908913D-13
 0.2458564D-13
 0.8873308D-14
 0.1074975D-13
 0.0

A= 0.98000E 00
 N= 0.13740E-02
 AW= 0.23705E 03
 R= 0.98000E 00
 DIST= 0.31893E 02
 T= 0.16000E 00
 T DELAY= 0.32057E 03
 DO= 0.31800E 00
 BO= 0.22690E-04
 B1= 0.87339E-03
 CN= 162
 CF= 1
 CL= 162
 NO= 8
 IF= 2
 IM= 6
 K= 2
 RO= 0.17290E 01
 R1= 0.72710E-03
 PSA= 0.15000E 01

K0= 0.871284E 00
 K1= 0.871475E 00
 K2= 0.0
 CORRECTED R(CF)= 0.11817E 01 , CORRECTED R(CL)= 0.91166E 00
 F= 0.10000E 01
 G1= 0.50000E 00
 G2= 0.50000E 00
 FG1= 0.50000E 00
 FG2= 0.50000E 00

OBS.	CALC.	BASIS	CHAN
0.9622	0.9691	0.9762	1
0.9628	0.9688	0.9762	2
0.9499	0.9685	0.9763	3
0.9855	0.9681	0.9764	4
0.9956	0.9677	0.9764	5
0.9764	0.9672	0.9765	6
0.9661	0.9666	0.9765	7
0.9789	0.9659	0.9766	8
0.9742	0.9652	0.9767	9
0.9719	0.9642	0.9767	10
0.9651	0.9631	0.9768	11
0.9499	0.9618	0.9768	12
0.9552	0.9602	0.9769	13
0.9588	0.9581	0.9770	14
0.9627	0.9554	0.9770	15
0.9518	0.9517	0.9771	16
0.9490	0.9461	0.9771	17
0.9455	0.9367	0.9772	18
0.9306	0.9189	0.9772	19
0.9140	0.8830	0.9773	20
0.8579	0.8150	0.9774	21
0.7772	0.7058	0.9774	22
0.6432	0.5669	0.9775	23
0.4971	0.4340	0.9775	24
0.3999	0.3432	0.9776	25
0.3255	0.3138	0.9777	26
0.3369	0.3500	0.9777	27
0.3867	0.4472	0.9778	28
0.4959	0.5835	0.9778	29
0.6211	0.7188	0.9779	30
0.7489	0.8151	0.9780	31
0.8001	0.8556	0.9780	32
0.8232	0.8417	0.9781	33
0.7930	0.7797	0.9781	34
0.7258	0.6836	0.9782	35
0.6441	0.5816	0.9783	36
0.5622	0.5063	0.9783	37
0.4971	0.4814	0.9784	38
0.5103	0.5149	0.9784	39
0.5806	0.5985	0.9785	40
0.6634	0.7084	0.9786	41
0.7657	0.8126	0.9786	42
0.8651	0.8885	0.9787	43
0.9231	0.9330	0.9787	44
0.9245	0.9552	0.9788	45
0.9538	0.9653	0.9789	46
0.9443	0.9700	0.9789	47
0.9503	0.9724	0.9790	48
0.9515	0.9738	0.9790	49
0.9606	0.9746	0.9791	50
0.9467	0.9749	0.9792	51
0.9852	0.9749	0.9792	52
0.9536	0.9743	0.9793	53
0.9561	0.9727	0.9793	54
0.9625	0.9689	0.9794	55

OBS.	CALC.	BASIS	CHAN
0.9449	0.9614	0.9794	56
0.9315	0.9482	0.9795	57
0.9093	0.9293	0.9796	58
0.9118	0.9079	0.9796	59
0.9402	0.8907	0.9797	60
0.9024	0.8846	0.9797	61
0.9239	0.8922	0.9798	62
0.9561	0.9103	0.9799	63
0.9475	0.9319	0.9799	64
0.9593	0.9501	0.9800	65
0.9561	0.9623	0.9800	66
0.9577	0.9690	0.9801	67
0.9587	0.9724	0.9802	68
0.9655	0.9742	0.9802	69
0.9701	0.9755	0.9803	70
0.9806	0.9764	0.9803	71
0.9810	0.9771	0.9804	72
0.9969	0.9775	0.9805	73
0.9957	0.9776	0.9805	74
1.0037	0.9776	0.9806	75
0.9799	0.9774	0.9806	76
0.9824	0.9771	0.9807	77
0.9935	0.9767	0.9808	78
0.9886	0.9762	0.9808	79
0.9825	0.9755	0.9809	80
0.9813	0.9745	0.9809	81
0.9799	0.9731	0.9810	82
0.9787	0.9709	0.9811	83
0.9766	0.9671	0.9811	84
0.9589	0.9596	0.9812	85
0.9296	0.9449	0.9812	86
0.9012	0.9178	0.9813	87
0.8486	0.8742	0.9814	88
0.7797	0.8162	0.9814	89
0.7200	0.7555	0.9815	90
0.6861	0.7095	0.9815	91
0.6963	0.6936	0.9816	92
0.7053	0.7136	0.9816	93
0.7994	0.7628	0.9817	94
0.8491	0.8251	0.9818	95
0.9199	0.8829	0.9818	96
0.9350	0.9251	0.9819	97
0.9705	0.9505	0.9819	98
0.9571	0.9635	0.9820	99
0.9471	0.9693	0.9821	100
0.9616	0.9716	0.9821	101
0.9793	0.9720	0.9822	102
0.9583	0.9715	0.9822	103
0.9611	0.9700	0.9823	104
0.9619	0.9671	0.9824	105
0.9602	0.9616	0.9824	106
0.9342	0.9506	0.9825	107
0.8850	0.9292	0.9825	108
0.8565	0.8910	0.9826	109

OBS.

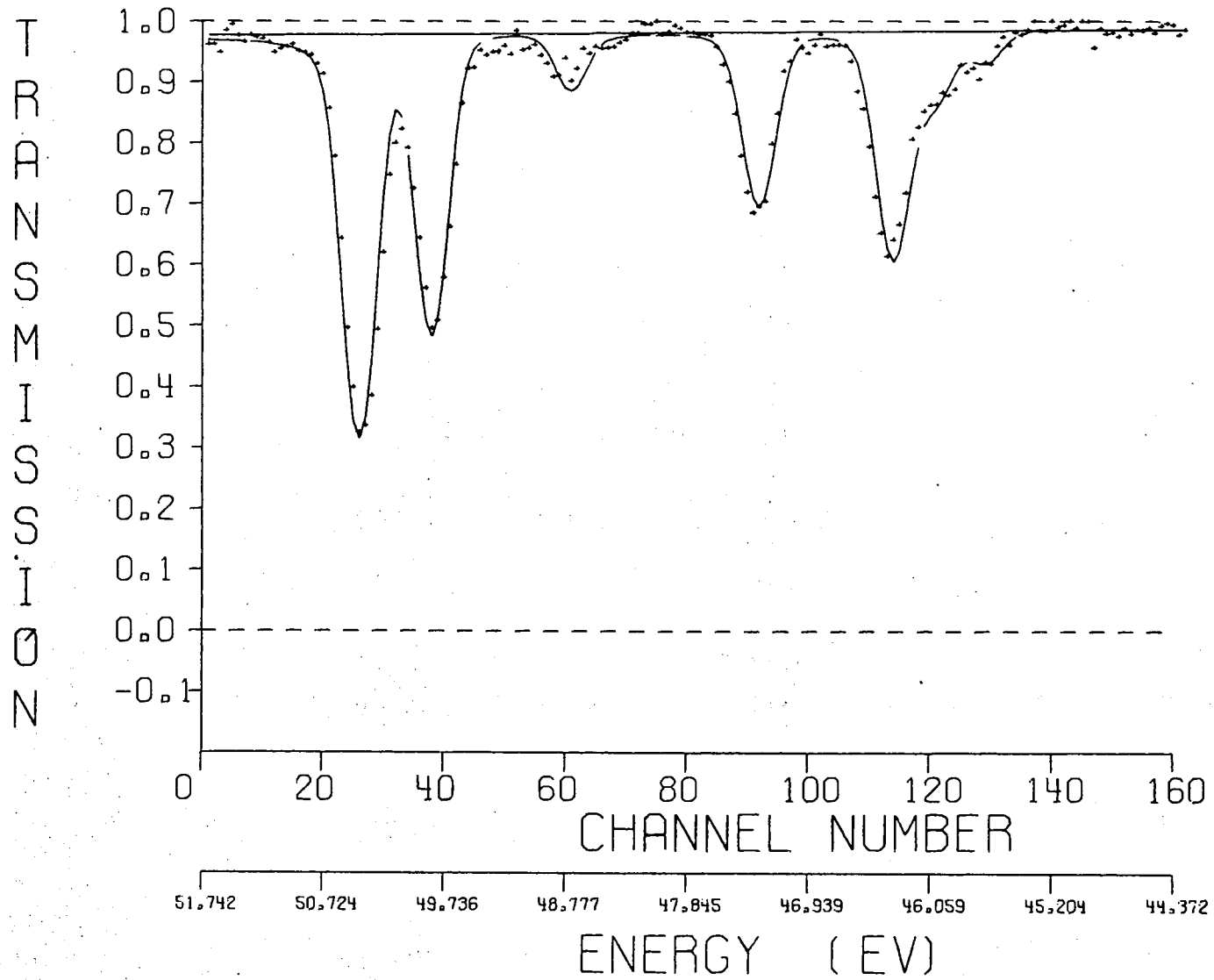
CALC.

BASIS

CHAN

0.7116	0.7572	0.9827	111
0.6528	0.6813	0.9828	112
0.6142	0.6254	0.9828	113
0.6420	0.6051	0.9829	114
0.6679	0.6251	0.9830	115
0.7184	0.6767	0.9830	116
0.8061	0.7405	0.9831	117
0.8269	0.7949	0.9831	118
0.8521	0.8289	0.9832	119
0.8628	0.8460	0.9833	120
0.8639	0.8575	0.9833	121
0.8833	0.8728	0.9834	122
0.8782	0.8931	0.9834	123
0.8887	0.9136	0.9835	124
0.9283	0.9282	0.9836	125
0.9165	0.9338	0.9836	126
0.9236	0.9325	0.9837	127
0.9048	0.9290	0.9837	128
0.9323	0.9287	0.9838	129
0.9298	0.9340	0.9838	130
0.9591	0.9442	0.9839	131
0.9750	0.9563	0.9840	132
0.9601	0.9671	0.9840	133
0.9821	0.9751	0.9841	134
0.9776	0.9800	0.9841	135
0.9866	0.9827	0.9842	136
1.0067	0.9841	0.9843	137
0.9846	0.9849	0.9843	138
0.9837	0.9853	0.9844	139
1.0069	0.9856	0.9844	140
0.9905	0.9858	0.9845	141
0.9940	0.9859	0.9846	142
1.0050	0.9861	0.9846	143
0.9882	0.9862	0.9847	144
1.0025	0.9863	0.9847	145
0.9998	0.9864	0.9848	146
0.9561	0.9865	0.9849	147
0.9889	0.9866	0.9849	148
0.9791	0.9866	0.9850	149
0.9800	0.9867	0.9850	150
0.9753	0.9868	0.9851	151
0.9885	0.9868	0.9852	152
0.9799	0.9869	0.9852	153
0.9860	0.9870	0.9853	154
0.9848	0.9870	0.9853	155
0.9890	0.9871	0.9854	156
0.9800	0.9871	0.9855	157
0.9927	0.9872	0.9855	158
0.9964	0.9872	0.9856	159
0.9942	0.9873	0.9856	160
0.9776	0.9873	0.9857	161
0.9867	0.9874	0.9858	162

RUN 10



STANDARDIZATION OF THE NATIONAL BUREAU OF STANDARDS

APPENDIX B

1949	1949	1949
1950	1950	1950
1951	1951	1951
1952	1952	1952
1953	1953	1953
1954	1954	1954
1955	1955	1955
1956	1956	1956
1957	1957	1957
1958	1958	1958
1959	1959	1959
1960	1960	1960
1961	1961	1961
1962	1962	1962
1963	1963	1963
1964	1964	1964
1965	1965	1965
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1981	1981	1981
1982	1982	1982
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2016	2016	2016
2017	2017	2017
2018	2018	2018
2019	2019	2019
2020	2020	2020
2021	2021	2021
2022	2022	2022
2023	2023	2023
2024	2024	2024
2025	2025	2025
2026	2026	2026
2027	2027	2027
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2029	2029	2029
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2046	2046	2046
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2090	2090	2090
2091	2091	2091
2092	2092	2092
2093	2093	2093
2094	2094	2094
2095	2095	2095
2096	2096	2096
2097	2097	2097
2098	2098	2098
2099	2099	2099
2100	2100	2100

FORTTRAN LISTINGS OF THE DIFFERENT PROGRAM VERSIONS:

Program: ATSHA	Version IBM 360/65	page 55
Program: ATSHA	Version IBM 1800	page 65
Program: AREAT	Version IBM 360/65	page 81
Program: AREAT	Version IBM 1800	page 99
Program: SHAPL		page 119
Program: ARPLO		page 121

PROGRAM: ATSHA

Version IBM 360/65

C
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SHAPE ANALYSIS PROGRAM OF S.E.ATTA AND J.A.HARVEY
FORTRAN IV VERSION IBM 360

REAL*8 F2A,FE,SXI,ETA,U,V,ZTZ,AT,ZTT,X,RELA
ODIMENSION GN(35),EN(35),G(35),EL(35),T(1000),E(1000),S(1000),SA(1000),TITEL(18),RELA(30)
ODIMENSION ZTZ(30,30),ZTT(30),AT(30,30),X(30),AM(30),F1(10),F2(10),F3(10),SIGT1(10,1000),SIGT2(10,1000),SIGT3(10,1000),SIGTC(3050)

C
C
C

FORMAT STATEMENTS

1 FORMAT(50H1SHAPE ANALYSIS OF TRANSMISSION DATA JOB 1910/
14HORUN,2X,A8)
2 FORMAT(I6,2A8)
3 FORMAT(43H0 E0 GAMMA FGXGAMMA N O)
4 FORMAT(I6)
8 FORMAT(7I5,2E12.6)
9 FORMAT(3E12.6)
10 FORMAT(6E12.6)
15 FORMAT(8H0ELEMENT,6X,A8)
282 FORMAT(16H0COMPUTED I.F.=0)
269 FORMAT(36H0THERE HAS BEEN A REDUCTION IN I.F.=I3)
285 FORMAT(47H0COMPUTATIONS STOPPED DUE TO DETECTION OF ERROR)
79 FORMAT(1H03E14.6)
500 FORMAT(41H0 STOPPED ON MAXIMUM NUMBER OF ITERATIONS)
905 FORMAT(1H1)
111 FORMAT(24H0 NUMBER OF ITERATIONS I2,///
901 FORMAT('0ITERATED RESONANCES')
902 FORMAT ('0SET OF RESONANCES')
7790FORMAT(//'0RELATIVE ACCURACY (PER CENT) OF THE SOLUTION OF THE NOR
1MAL EQUATIONS')
777 FORMAT (15X,E15.7)
14 FORMAT(99H0 E0 S.D. E0 GAMMA S.D. G FGXGN0
1 GNO S.D. GNO COV.(G,GNO) GN)
24 FORMAT(1H0E13.5,E10.2,E12.4,E10.2,2E12.4,E10.2,E13.5,E12.4)
113 FORMAT(3H0A=E12.5,23H K1=E14.6/4H AW=E12.5,22H
123H 2K2=E14.6/3H R=E12.5/6H DIST=E12.5,19H F=E14.6/
33H T=E12.5,22H G=E14.6/9H T DELAY=E12.5,17H
4 FG=E14.6/4H D0=E12.5/4H B0=E12.5,30H
5HI SQUARE=E12.4/4H B1=E12.5,38H DEGREES OF FREED
60M=14/4H CN=14,31H PSA=E14.6/4H CF=14/4H
7 CL=14/4H NO=14/6H I.F.=14/4H IM=14/4H RO=E12.6/4H R1=E12.5)
19000FORMAT (1H1/8X,3HCH.,17X,6HENERGY,15X,9HSIG. OBS.,15X,10HSIG. CALC
1.,15X,13HERROR PERCENT)
1902 FORMAT(5X,I5,16X,F10.4,12X,F10.4,15X,F10.4,18X,F10.4)

C
C
C

BEGIN OF CALCULATION

L2=0
5 READ (5,2) L1,F2A,FE
IF(L1)6,6,7
6 CALL FINIM(0.,0.)
CALL FINTRA
CALL EXIT
7 WRITE (6,1) F2A
READ (5,8) IMN,IO,IM,N,M,KI,ITMAX,F,GI
FG=F*GI
READ (5,9) CO, C1,C2
READ (5,9) (G(J),EN(J),GN(J),J=1,N)

SHAP0001
SHAP0002
SHAP0003
SHAP0004
SHAP0005
SHAP0006
SHAP0007
SHAP0008
SHAP0009
SHAP0010
SHAP0011
SHAP0012
SHAP0013
SHAP0014
SHAP0015
SHAP0016
SHAP0017
SHAP0018
SHAP0019
SHAP0020
SHAP0021
SHAP0022
SHAP0023
SHAP0024
SHAP0025
SHAP0026
SHAP0027
SHAP0028
SHAP0029
SHAP0030
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SHAP0047
SHAP0048
SHAP0049
SHAP0050
SHAP0051
SHAP0052
SHAP0053
SHAP0054
SHAP0055
SHAP0056
SHAP0057
SHAP0058
SHAP0059
SHAP0060
SHAP0061
SHAP0062
SHAP0063

	IT=0	SHAP0064
	IF(L1-L2)12,13,12	SHAP0065
12	READ (5,10) A,ON,AW,R,DIST,T1,DELAY,HO,RO,R1,PSA	SHAP0066
	B0=(RO*T1-R1*DELAY)/(72.3*DIST*.8325)	SHAP0067
	B1=R1/0.8325	SHAP0068
	READ (5,11) (E(I),S(I),I=1,IMN)	SHAP0069
11	FORMAT (2E12.5,12X,2E12.5)	SHAP0070
	DO 70 K=1,IMN	SHAP0071
	T(K)=EXP(-ON*S(K))	SHAP0072
70	CONTINUE	SHAP0073
13	WRITE (6,15) FE	SHAP0074
	IF(KI)286,220,286	SHAP0075
220	DO 218 J=1,N	SHAP0076
	EL(J)=((72.3*DIST/SQRT (EN(J)))-DELAY)/T1	SHAP0077
	K3=3.0/(RO+EL(J)*R1)	SHAP0078
	IF(KI-K3)221,222,222	SHAP0079
221	KI=K3	SHAP0080
222	K3=6.0*T1*EN(J)/((EL(J)*T1+DELAY)*(1.665*HO*SQRT (EN(J)/AW)+G(J)))	SHAP0081
	IF(KI-K3)223,218,218	SHAP0082
223	KI=K3	SHAP0083
218	CONTINUE	SHAP0084
	KI=KI+1	SHAP0085
286	KIF=KI	SHAP0086
	IF(M-10) 219,219,715	SHAP0087
715	IFL=(3050/KI)	SHAP0088
	GO TO 716	SHAP0089
219	IFL=(1000/KI)	SHAP0090
716	DO 267 J=1,M	SHAP0091
	K3=5.0/(RO+EL(J)*R1)	SHAP0092
	IF((IM-IO+1)-(IFL-K3))267,267,268	SHAP0093
268	KI=KI-1	SHAP0094
	IF (M-10) 717,717,718	SHAP0095
717	IF(KI)280,280,219	SHAP0096
718	IF(KI) 280,280,715	SHAP0097
267	CONTINUE	SHAP0098
	IF(KI-KIF)283,281,281	SHAP0099
280	WRITE (6,282)	SHAP0100
	GOTO76	SHAP0101
283	WRITE (6,269) KIF	SHAP0102
281	SIGP=12.566368*R*R	SHAP0103
	ONSIGP=EXP (-ON*SIGP)	SHAP0104
	COM1=SQRT (AW)/HO	SHAP0105
	COM4=A*2.86239E3	SHAP0106
	SIG=(-2.0*ON*1.7724538)	SHAP0107
	VI=(72.3*DIST)**2	SHAP0108
	SIO=IO	SHAP0109
	EIRO=VI/(SIO*T1+DELAY)**2	SHAP0110
	SIO=IM	SHAP0111
	EIRM=VI/(SIO*T1+DELAY)**2	SHAP0112
	EIRO=EIRO+(4.0*(B1*EIRO+B0*(EIRO**1.5)))	SHAP0113
	EIRM=EIRM-(4.0*(B1*EIRM+B0*(EIRM**1.5)))	SHAP0114
	INT=((SQRT (VI/EIRM)-SQRT (VI/EIRO))/T1)	SHAP0115
	INT=INT*KI	SHAP0116
76	IF((INT/2)**2-INT)77,78,76	SHAP0117
	WRITE (6,285)	SHAP0118
	GOTO287	SHAP0119
77	INT=INT+1	SHAP0120
78	EINT=INT	SHAP0121
	H=(EIRO-EIRM)/EINT	SHAP0122
	HH=H*H	SHAP0123
	HH2=HH+HH	SHAP0124
	H31=(H/2.0)	SHAP0125
	H32=H	SHAP0126

```

      INT1=INT+1
      IF(M-10) 700,700,701
700  M3=3*M
      DO 101 J=1,M3
101  RELA(J)=0.0
      17 DO18J=1,M3
      DO19JJ=1,M3
      ZTZ(J,JJ)=0.0
      19 CONTINUE
      18 CONTINUE
      DO 21 J=1,M3
      ZTT(J)=0.0
      X(J)=0.0
      21 CONTINUE
701  Y=EIRM
      DO80IJ=1,INT1
      CON=1.0/SQRT(Y)
      COM2=1.0/(COM1*2.0*Y)
      COM3=COM1*CON
      SIGMA=SIG*COM3
      CON=6.52E5*CON
      COM2=6.52E5*COM2
      SUMJ=0.0
      L=0
      DO 84 JY=1,N
      SXI=COM3*(Y-EN(JY))
      ETA=COM3*G(JY)/2.0
      CALL PFCN (SXI,ETA,U,V,L)
      HG=CON+COM2*SXI
      HK=COM2*ETA-COM4
      SOM=SIGMA*(HG*U-HK*V)
      SUMJ=SUMJ+GN(JY)*SOM
      IF(M-10) 720,720,84
720  IF(JY-M) 85,85,84
      85 SXIU=2.0*(ETA*V-SXI*U)
      ETAU=2.0*(0.56418958-SXI*V-ETA*U)
      GNCOM3=GN(JY)*COM3*SIGMA
      F1(JY)=SOM
      F2(JY)=-GNCOM3*(COM2*U+(HG*SXIU)-(HK*ETAU))
      F3(JY)=(GNCOM3/2.0)*(HG*(-ETAU)-(COM2*V+(HK*SXIU)))
      84 CONTINUE
      ONE=EXP (SUMJ)
      67 SIGTC(IJ)=ONE
      IF(M-10) 702,702,703
702  DO30JM=1,M
      SIGT1(JM,IJ)=ONE*F1(JM)
      SIGT2(JM,IJ)=ONE*F2(JM)
      SIGT3(JM,IJ)=ONE*F3(JM)
      30 CONTINUE
703  Y=Y+H
      80 CONTINUE
      SUSQ=0.0
      SSQ=0.0
      THICK=(-1./ON)
      DO90I=10,IM
      SIO=I
      EI=VI/(SIO*T1+DELAY)**2
      BI=B1*EI+80*(EI**1.5)
      BI2=BI*BI
      CI=CO+(C1/(SQRT (EI)))+(C2/EI)
      CI=CI*ONSIGP
      ACI=CI/(BI*1.772454)
      EIKO=4.0*BI

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SHAPO127
SHAPO128
SHAPO129
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SHAPO184
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SHAPO187
SHAPO188
SHAPO189

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EIKN=EI-EIKO
EIKO=EI+EIKO
IN=(EIRO-EIKN)/H
SIN=IN
EIKN=EIRO-SIN*H
INT=(EIKO-EIKN)/H
401 IF((INT/2)*2-INT)401,402,76
402 INT=INT-1
IJS=INT1-IN
IJM=IJS+INT
EA=EXP(-(EI-EIKN)/BI)**2)
EAH=EXP((2.0*(EI-EIKN)*H-HH)/BI2)
EHH2=EXP(-HH2/BI2)
KJ=0
TM1=0.0
704 IF(M-10) 704,704,705
DO81J=1,M
KJ=KJ+J
AM(KJ)=0.0
KJ=KJ+1
AM(KJ)=0.0
KJ=KJ+1
AM(KJ)=0.0
KJ=KJ-J
81 CONTINUE
705 DO 95 IJ=IJS,IJM
IF(IJS-IJ)68,64,76
64 ONE=EA*H31
GO TO 407
68 IF(IJ-IJM)406,64,76
406 ONE=EA*H32
407 TM1=TM1+SIGTC(IJ)*ONE
IF(M-10) 706,706,707
706 KJ=0
DO91J=1,M
KJ=KJ+J
AM(KJ)=AM(KJ)+SIGT1(J,IJ)*ONE
KJ=KJ+1
AM(KJ)=AM(KJ)+SIGT2(J,IJ)*ONE
KJ=KJ+1
AM(KJ)=AM(KJ)+SIGT3(J,IJ)*ONE
KJ=KJ-J
91 CONTINUE
707 EA=EA*EAH
EAH=EAH*EHH2
95 CONTINUE
TM1=TM1*ACI
DIF=T(I)-TM1
SUSQ=SUSQ+((DIF*DIF)/TM1)
SSQ=SSQ+(DIF*DIF)
IDF=IM-IO-(3*M)
708 IF(M-10) 708,708,709
KJ=0
DO96J=1,M
KJ=KJ+J
AM(KJ)=AM(KJ)*ACI
KJ=KJ+1
AM(KJ)=AM(KJ)*ACI
KJ=KJ+1
AM(KJ)=AM(KJ)*ACI
KJ=KJ-J
96 CONTINUE
DO97J=1,M3

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SHAP0190
SHAP0191
SHAP0192
SHAP0193
SHAP0194
SHAP0195
SHAP0196
SHAP0197
SHAP0198
SHAP0199
SHAP0200
SHAP0201
SHAP0202
SHAP0203
SHAP0204
SHAP0205
SHAP0206
SHAP0207
SHAP0208
SHAP0209
SHAP0210
SHAP0211
SHAP0212
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SHAP0214
SHAP0215
SHAP0216
SHAP0217
SHAP0218
SHAP0219
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SHAP0221
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SHAP0223
SHAP0224
SHAP0225
SHAP0226
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SHAP0228
SHAP0229
SHAP0230
SHAP0231
SHAP0232
SHAP0233
SHAP0234
SHAP0235
SHAP0236
SHAP0237
SHAP0238
SHAP0239
SHAP0240
SHAP0241
SHAP0242
SHAP0243
SHAP0244
SHAP0245
SHAP0246
SHAP0247
SHAP0248
SHAP0249
SHAP0250
SHAP0251
SHAP0252

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      UUY8JJ=J,M3
      ZTZ(J,JJ)=ZTZ(J,JJ)+AM(J)*AM(JJ)
98  CONTINUE
      ZTT(J)=ZTT(J)+AM(J)*DIF
97  CONTINUE
      DO31J=2,M3
      J1=J-1
      DO32JJ=1,J1
      ZTZ(J,JJ)=ZTZ(JJ,J)
32  CONTINUE
31  CONTINUE
709 SA(I)=THICK*ALOG(TM1)
90  CONTINUE
      WRITE (6,905)
      IF(M-10) 711,711,712
711 WRITE (6,111) IT
      WRITE (6,901)
      WRITE (6,3)
      WRITE (6,79) ( EN(J),G(J), GN(J), J=1,M)
      MS=M+1
      IF (MS-N)719,719,713
712 MS=1
719 WRITE (6,902)
      WRITE (6,3)
      WRITE (6,79) (EN(J),G(J),GN(J),J=MS,N)
      IF (M-10) 713,713,714
713 IT=IT+1
      CALL SIMH (ZTZ,AT,ZTT,X,M3,40,30,RELA)
      KJ=0
      DO110J=1,M
      KJ=KJ+J
      GN(J)=GN(J)+X(KJ)
      KJ=KJ+1
      EN(J)=EN(J)+X(KJ)
      KJ=KJ+1
      G(J)=G(J)+X(KJ)
      KJ=KJ-J
110 CONTINUE
      KJ=0
      DO106J=1,M
      KJ=KJ+J
      QOT=X(KJ)/GN(J)
      IF (ABS(QOT)-0.002)107,107,109
107 KJ=KJ+1
      QOT=X(KJ)/EN(J)
      IF (ABS(QOT)-0.0001) 108,108,109
108 KJ=KJ+1
      QOT=X(KJ)/G(J)
      IF (ABS(QOT)-0.009) 306,306,109
306 KJ=KJ-J
106 CONTINUE
      GO TO 502
109 IF(IT-ITMAX)105,501,501
105 GOTO17
501 WRITE (6,905)
      WRITE (6,500)
      GO TO 503
502 WRITE (6,905)
503 WRITE (6,111) IT
      SN=IDF+1
      SSQ=SSQ/SN
      KJ=0
      DO 16 J=1,M

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SHAP0253
SHAP0254
SHAP0255
SHAP0256
SHAP0257
SHAP0258
SHAP0259
SHAP0260
SHAP0261
SHAP0262
SHAP0263
SHAP0264
SHAP0265
SHAP0266
SHAP0267
SHAP0268
SHAP0269
SHAP0270
SHAP0271
SHAP0272
SHAP0273
SHAP0274
SHAP0275
SHAP0276
SHAP0277
SHAP0278
SHAP0279
SHAP0280
SHAP0281
SHAP0282
SHAP0283
SHAP0284
SHAP0285
SHAP0286
SHAP0287
SHAP0288
SHAP0289
SHAP0290
SHAP0291
SHAP0292
SHAP0293
SHAP0294
SHAP0295
SHAP0296
SHAP0297
SHAP0298
SHAP0299
SHAP0300
SHAP0301
SHAP0302
SHAP0303
SHAP0304
SHAP0305
SHAP0306
SHAP0307
SHAP0308
SHAP0309
SHAP0310
SHAP0311
SHAP0312
SHAP0313
SHAP0314
SHAP0315

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KJ=KJ+J
AT(KJ,KJ+2)=SSQ*AT(KJ,KJ+2)
SSAT=SSQ*AT(KJ,KJ)
  AT(KJ,KJ )=SQRT (SSAT)
KJ=KJ+1
SSAT=SSQ*AT(KJ,KJ)
  AT(KJ,KJ )=SQRT (SSAT)
KJ=KJ+1
SSAT=SSQ*AT(KJ,KJ)
  AT(KJ,KJ )=SQRT (SSAT)
KJ=KJ-J
16 CONTINUE
SUSQ=SUSQ*((100.0/PSA)**2)
WRITE (6,14)
KJ=1
DO 20 J=1,M
  AT(KJ,KJ) = AT(KJ,KJ)/FG
  AT(KJ,KJ+2)= AT(KJ,KJ+2)/FG
  GNO=GN(J)/FG
  GN1=GNO*SQRT (EN(J))
  OWRITE (6,24) EN(J),AT(KJ+1,KJ+1),G(J),AT(KJ+2,KJ+2),GN(J),GNO,
  1AT(KJ,KJ),AT(KJ,KJ+2),GN1
  KJ=KJ+3
20 CONTINUE
WRITE (6,779)
WRITE (6,777) (RELA(I),I=1,M3)
7140 WRITE (6,113) A,CO,ON,C1,AW,C2,R,DIST,F,T1,GI,DELAY,FG,HO,BO,SUSQ,
1B1,1DF,1MN,PSA,1O,1M,1KI,1TMAX,RO,RI
DO 1901 I=1O,1M
  IF((I-1O)/55*55-I+1O) 1907,1908,1907
1908 WRITE (6,1900)
1907 DIFE=(SA(I)-S(I))/S(I)*100.
  WRITE (6,1902) I, E(I), S(I),SA(I),DIFE
1901 CONTINUE
C
C
C
CALCOMP PLOTTER
1910 READ (5,1910) (TITEL(I),I=1,18)
  FORMAT (18A4)
  READ (5,1911) SIZX,SIZY,IX,IY
1911 FORMAT (2F10.0,2I5)
  ORX=SIZX/3.
  ORY=SIZY+3.
  IMO=IM-1O+1
  DO 802 I=1,IMO
  E(I)=E(1O)
  S(I)=S(1O)
  SA(I)=SA(1O)
  1O=1O+1
802 CONTINUE
  CALL FINIM(0.,0.)
  CALL SYMBL4(ORX,ORY,.3,0.,TITEL,72)
  CALL DESSIN (E,S,IMO,1,1,1,0,0,SIZX,SIZY,IX,IY,2HEV,-2,4HBARN,4,-1
  1)
  GIZ=-SIZY
  ORX=SIZX+5.
  CALL DESSIN (E,SA,IMO,1,1,1,0,0,SIZX,GIZ,IX,IY,2HEV,-2,4HBARN,4,0)
  CALL FINIM(ORX,0.)
  WRITE (6,444)
444 FORMAT ('1 PLOT READY')
287 L2=L1
  GO TO 5
END

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SHAP0316
SHAP0317
SHAP0318
SHAP0319
SHAP0320
SHAP0321
SHAP0322
SHAP0323
SHAP0324
SHAP0325
SHAP0326
SHAP0327
SHAP0328
SHAP0329
SHAP0330
SHAP0331
SHAP0332
SHAP0333
SHAP0334
SHAP0335
SHAP0336
SHAP0337
SHAP0338
SHAP0339
SHAP0340
SHAP0341
SHAP0342
SHAP0343
SHAP0344
SHAP0345
SHAP0346
SHAP0347
SHAP0348
SHAP0349
SHAP0350
SHAP0351
SHAP0352
SHAP0353
SHAP0354
SHAP0355
SHAP0356
SHAP0357
SHAP0358
SHAP0359
SHAP0360
SHAP0361
SHAP0362
SHAP0363
SHAP0364
SHAP0365
SHAP0366
SHAP0367
SHAP0368
SHAP0369
SHAP0370
SHAP0371
SHAP0372
SHAP0373
SHAP0374
SHAP0375
SHAP0376
SHAP0377
SHAP0378

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```

SUBROUTINE PFCN(X,Y,U,V,L)
DIMENSION W287(4),W283(4)
C DATA W283/1.65068012,0.524647623,-0.524647623,-1.65068012 /
C DATA W287/0.0258826794,0.256212112,0.256212112,0.0258826794/
W283(1)=1.65068012
W283(2)=0.524647623
W283(3)=-0.524647623
W283(4)=-1.65068012
W287(1)=0.0258826794
W287(2)=0.256212112
W287(3)=0.256212112
W287(4)=0.0258826794
II=1
ASSIGN 244 TO J
C5=X
C6=Y
IF(C5.LT.0.0) GO TO 8
IF(C6.LT.0.0) GO TO 287
GO TO 11
8 IF(C6.GE.0.0) GO TO 14
ASSIGN 245 TO I
GO TO 20
11 ASSIGN 257 TO I
GO TO 46
14 ASSIGN 255 TO I
GO TO 46
20 Z=C6*C6-C5*C5
CO=EXP(Z)
C7=CO+CO
C0=C5*C6
C9=CO+CO
C8=-C7*SIN(C9)
C7=C7*COS(C9)
46 C5=ABS(C5)
C6=ABS(C6)
IF(C5.GE.6.0) GO TO 219
50 IF(C6.LE.0.5) GO TO 65
IF(C6.GT.6.0) GO TO 219
C9=0.5
GO TO 73
61 IF(C6.LE.1.5) GO TO 71
C9=0.25
GO TO 73
65 C10=C6
C6=0.5
ASSIGN 128 TO J
71 C9=0.09375
73 C11=0.0
C17=0.0
C18=0.0
ASSIGN 123 TO K
79 C21=C5-C11
C19=C21*C21
C20=C6*C6+C19
T=C11*C11
C19=EXP(-T)/C20*0.318309886*C9
C17=C19*C6+C17
C18=C21*C19+C18
107 GO TO K,(108,123)
108 II=3-II
IF(II.EQ.1) GO TO 114
C11=-C11
GO TO 79

```

```

PFCN0001
PFCN0002
PFCN0003
PFCN0004
PFCN0005
PFCN0006
PFCN0007
PFCN0008
PFCN0009
PFCN0010
PFCN0011
PFCN0012
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PFCN0049
PFCN0050
PFCN0051
PFCN0052
PFCN0053
PFCN0054
PFCN0055
PFCN0056
PFCN0057
PFCN0058
PFCN0059
PFCN0060
PFCN0061
PFCN0062
PFCN0063

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```

114 IF(-C11-4.0.GT.0.0) GO TO J,(128,244)
    C11=-C11+C9
    GO TO 79
123 I1=1
    ASSIGN 108 TO K
    C11=C9
    GO TO 79
128 C11=C17
    C12=C18
    C9=2.0
    C6=C10-0.5
    C6=C6+C6
    C10=C11/2.0
    C13=(C5*C12+C10-0.564189584)*C6
    C10=C12/2.0
    C14=(-C5*C11+C10)*C6
    C17=C11+C13
    C18=C12+C14
165 C10=C6/C9
    C19=C13/2.0
    C19=C5*C14+C19
    C15=(C6/2.0*C11+C19)*C10
    C17=C15+C17
    T1=C5*C13
    C19=(C6*C12+C14)/2.0
    C16=(-T1+C19)*C10
    C18=C16+C18
    T1=C17+C15
    IF((T1-C17).NE.0.0) GO TO 207
    T1=C18+C16
    IF((T1-C18).EQ.0.0) GO TO 244
207 C11=C13
    C12=C14
    C13=C15
    C14=C16
    C9=C9+1.0
    GO TO 165
219 C17=0.0
    C18=0.0
    DO 230 M=1,4
    C12=C5-W283(M)
    C11=C12*C12
    C11=C6*C6+C11
    C11=W287(M)/C11
    C17=C11*C6+C17
    C18=C11*C12+C18
230 CONTINUE
244 GO TO I,(245,249,255,257)
245 C8=-C8
    C18=-C18
249 C17=C7-C17
    C18=C8-C18
255 C18=-C18
257 U=C17
    V=C18
    L=0
    RETURN
287 C5=-C5
    ASSIGN 249 TO I
    GO TO 20
    END

```

```

PFCN0064
PFCN0065
PFCN0066
PFCN0067
PFCN0068
PFCN0069
PFCN0070
PFCN0071
PFCN0072
PFCN0073
PFCN0074
PFCN0075
PFCN0076
PFCN0077
PFCN0078
PFCN0079
PFCN0080
PFCN0081
PFCN0082
PFCN0083
PFCN0084
PFCN0085
PFCN0086
PFCN0087
PFCN0088
PFCN0089
PFCN0090
PFCN0091
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PFCN0095
PFCN0096
PFCN0097
PFCN0098
PFCN0099
PFCN0100
PFCN0101
PFCN0102
PFCN0103
PFCN0104
PFCN0105
PFCN0106
PFCN0107
PFCN0108
PFCN0109
PFCN0110
PFCN0111
PFCN0112
PFCN0113
PFCN0114
PFCN0115
PFCN0116
PFCN0117
PFCN0118
PFCN0119
PFCN0120
PFCN0121
PFCN0122
PFCN0123
PFCN0124

```

```

SUBROUTINE SIMH(A,AT,B,X,N,ITER,LA,RELA)
IMPLICIT REAL*8 (A-H,O-Z),INTEGER (I-N)
DIMENSION A(LA,LA),AT(LA,LA),B(LA),X(LA),RELA(LA)
1 DO 2 I=1,N
DO 2 J=1,N
2 AT(I,J)=A(J,I)
DO 80 IL=1,ITER
DO 80 I=1,N
C=0.
DO 10 K=1,N
10 C=C+A(I,K)*AT(K,I)
IF(C) 20,333,20
20 CONTINUE
DO 30 J=1,N
30 AT(J,I)=AT(J,I)/C
DO 70 J=1,N
IF(J-I)40,70,40
40 H=0.
DO 50 K=1,N
50 H=H+A(I,K)*AT(K,J)
DO 60 K=1,N
60 AT(K,J)=AT(K,J)-H*AT(K,I)
70 CONTINUE
80 CONTINUE
DO 90 I=1,N
H=0.0
DO 91 J=1,N
91 H=H+B(J)*AT(I,J)
X(I)=H
90 CONTINUE
DO 100 I=1,N
BRE=0.0
DO 110 J=1,N
110 BRE=BRE+A(I,J)*X(J)
100 RELA(I)=(B(I)-BRE)/BRE*100.
RETURN
333 WRITE (6,666)
STOP
666 FORMAT (23H1(A) IS SINGULAR, C = 0)
END

```

```

SIMH0001
SIMH0002
SIMH0003
SIMH0004
SIMH0005
SIMH0006
SIMH0007
SIMH0008
SIMH0009
SIMH0010
SIMH0011
SIMH0012
SIMH0013
SIMH0014
SIMH0015
SIMH0016
SIMH0017
SIMH0018
SIMH0019
SIMH0020
SIMH0021
SIMH0022
SIMH0023
SIMH0024
SIMH0025
SIMH0026
SIMH0027
SIMH0028
SIMH0029
SIMH0030
SIMH0031
SIMH0032
SIMH0033
SIMH0034
SIMH0035
SIMH0036
SIMH0037
SIMH0038
SIMH0039
SIMH0040

```

PROGRAM: ATSHA

Version IBM 1800

C
C

MONITOR CONTROL CARDS IBM 1800
SHAPE PROGRAM

```
// JOB      X      X      X
// XEQ ATSHA
*FILES(2,ENER,2),(3,SIGMA,2),(4,DERGN,2),(5,DEREN,2)
*FILES(6,DERG,2),(7,SIDOP,2),(8,SICA,2)
*LOCAL INSHA,(DOPL,PFCN),MACAL,(OUTSH,SIMH),SHPLO
*CCEND
```

C
C
C
C
C

PROGRAM 'ATSHA'
SHAPE ANALYSIS PROGRAM OF S.E. ATTA AND J.A. HARVEY
FORTRAN IV VERSION IBM 1800

```
DIMENSION G(35),EN(35),GN(35),ZTZ(15,15),ZTT(15),T(1000),EL(35)
COMMON IMN,IO,IM,N,M,KI,ITMAX,F,GI,CO,C1,C2,ON,AW,R,DIST,T1,
1DELAY,HO,RO,RI,PSA,BO,B1,H,COM1,COM4,INT1,VI,A,INT2,SIG,EIRO,OSIGPATSH0009
2,THICK,IT,JK,IDF,ITRAN,IENER,ISIG,IGN,IEN,IGA,IDOP,ISICA,EIRM,SN,SATSH0010
3SQ,SUSQ,L1,L2
COMMON G,EN,GN,ZTZ,ZTT,T,EL
DEFINE FILE 2(7,320,U,IENER)
DEFINE FILE 3(7,320,U,ISIG)
DEFINE FILE 4(1000,10,U,IGN)
DEFINE FILE 5(1000,10,U,IEN)
DEFINE FILE 6(1000,10,U,IGA)
DEFINE FILE 7(3000,2,U,IDOP)
DEFINE FILE 8(7,320,U,ISICA)

L2=0
11 CALL INSHA
8 CALL DOPL
CALL MACAL
CALL OUTSH
IF(JK-1)76,8,9
9 CALL SHPLO
L2=L1
GO TO 11
76 WRITE (6,285)
285 FORMAT('COMPUTATIONS STOPPED DUE TO DETECTION OF ERROR NR. 1')
CALL EXIT
END
```

ATSH0001
ATSH0002
ATSH0003
ATSH0004
ATSH0005
ATSH0006
ATSH0007
ATSH0008
ATSH0009
ATSH0010
ATSH0011
ATSH0012
ATSH0013
ATSH0014
ATSH0015
ATSH0016
ATSH0017
ATSH0018
ATSH0019
ATSH0020
ATSH0021
ATSH0022
ATSH0023
ATSH0024
ATSH0025
ATSH0026
ATSH0027
ATSH0028
ATSH0029
ATSH0030
ATSH0031
ATSH0032
ATSH0033

C

	SUBROUTINE INSHA	INSH0001
	DIMENSION G(35),EN(35),GN(35),ZTZ(15,15),ZTT(15),T(1000),EL(35)	INSH0002
	DIMENSION F2A(2),FE(2),E(1000),S(1000)	INSH0003
	COMMON IMN,IO,IM,N,M,KI,ITMAX,F,GI,CO,C1,C2,ON,AW,R,DIST,T1,	INSH0004
	1DELAY,HO,RO,R1,PSA,BO,B1,H,COM1,COM4,INT1,VI,A,INT2,SIG,EIRO,OSIGP	INSH0005
	2,THICK,IT,JK,IDF,ITRAN,IENER,ISIG,IGN,IEN,IGA,IDOP,ISICA,EIRM,SN,S	INSH0006
	3SQ,SUSQ,L1,L2	INSH0007
	COMMON G,EN,GN,ZTZ,ZTT,T,EL	INSH0008
C	5 READ (5,2) L1,F2A,FE	INSH0009
	2 FORMAT(16,2A4,2A4)	INSH0010
	IF(L1)6,6,7	INSH0011
	6 CALL FINIM(0.,0.)	INSH0012
	CALL FINTR	INSH0013
	CALL EXIT	INSH0014
	7 WRITE (6,1) F2A	INSH0015
	1 FORMAT(36H1SHAPE ANALYSIS OF TRANSMISSION DATA/	INSH0016
	14HORUN,2X,2A4)	INSH0017
	READ (5,8) IMN,IO,IM,N,M,KI,ITMAX,F,GI	INSH0018
	8 FORMAT(7I5,2E12.6)	INSH0019
	FG=F*GI	INSH0020
	READ (5,9) CO, C1,C2	INSH0021
	9 FORMAT(3E12.6)	INSH0022
	READ (5,9) (G(J),EN(J),GN(J),J=1,N)	INSH0023
	IT=0	INSH0024
	IF(L1-L2)12,13,12	INSH0025
	12 READ (5,10) A,ON,AW,R,DIST,T1,DELAY,HO,RO,R1,PSA	INSH0026
	10 FORMAT(6E12.6)	INSH0027
	THICK=(-1./ON)	INSH0028
	BO=(RO*T1-R1*DELAY)/(72.3*DIST*.8325)	INSH0029
	B1=R1/0.8325	INSH0030
	READ (5,11) (E(I),S(I),I=1,IMN)	INSH0031
	11 FORMAT (2E12.5,12X,2E12.5)	INSH0032
	IENER=1	INSH0033
	ISIG=1	INSH0034
	WRITE (2'IENER) (E(K),K=1,IMN)	INSH0035
	WRITE (3'ISIG) (S(K),K=1,IMN)	INSH0036
	DO 70 K=1,IMN	INSH0037
	T(K)=EXP(-ON*S(K))	INSH0038
	70 CONTINUE	INSH0039
	13 WRITE (6,15) FE	INSH0040
	15 FORMAT(8HOELEMENT,6X,2A4)	INSH0041
	CALL CLOCK(ITIME)	INSH0042
	KHOUR=ITIME/1000	INSH0043
	KMINU=ITIME-KHOUR*1000	INSH0044
	KMINU=KMINU*.06	INSH0045
	WRITE(6,911)KHOUR,KMINU	INSH0046
	911 FORMAT(/,' TIME AT THE BEGIN OF CYCLE 1 ',I4,'.',I2,//)	INSH0047
	IF(KI)286,220,286	INSH0048
	220 DO 218 J=1,N	INSH0049
	EL(J)=((72.3*DIST/SQRT (EN(J)))-DELAY)/T1	INSH0050
	K3=3.0/(RO+EL(J)*R1)	INSH0051
	IF(KI-K3)221,222,222	INSH0052
	221 KI=K3	INSH0053
	222 K3=6.0*T1*EN(J)/((EL(J)*T1+DELAY)*(1.665*HO*SQRT (EN(J)/AW)+G(J)))	INSH0054
	IF(KI-K3)223,218,218	INSH0055
	223 KI=K3	INSH0056
	218 CONTINUE	INSH0057
	KI=KI+1	INSH0058
	286 KIF=KI	INSH0059
	IF(M-5)219,219,720	INSH0060
	720 IFL=3050/KI	INSH0061
	GO TO 721	INSH0062
		INSH0063

219	IFL=(1000/KI)	INSH0064
721	DO 267 J=1,M	INSH0065
	K3=5.0/(R0+EL(J)*R1)	INSH0066
	IF((IM-IO+1)-(IFL-K3))267,267,268	INSH0067
268	KI=KI-1	INSH0068
	IF(M-5)722,722,723	INSH0069
722	IF(KI)280,280,219	INSH0070
723	IF(KI)280,280,720	INSH0071
267	CONTINUE	INSH0072
	GO TO 284	INSH0073
280	WRITE (6,282)	INSH0074
282	FORMAT(16HOCOMPUTED I.F.=0)	INSH0075
	WRITE (6,285)	INSH0076
285	FORMAT(10COMPUTATIONS STOPPED DUE TO DETECTION OF ERROR NR. 2')	INSH0077
	GO TO 76	INSH0078
284	IF(KI-KIF)283,281,281	INSH0079
283	WRITE (6,269)KIF	INSH0080
269	FORMAT(36HOTHERE HAS BEEN A REDUCTION IN I.F.=I3)	INSH0081
281	SIGP=12.566368*R*R	INSH0082
	OSIGP=EXP(-ON*SIGP)	INSH0083
	COM1=SQRT (AW)/HO	INSH0084
	COM4=A*2.86239E3	INSH0085
	SIG=(-2.0*ON*1.7724538)	INSH0086
	VI=(72.3*DIST)**2	INSH0087
	SIO=IO	INSH0088
	EIRO=VI/(SIO*T1+DELAY)**2	INSH0089
	SIO=IM	INSH0090
	EIRM=VI/(SIO*T1+DELAY)**2	INSH0091
	EIRO=EIRO+(4.0*(B1*EIRO+B0*(EIRO**1.5)))	INSH0092
	EIRM=EIRM-(4.0*(B1*EIRM+B0*(EIRM**1.5)))	INSH0093
	INT=((SQRT (VI/EIRM)-SQRT (VI/EIRO))/T1)	INSH0094
	INT=INT*KI	INSH0095
	IF((INT/2)*2-INT)77,78,76	INSH0096
77	INT=INT+1	INSH0097
78	EINT=INT	INSH0098
	H=(EIRO-EIRM)/EINT	INSH0099
	INT1=INT+1	INSH0100
	Y=EIRM	INSH0101
	RETURN	INSH0102
76	CALL EXIT	INSH0103
	END	INSH0104


```

SUBROUTINE DOPL
DIMENSION G(35),EN(35),GN(35),ZTZ(15,15),ZTT(15),T(1000),EL(35)
DIMENSION SIGTC(200),SIGT1(5,200),SIGT2(5,200),SIGT3(5,200),F1(5),
1F2(5),F3(5)
COMMON IMN,IO,IM,N,M,KI,ITMAX,F,GI,CO,C1,C2,ON,AW,R,DIST,T1,
1DELAY,HO,RO,R1,PSA,BO,B1,H,COM1,COM4,INT1,VI,A,INT2,SIG,EIRO,OSIGP
2,THICK,IT,JK,IDF,ITRAN,IENER,ISIG,IGN,IEN,IGA,IDOP,ISICA,EIRM,SN,S
3SQ,SUSQ,L1,L2
COMMON G,EN,GN,ZTZ,ZTT,T,EL
C
Y=EIRM
INTK=INT1
IGN=1
IEN=1
IGA=1
IDOP=1
700 IF(INTK-200) 700,700,701
INT2=INTK
GO TO 717
701 INT2=200
717 DO 80IJ=1,INT2
CON=1.0/ SQRT(Y)
COM2=1.0/(COM1*2.0*Y)
COM3=COM1*CON
SIGMA=SIG*COM3
CON=6.52E5*CON
COM2=6.52E5*COM2
SUMJ=0.0
L=0
DO 84 JY=1,N
SXI=COM3*(Y-EN(JY))
ETA=COM3*G(JY)/2.0
CALL PFCN (SXI,ETA,U,V,L)
HG=CON+COM2*SXI
HK=COM2*ETA-COM4
SOM=SIGMA*(HG*U-HK*V)
SUMJ=SUMJ+GN(JY)*SOM
704 IF(M-5) 704,704,84
85 IF(JY-M) 85,85,84
SXIU=2.0*(ETA*V-SXI*U)
ETAU=2.0*(0.56418958-SXI*V-ETA*U)
GNCO3 =GN(JY)*COM3*SIGMA
F1(JY)=SOM
F2(JY)=-GNCO3 *(COM2*U+(HG*SXIU)-(HK*ETAU))
F3(JY)=(GNCO3 /2.0)*(HG*(-ETAU)-(COM2*V+(HK*SXIU)))
84 CONTINUE
ONE=EXP. (SUMJ)
SIGTC(IJ)=ONE
705 IF(M-5) 705,705,706
DO30JM=1,M
SIGT1(JM,IJ)=ONE*F1(JM)
SIGT2(JM,IJ)=ONE*F2(JM)
SIGT3(JM,IJ)=ONE*F3(JM)
30 CONTINUE
706 Y=Y+H
80 CONTINUE
IF(M-5) 707,707,708
707 WRITE(4,IGN) ((SIGT1(LC,LR),LC=1,5),LR=1,200)
WRITE(5,IEN) ((SIGT2(LC,LR),LC=1,5),LR=1,200)
WRITE(6,IGA) ((SIGT3(LC,LR),LC=1,5),LR=1,200)
708 WRITE(7,IDOP) (SIGTC(K),K=1,200)
INTK=INTK-200
IF(INTK-200) 702,701,701
DOPLO001
DOPLO002
DOPLO003
DOPLO004
DOPLO005
DOPLO006
DOPLO007
DOPLO008
DOPLO009
DOPLO010
DOPLO011
DOPLO012
DOPLO013
DOPLO014
DOPLO015
DOPLO016
DOPLO017
DOPLO018
DOPLO019
DOPLO020
DOPLO021
DOPLO022
DOPLO023
DOPLO024
DOPLO025
DOPLO026
DOPLO027
DOPLO028
DOPLO029
DOPLO030
DOPLO031
DOPLO032
DOPLO033
DOPLO034
DOPLO035
DOPLO036
DOPLO037
DOPLO038
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DOPLO040
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DOPLO042
DOPLO043
DOPLO044
DOPLO045
DOPLO046
DOPLO047
DOPLO048
DOPLO049
DOPLO050
DOPLO051
DOPLO052
DOPLO053
DOPLO054
DOPLO055
DOPLO056
DOPLO057
DOPLO058
DOPLO059
DOPLO060
DOPLO061
DOPLO062
DOPLO063

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702 IF (INTK) 703,703,700
703 CONTINUE
RETURN
END

DOPLO064
DOPLO065
DOPLO066
DOPLO067

	SUBROUTINE MACAL	MACA0001
	DIMENSION G(35),EN(35),GN(35),ZTZ(15,15),ZTT(15),T(1000),EL(35)	MACA0002
	DIMENSION SIGT1(5,200),SIGT2(5,200),SIGT3(5,200),SIGTC(200),AM(15)	MACA0003
	1,SA(1000)	MACA0004
	COMMON IMN,IO,IM,N,M,KI,ITMAX,F,GI,CO,C1,C2,ON,AW,R,DIST,T1,	MACA0005
	1DELAY,HO,RO,R1,PSA,B0,B1,H,COM1,COM4,INT1,VI,A,INT2,SIG,EIRO,OSIGP	MACA0006
	2,THICK,IT,JK,IDF,ITRAN,IENER,ISIG,IGN,IEN,IGA,IDOP,ISICA,EIRM,SN,S	MACA0007
	3SQ,SUSQ,L1,L2	MACA0008
	COMMON G,EN,GN,ZTZ,ZTT,T,EL	MACA0009
	SUSQ=0.0	MACA0010
	SSQ=0.0	MACA0011
	M3=M*3	MACA0012
	HH=H*H	MACA0013
	HH2=HH+HH	MACA0014
	H31=(H/2.0)	MACA0015
	H32=H	MACA0016
	IF(M-5)720,720,23	MACA0017
720	DO 23 J=1,M3	MACA0018
	ZTT(J)=0.0	MACA0019
	DO22JJ=1,M3	MACA0020
	ZTZ(J,JJ)=0.0	MACA0021
22	CONTINUE	MACA0022
23	CONTINUE	MACA0023
	INTF=IDOP-200	MACA0024
	IF(INTF-200)36,36,37	MACA0025
36	IGN=1	MACA0026
	IEN=1	MACA0027
	IGA=1	MACA0028
	IDOP=1	MACA0029
	GO TO 33	MACA0030
37	IGN=INTF	MACA0031
	IEN=INTF	MACA0032
	IGA=INTF	MACA0033
	IDOP=INTF	MACA0034
33	IF(M-5)709,709,710	MACA0035
709	READ(4,IGN)((SIGT1(LC,LR),LC=1,5),LR=1,200)	MACA0036
	READ(5,IEN)((SIGT2(LC,LR),LC=1,5),LR=1,200)	MACA0037
	READ(6,IGA)((SIGT3(LC,LR),LC=1,5),LR=1,200)	MACA0038
710	READ(7,IDOP)(SIGTC(K),K=1,200)	MACA0039
	DO90I=IO,IM	MACA0040
	SIO=I	MACA0041
	EI=VI/(SIO*T1+DELAY)**2	MACA0042
	BI=B1*EI+B0*(EI**1.5)	MACA0043
	BI2=BI*BI	MACA0044
	CI=CO+(C1/(SQRT(EI)))+(C2/EI)	MACA0045
	CI=CI*OSIGP	MACA0046
	ACI=CI/(BI*1.772454)	MACA0047
	EIKO=4.0*BI	MACA0048
	EIKN=EI-EIKO	MACA0049
	EIKO=EI+EIKO	MACA0050
	IN=(EIRO-EIKN)/H	MACA0051
	SIN=IN	MACA0052
	EIKN=EIRO-SIN*H	MACA0053
	INT=(EIKO-EIKN)/H	MACA0054
	IF((INT/2)*2-INT)401,402,76	MACA0055
401	INT=INT-1	MACA0056
402	INTK=INTF-1	MACA0057
	IJSK=INT1-IN-INTK	MACA0058
	IJM=IJSK+INT	MACA0059
	IF(IJSK)403,403,404	MACA0060
403	I=I-1	MACA0061
	GO TO 8	MACA0062
		MACA0063

404	EA=EXP (-(EI-EIKN)/BI)**2)	MACA0064
	EAH=EXP ((2.0*(EI-EIKN)*H-HH)/BI2)	MACA0065
	EHH2=EXP (-HH2/BI2)	MACA0066
	KJ=0	MACA0067
	TM1=0.0	MACA0068
	IF(M-5)721,721,81	MACA0069
721	DO81J=1,M	MACA0070
	KJ=KJ+J	MACA0071
	AM(KJ)=0.0	MACA0072
	KJ=KJ+1	MACA0073
	AM(KJ)=0.0	MACA0074
	KJ=KJ+1	MACA0075
	AM(KJ)=0.0	MACA0076
	KJ=KJ-J	MACA0077
81	CONTINUE	MACA0078
	DO 95 IJ=IJSK,IJM	MACA0079
	IF(IJSK-IJ)68,64,76	MACA0080
64	ONE=EA*H31	MACA0081
	GO TO 407	MACA0082
68	IF(IJ-IJM)406,64,76	MACA0083
406	ONE=EA*H32	MACA0084
407	TM1=TM1+SIGTC(IJ)*ONE	MACA0085
	IF(M-5)711,711,712	MACA0086
711	KJ=0	MACA0087
	DO91J=1,M	MACA0088
	KJ=KJ+J	MACA0089
	AM(KJ)=AM(KJ)+SIGT1(J,IJ)*ONE	MACA0090
	KJ=KJ+1	MACA0091
	AM(KJ)=AM(KJ)+SIGT2(J,IJ)*ONE	MACA0092
	KJ=KJ+1	MACA0093
	AM(KJ)=AM(KJ)+SIGT3(J,IJ)*ONE	MACA0094
	KJ=KJ-J	MACA0095
91	CONTINUE	MACA0096
712	EA=EA*EAH	MACA0097
	EAH=EAH*EHH2	MACA0098
95	CONTINUE	MACA0099
	TM1=TM1*ACI	MACA0100
	DIF=T(I)-TM1	MACA0101
	SUSQ=SUSQ+((DIF*DIF)/TM1)	MACA0102
	SSQ=SSQ+(DIF*DIF)	MACA0103
	IDF=IM-IO-(3*M)	MACA0104
	IF(M-5)713,713,714	MACA0105
713	KJ=0	MACA0106
	DO96J=1,M	MACA0107
	KJ=KJ+J	MACA0108
	AM(KJ)=AM(KJ)*ACI	MACA0109
	KJ=KJ+1	MACA0110
	AM(KJ)=AM(KJ)*ACI	MACA0111
	KJ=KJ+1	MACA0112
	AM(KJ)=AM(KJ)*ACI	MACA0113
	KJ=KJ-J	MACA0114
96	CONTINUE	MACA0115
	DO97J=1,M3	MACA0116
	DO98JJ=J,M3	MACA0117
	ZTZ(J,JJ)=ZTZ(J,JJ)+AM(J)*AM(JJ)	MACA0118
98	CONTINUE	MACA0119
	ZTT(J)=ZTT(J)+AM(J)*DIF	MACA0120
97	CONTINUE	MACA0121
	DO31J=2,M3	MACA0122
	J1=J-1	MACA0123
	DO32JJ=1,J1	MACA0124
	ZTZ(J,JJ)=ZTZ(JJ,J)	MACA0125
32	CONTINUE	MACA0126

31	CONTINUE	MACA0127
714	SA(I)=THICK#ALOG(TM1)	MACA0128
	IF(IJSK-10)7,7,90	MACA0129
7	IF(INTF-1)76,90,8	MACA0130
8	INTF=INTF-100	MACA0131
	IGN=INTF	MACA0132
	IEN=INTF	MACA0133
	IGA=INTF	MACA0134
	IDOP=INTF	MACA0135
	IF(M-5)715,715,716	MACA0136
715	READ (4'IGN) ((SIGT1(LC,LR),LC=1,5),LR=1,200)	MACA0137
	READ (5'IEN) ((SIGT2(LC,LR),LC=1,5),LR=1,200)	MACA0138
	READ (6'IGA) ((SIGT3(LC,LR),LC=1,5),LR=1,200)	MACA0139
716	READ (7'IDOP) (SIGTC(K),K=1,200)	MACA0140
90	CONTINUE	MACA0141
	ISICA=1	MACA0142
	WRITE(8'ISICA) (SA(K),K=10,IM)	MACA0143
	RETURN	MACA0144
76	WRITE (6,285)	MACA0145
285	FORMAT('COMPUTATIONS STOPPED DUE TO DETECTION OF ERROR NR. 3')	MACA0146
	CALL EXIT	MACA0147
	END	MACA0148

	SUBROUTINE OUTSH	OUTS0001
	DIMENSION G(35),EN(35),GN(35),ZTZ(15,15),ZTT(15),T(1000),EL(35)	OUTS0002
	DIMENSION E(1000),S(1000),SA(1000),AT(15,15),X(15),RELA(15)	OUTS0003
	COMMON IMN,IO,IM,N,M,KI,ITMAX,F,G,I,CO,C1,C2,ON,AW,R,DIST,T1,	OUTS0004
	1DELAY,HO,RO,RI,PSA,BO,BI,H,COM1,COM4,INT1,VI,A,INT2,SIG,EIRO,OSIGP	OUTS0005
	2,THICK,IT,JK,IDF,ITRAN,IENER,ISIG,IGN,IEN,IGA,IDOP,ISICA,EIRM,SN,S	OUTS0006
	3SQ,SUSQ,L1,L2	OUTS0007
	COMMON G,EN,GN,ZTZ,ZTT,T,EL	OUTS0008
C		OUTS0009
	WRITE (6,905)	OUTS0010
905	FORMAT(1H1)	OUTS0011
	IF(M-5)717,717,718	OUTS0012
718	MS=1	OUTS0013
	GO TO 903	OUTS0014
717	M3=M*3	OUTS0015
	FG=F*GI	OUTS0016
	DO 1 I=1,M3	OUTS0017
1	RELA(I)=0.0	OUTS0018
	WRITE (6,111) IT	OUTS0019
111	FORMAT(24HO NUMBER OF ITERATIONS I2,///)	OUTS0020
	WRITE(6,901)	OUTS0021
901	FORMAT('ITERATED RESONANCES')	OUTS0022
	WRITE (6,3)	OUTS0023
3	FORMAT(43HO EO GAMMA FGXGAMMA N O)	OUTS0024
	WRITE (6,79) (EN(J),G(J), GN(J), J=1,M)	OUTS0025
79	FORMAT(1H03E14.6)	OUTS0026
	MS=M+1	OUTS0027
	IF(MS-N)903,903,904	OUTS0028
903	WRITE (6,902)	OUTS0029
902	FORMAT ('OSET OF RESONANCES')	OUTS0030
	WRITE (6,3)	OUTS0031
	WRITE (6,79) (EN(J),G(J), GN(J), J=MS,N)	OUTS0032
	IF(M-5)904,904,719	OUTS0033
904	IT=IT+1	OUTS0034
	CALL SIMH (ZTZ,AT,ZTT,X,M3,40,18,RELA)	OUTS0035
	KJ=0	OUTS0036
	DO110J=1,M	OUTS0037
	KJ=KJ+J	OUTS0038
	GN(J)=GN(J)+X(KJ)	OUTS0039
	KJ=KJ+1	OUTS0040
	EN(J)=EN(J)+X(KJ)	OUTS0041
	KJ=KJ+1	OUTS0042
	G(J)=G(J)+X(KJ)	OUTS0043
	KJ=KJ-J	OUTS0044
110	CONTINUE	OUTS0045
	KJ=0	OUTS0046
	DO106J=1,M	OUTS0047
	KJ=KJ+J	OUTS0048
	QOT=X(KJ)/GN(J)	OUTS0049
	IF (ABS(QOT)-0.002)107,107,109	OUTS0050
107	KJ=KJ+1	OUTS0051
	QOT=X(KJ)/EN(J)	OUTS0052
	IF (ABS(QOT)-0.0001) 108,108,109	OUTS0053
108	KJ=KJ+1	OUTS0054
	QOT=X(KJ)/G(J)	OUTS0055
	IF (ABS(QOT)-0.009) 306,306,109	OUTS0056
306	KJ=KJ-J	OUTS0057
106	CONTINUE	OUTS0058
	GO TO 502	OUTS0059
109	IF(IT-ITMAX)105,501,501	OUTS0060
105	JK=1	OUTS0061
	CALL CLOCK(ITIME)	OUTS0062
	KHOUR=ITIME/1000	OUTS0063

```

KMINU=ITIME-KHOUR*1000
KMINU=KMINU*.06
WRITE(6,912)KHOUR,KMINU
912 FORMAT( /, ' TIME AT THE END OF THIS ITERATION',I4,'.',I2//)
RETURN
501 WRITE(6,905)
WRITE(6,500)
500 FORMAT(41H0 STOPPED ON MAXIMUM NUMBER OF ITERATIONS)
GO TO 503
502 WRITE(6,905)
503 WRITE(6,111) IT
SN=IDF+1
SSQ=SSQ/SN
KJ=0
DO 16 J=1,M
KJ=KJ+J
AT(KJ,KJ+2)=SSQ*AT(KJ,KJ+2)
SSAT=SSQ*AT(KJ,KJ)
AT(KJ,KJ)=SQRT(SSAT)
KJ=KJ+1
SSAT=SSQ*AT(KJ,KJ)
AT(KJ,KJ)=SQRT(SSAT)
KJ=KJ+1
SSAT=SSQ*AT(KJ,KJ)
AT(KJ,KJ)=SQRT(SSAT)
KJ=KJ-J
16 CONTINUE
SUSQ=SUSQ*((100.0/PSA)**2)
WRITE(6,14)
14 FORMAT(99H0 EO S.D. EO GAMMA S.D. G FGXGNO
1 GNO S.D. GNO COV.(G,GNO) GN)
KJ=1
DO 20 J=1,M
AT(KJ,KJ)=AT(KJ,KJ)/FG
AT(KJ,KJ+2)=AT(KJ,KJ+2)/FG
GNO=GN(J)/FG
GN1=GNO*SQRT(EN(J))
OWRITE(6,24) EN(J),AT(KJ+1,KJ+1),G(J),AT(KJ+2,KJ+2),GN(J),GNO,
1AT(KJ,KJ),AT(KJ,KJ+2),GN1
24 FORMAT(1H0E13.5,E10.2,E12.4,E10.2,2E12.4,E10.2,E13.5,E12.4)
KJ=KJ+3
20 CONTINUE
WRITE(6,779)
7790 FORMAT(//'ORELATIVE ACCURACY (PER CENT) OF THE SOLUTION OF THE NOR
1MAL EQUATIONS')
WRITE(6,777) (RELA(I),I=1,M3)
777 FORMAT(15X,E15.7)
7190WRITE(6,113) A,CO,ON,C1,AW,C2,R,DIST,F,T1,GI,DELAY,FG,H0,BO,SUSQ,
1B1,IDF,IMN,PSA,IO,IM,M,K1,ITMAX,RO,R1
1130FORMAT(//'OA=',E12.5,20X,'KO=',E14.6/' N=',E12.5,20X,'K1=',E14.6/'
1 AW=',E12.5,19X,'K2=',E14.6/' R=',E12.5,/' DIST=',E12.5,17X,'F=',E
214.6/' T=',E12.5,20X,'G=',E14.6/' T DELAY=',E12.5,14X,'FG=',E14.6/'
3 DO=',E12.5/' BO=',E12.5,19X,'CHI SQUARE=',E12.4/' B1=',E12.5,19X
4,'DEGREES OF FREEDOM=',I4/' CN=',I4,27X,'PSA=',E14.6/' CF=',I4/' C
5L=',I4,/' NO=',I4/' I.F.=',I4/' IM=',I4/' RO=',E12.6/' R1=',E12.6)
IENER=1
ISIG=1
ISICA=1
READ(2,IENER)(E(K),K=1,IMN)
READ(3,ISIG)(S(K),K=1,IMN)
READ(8,ISICA)(SA(K),K=IO,IM)
DO 1901 I=IO,IM
IF((I-IO)/55*55-I+IO) 1907,1908,1907
OUTS0064
OUTS0065
OUTS0066
OUTS0067
OUTS0068
OUTS0069
OUTS0070
OUTS0071
OUTS0072
OUTS0073
OUTS0074
OUTS0075
OUTS0076
OUTS0077
OUTS0078
OUTS0079
OUTS0080
OUTS0081
OUTS0082
OUTS0083
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OUTS0085
OUTS0086
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OUTS0090
OUTS0091
OUTS0092
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OUTS0098
OUTS0099
OUTS0100
OUTS0101
OUTS0102
OUTS0103
OUTS0104
OUTS0105
OUTS0106
OUTS0107
OUTS0108
OUTS0109
OUTS0110
OUTS0111
OUTS0112
OUTS0113
OUTS0114
OUTS0115
OUTS0116
OUTS0117
OUTS0118
OUTS0119
OUTS0120
OUTS0121
OUTS0122
OUTS0123
OUTS0124
OUTS0125
OUTS0126

```

```
1908 WRITE (6,1900) OUTS0127
19000FORMAT (1H1/8X,3HCH.,17X,6HENERGY,15X,9HSIG. OBS.,15X,10HSIG. CALC OUTS0128
1.,15X,13HERROR PERCENT) OUTS0129
1907 DIFE=(SA(I)-S(I))/S(I)*100. OUTS0130
WRITE (6,1902) I, E(I), S(I), SA(I), DIFE OUTS0131
1902 FORMAT( 5X,15,16X,F10.4,12X,F10.4,15X,F10.4,18X,F10.4) OUTS0132
1901 CONTINUE OUTS0133
JK=2 OUTS0134
RETURN OUTS0135
END OUTS0136
```


	SUBROUTINE SHPLO	SHPL0001
	DIMENSION E(1000),S(1000),SA(1000)	SHPL0002
	DIMENSION TITEL(18),EBCX(3),EBCY(3)	SHPL0003
	COMMON IMN,IO,IM,N,M,KI,ITMAX,F,GI,CO,C1,C2,ON,AW,R,DIST,T1,	SHPL0004
	1 DELAY,HO,RO,RI,PSA,BO,B1,H,COM1,COM4,INT1,VI,A,INT2,SIG,EIRO,OSIGP	SHPL0005
	2,THICK,IT,JK,IDF,ITRAN,IENER,ISIG,IGN,IEN,IGA,IDOP,ISICA,EIRM,SN,SS	SHPL0006
	3 SQ,SUSQ,L1,L2	SHPL0007
	DATA EBCX/('EV'),'RGY ',' ENE'/,EBCY/'ARN'),'A (B','SIGM'/'	SHPL0008
C	IENER=1	SHPL0009
	ISIG=1	SHPL0010
	ISICA=1	SHPL0011
	READ (2'IENER) (E(K),K=1,IMN)	SHPL0012
	READ (3'ISIG) (S(K),K=1,IMN)	SHPL0013
	READ (8'ISICA)(SA(K),K=IO,IM)	SHPL0014
C	CALCOMP PLOTTER	SHPL0015
C	READ (5,1910) (TITEL(I),I=1,18)	SHPL0016
	FORMAT (18A4)	SHPL0017
1910	READ (5,1911) SIZX,SIZY,IX,IY	SHPL0018
1911	FORMAT (2F10.0,2I5)	SHPL0019
	DO 1912 I=1,9	SHPL0020
	ARRAN=TITEL(I)	SHPL0021
	I1=19-I	SHPL0022
	TITEL(I)=TITEL(I1)	SHPL0023
	TITEL(I1)=ARRAN	SHPL0024
1912	CONTINUE	SHPL0025
	CALL FINIM(0.,3.)	SHPL0026
	ORX=SIZX/3.	SHPL0027
	ORY=SIZY/3.	SHPL0028
	IMO=IM-IO+1	SHPL0029
	DO 802 I=1,IMO	SHPL0030
	E(I)=E(IO)	SHPL0031
	S(I)=S(IO)	SHPL0032
	SA(I)=SA(IO)	SHPL0033
	IO=IO+1	SHPL0034
802	CONTINUE	SHPL0035
	CALL SYMBL (ORX,ORY,.3,0.,TITEL(18),72)	SHPL0036
	CALL DESLG(E,S,IMO,1,1,1,0,0,SIZX,SIZY,IX,IY,EBCX(3),-12,EBCY(3),1	SHPL0037
	12,-1)	SHPL0038
	CALL DESLG(E,SA,IMO,1,1,1,0,0,SIZX,-SIZY,IX,IY,EBCX(3),-12,EBCY(3)	SHPL0039
	1,12,0)	SHPL0040
	ORX=SIZX+5.	SHPL0041
	CALL FINIM(ORX,-3.)	SHPL0042
	WRITE (6,444)	SHPL0043
444	FORMAT ('I PLOT READY')	SHPL0044
	RETURN	SHPL0045
	END	SHPL0046
		SHPL0047
		SHPL0048
		SHPL0049

```

SUBROUTINE SIMH(A,AT,B,X,N,ITER,LA,RELA)
DIMENSION A(15,15),AT(15,15),B(15),X(15),RELA(15)
1 DO 2 I=1,N
DO 2 J=1,N
2 AT(I,J)=A(J,I)
DO 80 IL=1,ITER
DO 80 I=1,N
C=0.
DO 10 K=1,N
10 C=C+A(I,K)*AT(K,I)
IF(C) 20,333,20
20 CONTINUE
DO 30 J=1,N
30 AT(J,I)=AT(J,I)/C
DO 70 J=1,N
IF(J-I)40,70,40
40 H=0.
DO 50 K=1,N
50 H=H+A(I,K)*AT(K,J)
DO 60 K=1,N
60 AT(K,J)=AT(K,J)-H*AT(K,I)
70 CONTINUE
80 CONTINUE
DO 90 I=1,N
H=0.0
DO 91 J=1,N
91 H=H+B(J)*AT(I,J)
X(I)=H
90 CONTINUE
DO 100 I=1,N
BRE=0.0
DO 110 J=1,N
110 BRE=BRE+A(I,J)*X(J)
100 RELA(I)=(B(I)-BRE)/BRE*100.
RETURN
333 WRITE (6,666)
666 FORMAT (23H1(A) IS SINGULAR, C = 0)
CALL EXIT
END

```

```

SIMH0001
SIMH0002
SIMH0003
SIMH0004
SIMH0005
SIMH0006
SIMH0007
SIMH0008
SIMH0009
SIMH0010
SIMH0011
SIMH0012
SIMH0013
SIMH0014
SIMH0015
SIMH0016
SIMH0017
SIMH0018
SIMH0019
SIMH0020
SIMH0021
SIMH0022
SIMH0023
SIMH0024
SIMH0025
SIMH0026
SIMH0027
SIMH0028
SIMH0029
SIMH0030
SIMH0031
SIMH0032
SIMH0033
SIMH0034
SIMH0035
SIMH0036
SIMH0037
SIMH0038
SIMH0039

```

C
C
C

PFCN YIELDS REAL AND IMAGINARY PART OF THE COMPLEX
PROBABILITY INTEGRAL

```

SUBROUTINE PFCN (X,Y,U,V,L)
DIMENSION W287(4),W283(4)
DATA W283/1.65068012,0.524647623,-0.524647623,-1.65068012 /
DATA W287/0.0258826794,0.256212112,0.256212112,0.0258826794/
II=1
J=2
C5=X
C6=Y
300 IF(C5)8,300,300
8 IF(C6)287,11,11
301 I=1
GO TO 20
11 I=4
GO TO 46
14 I=3
GO TO 46
20 Z=C6*C6-C5*C5
CO=EXP(Z)
C7=CO+CO
CO=C5*C6
C9=CO+CO
C8=-C7*SIN(C9)
C7=C7*COS(C9)
46 C5=ABS(C5)
C6=ABS(C6)
IF(C5- 6.0)50,219,219
50 IF(C6- 0.5)65,65,302
302 IF(C6- 3.0)61,61,303
303 IF(C6- 6.0)304,304,219
304 C9=0.5
GO TO 73
61 IF(C6- 1.5)71,71,305
305 C9=0.25
GO TO 73
65 C10=C6
C6=0.5
J=1
71 C9=0.09375
73 C11=0.0
C18=0.0
K=2
C17=0.0
79 C21=C5-C11
C19=C21*C21
C20=C6*C6+C19
T=C11*C11
C19=EXP(-T)/C20*0.318309886*C9
C17=C19*C6+C17
C18=C21*C19+C18
GO TO (108,123),K
108 II=3-II
IF(II- 1)306,114,306
306 C11=-C11
GO TO 79
114 IF(-C11-4.0) 307,307,308
308 GO TO (128,244),J
307 C11=-C11+C9
GO TO 79

```

PFCN0001
PFCN0002
PFCN0003
PFCN0004
PFCN0005
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PFCN0055
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PFCN0058
PFCN0059
PFCN0060
PFCN0061
PFCN0062
PFCN0063

```

125 I1=1
    K=1
    C11=C9
    GO TO 79
128 C11=C17
    C12=C18
    C9=2.0
    C6=C10-0.5
    C6=C6+C6
    C10=C11/2.0
    C13=(C5*C12+C10-0.564189584)*C6
    C10=C12/2.0
    C14=(-C5*C11+C10)*C6
    C17=C11+C13
    C18=C12+C14
165 C10=C6/C9
    C19=C13/2.0
    C19=C5*C14+C19
    C15=(C6/2.0*C11+C19)*C10
    C17=C15+C17
    T1=C5*C13
    C19=(C6*C12+C14)/2.0
    C16=(-T1+C19)*C10
    C18=C16+C18
    T1=C17+C15
    IF((T1-C17))207,309,207
309 T1=C18+C16
    IF( T1-C18)207,244,207
207 C11=C13
    C12=C14
    C13=C15
    C14=C16
    C9=C9+1.0
    GO TO 165
219 C17=0.0
    C18=0.0
    DO 230 M=1,4
    C12=C5-W283(M)
    C11=C12*C12
    C11=C6*C6+C11
    C11=W287(M)/C11
    C17=C11*C6+C17
    C18=C11*C12+C18
230 CONTINUE
244 GO TO (245,249,255,257),I
245 C8=-C8
    C18=-C18
249 C17=C7-C17
    C18=C8-C18
255 C18=-C18
257 U=C17
    V=C18
    L=0
    RETURN
287 C5=-C5
    I=2
    GO TO 20
END

```

```

PFCN0064
PFCN0065
PFCN0066
PFCN0067
PFCN0068
PFCN0069
PFCN0070
PFCN0071
PFCN0072
PFCN0073
PFCN0074
PFCN0075
PFCN0076
PFCN0077
PFCN0078
PFCN0079
PFCN0080
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PFCN0110
PFCN0111
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PFCN0113
PFCN0114
PFCN0115
PFCN0116
PFCN0117
PFCN0118
PFCN0119
PFCN0120
PFCN0121

```

PROGRAM: AREAT

Version IBM 360/65

C
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CAREA ANALYSIS PROGRAM OF S.E. ATTA AND J.A. HARVEY
FORTRAN IV VERSION IBM 360C
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C

```
ODIMENSION GN(20),EN(20),G(20),EL(20),IRO(21),IRN(20),SIGMAT(20),TMAREAA0001
1(20),XX(20),RELA(20),AT(20,20),AM(20,20),ZTZ(3,3),ZTT(3),Z(3),ATI(AREA0002
23,3)AREAA0003
ODIMENSION S(2000),T(2000),TA(2000),AC(2000),SIGTC(1000),SIGT1(1000)AREAA0004
1),SIGT2(1000),SIGT3(1000)AREAA0005
EQUIVALENCE (S(1),T(1))AREAA0006
REAL#8 ZTZ,ATI,CHEC,F2A,FE,SXI,ETA,U,V,AM,AT,TM,XX,RELAAREAA0007
AREAA0008
AREAA0009
AREAA0010
AREAA0011
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AREAA0063
```

FORMAT STATEMENTS

```
1 FORMAT(50H1AREA ANALYSIS OF TRANSMISSION DATA      JOB 1910 /
14HORUN1A8)
23 FORMAT(120H0      C1      C2      GAMMA      C0      E0
1FGXGNO      GNO(FG1)      GNO(FG2)      O/O ERROR      GN(FG1)      GN(FG2))
2 FORMAT(2I6,2A8)
113 FORMAT(3H0A=E12.5,23H      KO=E14.6/3H N=E12.5,
123H      K1=E14.6/4H AW=E12.5,22H
2K2=E14.6/3H R=E12.5,24H      CORRECTED R(CF)=E12.5,
322H      CORRECTED R(CL)=E12.5/6H DIST=E12.5,19H
4=E12.5/3H T=E12.5,23H      G1=E12.5/9H T DELAY=E12.5
5,17H      G2=E12.5/4H DO=E12.5,23H      FG1=E
612.5/4H B0=E12.5,23H      FG2=E12.5/4H B1=E12.5/4H CN
7=I4/4H CF=I4/4H CL=I4/4H NO=I4/4H IF=I4/4H IM=I4/3H K=I4/4H RO=E12
8.5/4H R1=E12.5/5H PSA=E12.5)
24 FORMAT(1H02I6,E12.4,2E13.5,3E12.4,E09.2,2E12.4)
105 FORMAT(24H0 NUMBER OF ITERATIONS I2)
500 FORMAT(41H0 STOPPED ON MAXIMUM NUMBER OF ITERATIONS)
278 FORMAT(1E14.6)
273 FORMAT(17H0 DELTA GAMMA N 0)
274 FORMAT(31H0 STOPPED ON NEGATIVE GAMMA N 0)
6 FORMAT(7I5,3E12.6)
7 FORMAT(2I5,3E12.6)
8 FORMAT(6E12.6)
47 FORMAT(3E12.6)
260 FORMAT(8H0ELEMENT,2X,A8)
285 FORMAT(47H0COMPUTATIONS STOPPED DUE TO DETECTION OF ERROR)
282 FORMAT(16H0COMPUTED I.F.=0)
269 FORMAT(36H0THERE HAS BEEN A REDUCTION IN I.F.=I3)
1900 FORMAT (1H1/8X,4H0BS.,16X,5H0CALC.,15X,5H0BASIS,15X,4H0CHAN///)
1902 FORMAT (5X,F10.4,10X,F10.4,10X,F10.4,10X,F10.4,10X,I10)
1913 FORMAT ('1 NO PLOT DEMANDED')
781 FORMAT ('1 PLOT READY')
```

BEGIN OF CALCULATIONS

```
L2=0
X2=0.0
INDEX=0
CARRX=0.0
CARRY=0.0
3 READ (5,2) L1,L4,F2A,FE
IF(L1)4,4,5
4 IF (INDEX/2*2-INDEX )1918,1919,284
1918 CALL FINIM (CARRX,0. )
GO TO 1920
1919 CAR=AMAX1(CARRX,X2)
CALL FINIM (CAR,CARRY)
```

1920	CALL FINTRA	AREA0064
	CALL EXIT	AREA0065
5	WRITE (6,1) F2A	AREA0066
	READ (5,6) IMN, IO, IM, M, KI, ITMAX, IC, F, G1, G2	AREA0067
	FG1=F*G1	AREA0068
	FG2=F*G2	AREA0069
	IF(IC)46,45,46	AREA0070
45	READ (5,47) (ZTT(K), K=1,3)	AREA0071
46	READ (5,7) (IRO(J), IRN(J), G(J), EL(J), GN(J), J=1, M)	AREA0072
	IT=0	AREA0073
	IF(L2-L1)31,32,31	AREA0074
31	READ (5,8) A, ON, AW, R, DIST, T1, DELAY, HO, RO, R1, PSA	AREA0075
	BO=(RO*T1-R1*DELAY)/(72.3*DIST*.8325)	AREA0076
	B1=R1/.8325	AREA0077
	READ(5,9)(S(I), I=1, IMN)	AREA0078
9	FORMAT(2(12X, E12.5, 12X))	AREA0079
	DO 49 K=1, IMN	AREA0080
	T(K)=EXP(-ON*S(K))	AREA0081
49	CONTINUE	AREA0082
32	VI=(72.3*DIST)**2	AREA0083
	WRITE (6,260) FE	AREA0084
	DO15 J=1, M	AREA0085
	SIGMAT(J)=0.0	AREA0086
	SIO=EL(J)	AREA0087
	EN(J)=VI/(SIO*T1+DELAY)**2	AREA0088
	IROJ=IRO(J)	AREA0089
	IRNJ=IRN(J)	AREA0090
	DO10 I=IROJ, IRNJ	AREA0091
	SIGMAT(J)=T(I)+SIGMAT(J)	AREA0092
10	CONTINUE	AREA0093
	IF(GN(J))12,11,15	AREA0094
12	GOTO284	AREA0095
11	ILJ=EL(J)	AREA0096
	EI=EN(J)	AREA0097
	BI=B1*EI+BO*(EI**1.5)	AREA0098
	DELTA=HO*SQRT(EI/AW)	AREA0099
	GNJ=0.62+(1.66*SQRT(DELTA*DELTA+BI*BI))/G(J)	AREA0100
	TIROJ=T(IROJ)	AREA0101
	TIRNJ=T(IRNJ)	AREA0102
	IF(TIROJ-TIRNJ)17,17,18	AREA0103
18	TIRNJ=TIROJ	AREA0104
17	TILJ=T(ILJ)	AREA0105
	IF(TILJ)13,13,14	AREA0106
13	TILJ=0.001	AREA0107
	GO TO 16	AREA0108
14	IF(TILJ-0.001)13,16,16	AREA0109
16	GN(J)=-{(SQRT(EN(J)))*G(J)*(ALOG(TILJ)-ALOG(TIRNJ)))/(ON*12.608E6)*GNJ}	AREA0110
15	CONTINUE	AREA0111
	GO TO 705	AREA0112
284	WRITE (6,285)	AREA0113
	GO TO 287	AREA0114
705	IF(KI)286,220,286	AREA0115
220	DO218 J=1, M	AREA0116
	K3=3.0/(RO+EL(J)*R1)	AREA0117
	IF(KI-K3)221,222,222	AREA0118
221	KI=K3	AREA0119
222	K3=6.0*T1*EN(J)/((EL(J)*T1+DELAY)*(1.665*HO*SQRT(EN(J)/AW)+G(J)))	AREA0120
	IF(KI-K3)223,218,218	AREA0121
223	KI=K3	AREA0122
218	CONTINUE	AREA0123
	KI=KI+1	AREA0124
286	KIF=KI	AREA0125
		AREA0126

219	IFL=(1000/KI)	AREA0127
	DO267J=1,M	AREA0128
	K3=5.0/(RO+EL(J)*R1)	AREA0129
	IF((IRN(J)-IRO(J)+1)-(IFL-K3))267,267,268	AREA0130
268	KI=KI-1	AREA0131
	IF(KI)280,280,219	AREA0132
267	CONTINUE	AREA0133
	IF(KI-KIF)283,281,281	AREA0134
280	WRITE(6,282)	AREA0135
	GO TO 284	AREA0136
283	WRITE(6,269) KIF	AREA0137
281	SIGP=12.566368*R*R	AREA0138
	ONSIGP=EXP(-ON*SIGP)	AREA0139
	COM1=SQRT(AW)/HO	AREA0140
	COM4=A*2.86239E3	AREA0141
	SIG=(-2.0*ON*1.7724538)	AREA0142
	IRO(M+1)=IM	AREA0143
	M1=M+1	AREA0144
	IF(IC)21,48,21	AREA0145
21	CALLDPZTZ(10,M1,IRO,IRN,DELAY,T1,DIST,ZTZ)	AREA0146
	IF(IC-1)12,225,224	AREA0147
225	ATI(1,1)=1.0/ZTZ(1,1)	AREA0148
	GOTO19	AREA0149
224	CALL SIMIN(ZTZ,ATI,IC,40,3)	AREA0150
19	DO41L=1,3	AREA0151
	ZTT(L)=0.0	AREA0152
41	CONTINUE	AREA0153
	DO50J=1,M1	AREA0154
	IF(J-1)51,52,53	AREA0155
51	GOTO284	AREA0156
52	IRNJ1=10	AREA0157
	GOTO54	AREA0158
53	IRNJ1=IRN(J-1)	AREA0159
	M2=J-1	AREA0160
	DO 34 J1=1,M2	AREA0161
	IF(IRNJ1-IRN(J1))37,34,34	AREA0162
37	IRNJ1=IRN(J1)	AREA0163
34	CONTINUE	AREA0164
54	IROJ=IRO(J)	AREA0165
	IF(IROJ-IRNJ1-1)50,50,55	AREA0166
55	DO57I=IRNJ1,IROJ	AREA0167
	SIO=I	AREA0168
	SE=(SIO*T1+DELAY)/(72.3*DIST)	AREA0169
	E=VI/(SIO*T1+DELAY)**2	AREA0170
	EI=6.52E5*SE	AREA0171
	GE=0.0	AREA0172
	DO56K=1,M	AREA0173
	ENE=EN(K)-E	AREA0174
	GE=GE+(GN(K)*(EI*G(K)-5.72478E3*ENE*A)/(ENE**2+(G(K)/2.0)**2))	AREA0175
56	CONTINUE	AREA0176
	TE=T(1)*EXP(ON*(SIGP+GE))	AREA0177
	ZTT(1)=ZTT(1)+TE	AREA0178
	IF(IC-1)702,57,700	AREA0179
700	ZTT(2)=ZTT(2)+(TE*SE)	AREA0180
	IF(IC-2)702,57,701	AREA0181
702	GOTO284	AREA0182
701	ZTT(3)=ZTT(3)+(TE/E)	AREA0183
57	CONTINUE	AREA0184
50	CONTINUE	AREA0185
	Z(1)=ZTT(1)	AREA0186
	Z(2)=ZTT(2)	AREA0187
	Z(3)=ZTT(3)	AREA0188
	ZTT(1)=ATI(1,1)*Z(1)+ATI(1,2)*Z(2)+ATI(1,3)*Z(3)	AREA0189


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IF (IC-1)350,48,353
350 GOTO284
353 ZTT(2)=ATI(2,1)*Z(1)+ATI(2,2)*Z(2)+ATI(2,3)*Z(3)
IF (IC-2)350,48,355
355 ZTT(3)=ATI(3,1)*Z(1)+ATI(3,2)*Z(2)+ATI(3,3)*Z(3)
48 DO70J=1,M
IROJ=IRO(J)
IRNJ=IRN(J)
TM(J)=0.0
DO75JJ=1,M
AM(J,JJ)=0.0
75 CONTINUE
SIO=IROJ
EIROJ=VI/(SIO*T1+DELAY)**2
SIO=IRNJ
EIRNJ=VI/(SIO*T1+DELAY)**2
EIROJ=EIROJ+(4.0*(B1*EIROJ+B0*(EIROJ**1.5)))
EIRNJ=EIRNJ-(4.0*(B1*EIRNJ+B0*(EIRNJ**1.5)))
INT=((SQRT(VI/EIRNJ)-SQRT(VI/EIROJ))/T1)
INT=INT*KI
IF((INT/2)*2-INT)77,78,76
76 GOTO284
77 INT=INT+1
78 EINT=INT
H=(EIROJ-EIRNJ)/EINT
Y=EIRNJ
HH=H*H
HH2=HH+HH
H31=(H/2.0)
H32=H
INT1=INT+1
DO80IJ=1,INT1
CON=1.0/SQRT(Y)
COM2=1.0/(COM1*2.0*Y)
COM3=COM1*CON
SIGMA=SIG*COM3
CON=6.52E5*CON
COM2=6.52E5*COM2
L=0
SUMJ=0.0
DO84JY=1,M
SXI=COM3*(Y-EN(JY))
ETA=COM3*G(JY)/2.0
CALL PFCN(SXI,ETA,U,V,L)
SOM=(CON+COM2*SXI)*U-(COM2*ETA-COM4)*V
SUMJ=SUMJ+GN(JY)*SOM
IF(J-1)81,82,83
81 GOTO284
83 IF(JY-(J-1))84,85,82
85 F1=SIGMA*SOM
GOTO84
82 IF(JY-J)84,88,89
88 F2=SIGMA*SOM
GOTO84
89 IF(JY-(J+1))84,87,84
87 F3=SIGMA*SOM
84 CONTINUE
67 ONE=EXP(SIGMA*SUMJ)
SIGTC(IJ)=ONE
SIGT1(IJ)=ONE*F1
SIGT2(IJ)=ONE*F2
SIGT3(IJ)=ONE*F3
Y=Y+H

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AREA0190
AREA0191
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AREA0199
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AREA0201
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AREA0240
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AREA0247
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AREA0249
AREA0250
AREA0251
AREA0252

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80	CONTINUE	AREA0253
	DO90I=IROJ,IRNJ	AREA0254
	SIO=I	AREA0255
	EI=VI/(SIO*T1+DELAY)**2	AREA0256
	BI=BI*EI+BO*(EI**1.5)	AREA0257
	BI2=BI*BI	AREA0258
	CI=ZTT(1)	AREA0259
	IF(IC-1)303,304,303	AREA0260
303	CI=CI+(ZTT(2)/(SQRT(EI)))	AREA0261
	IF(IC-2)305,304,305	AREA0262
305	CI=CI+(ZTT(3)/EI)	AREA0263
304	ACI=CI*ONSIGP	AREA0264
	CI=CI/(BI*1.772454)	AREA0265
	EIRO=4.0*BI	AREA0266
	EIRN=EI-EIRO	AREA0267
	EIRO=EI+EIRO	AREA0268
	IN=(EIROJ-EIRN)/H	AREA0269
	SIN=IN	AREA0270
	EIRN=EIROJ-SIN*H	AREA0271
	INT=(EIRO-EIRN)/H	AREA0272
	IF((INT/2)*2-INT)401,402,400	AREA0273
400	GOTO284	AREA0274
401	INT=INT-1	AREA0275
402	IJS=INT1-IN	AREA0276
	IJM=IJS+INT	AREA0277
	EA=EXP(-(EI-EIRN)/BI)**2)	AREA0278
	EAH=EXP((2.0*(EI-EIRN)*H-HH)/BI2)	AREA0279
	EHH2=EXP(-HH2/BI2)	AREA0280
	TM1=0.0	AREA0281
	AM1=0.0	AREA0282
	AM2=0.0	AREA0283
	AM3=0.0	AREA0284
	DO 95 IJ=IJS,IJM	AREA0285
	IF(IJS-IJ)68,64,86	AREA0286
86	GOTO284	AREA0287
64	ONE=EA*H31	AREA0288
	GOTO 407	AREA0289
68	IF(IJ-IJM)406,64,86	AREA0290
406	ONE=EA*H32	AREA0291
407	TM1=TM1+SIGTC(IJ)*ONE	AREA0292
	IF(J-1)93,92,91	AREA0293
91	AM1=AM1+SIGT1(IJ)*ONE	AREA0294
92	AM2=AM2+SIGT2(IJ)*ONE	AREA0295
	AM3=AM3+SIGT3(IJ)*ONE	AREA0296
	EA=EA*EAH	AREA0297
	EAH=EAH*EHH2	AREA0298
95	CONTINUE	AREA0299
	TM(J)=TM(J)+TM1*CI	AREA0300
	TM1=TM1*CI*ONSIGP	AREA0301
	IF(J-1)93,96,97	AREA0302
97	AM(J,J-1)=AM(J,J-1)+AM1*CI	AREA0303
96	AM(J,J)=AM(J,J)+AM2*CI	AREA0304
	IF(J+1-M)110,110,112	AREA0305
110	AM(J,J+1)=AM(J,J+1)+AM3*CI	AREA0306
112	TA(I)=TM1	AREA0307
	AC(I)=ACI	AREA0308
90	CONTINUE	AREA0309
	TM(J)=SIGMAT(J)-ONSIGP*TM(J)	AREA0310
	IF(J-1)93,98,99	AREA0311
99	AM(J,J-1)=ONSIGP*AM(J,J-1)	AREA0312
98	AM(J,J)=ONSIGP*AM(J,J)	AREA0313
	IF(J+1-M)111,111,70	AREA0314
111	AM(J,J+1)=ONSIGP*AM(J,J+1)	AREA0315

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70 CONTINUE
DO 800 JR=1,M
IROJ=IRO(JR)
IRNJ=IRN(JR)
SRJ=IRNJ-IROJ+1
SRJ=SQRT (SRJ)
TIROJ=T(IROJ)
TIRNJ=T(IRNJ)
IF(TIROJ-TIRNJ)385,385,386
386 TIRNJ=TIROJ
385 IF(DABS(TM(JR))- .001*PSA*SRJ*TIRNJ)800,800,100
93 GOTO284
800 CONTINUE
GO TO 504
100 IF(IT-ITMAX)101,501,501
101 IT=IT+1
IF(M-1)93,107,108
107 XX(1)=TM(1)/AM(1,1)
GOTO109
108 CALL SIMH (AM,AT,TM,XX,M,40,20,RELA)
109 DO102J=1,M
GN(J)=GN(J)+XX(J)
102 CONTINUE
DO 270 J=1,M
IF(GN(J))271,270,270
270 CONTINUE
IF(IC)19,48,19
271 DO 272 J=1,M
GN(J)=GN(J)-XX(J)
272 CONTINUE
IT=IT-1
275 WRITE (6,274)
276 WRITE (6,273)
277 WRITE (6,278) ( TM(J),J=1,M)
GO TO 504
501 WRITE (6,500)
504 M1=M+1
DO505J=1,M1
IF(J-1)51,390,391
390 IRNJ=10
GOTO392
391 IRNJ=IRN(J-1)
M2=J-1
DO393J1=1,M2
IF(IRNJ-IRN(J1))394,393,393
394 IRNJ=IRN(J1)
393 CONTINUE
392 IROJ=IRO(J)
IF(IROJ-IRNJ-1)505,396,396
396 SIO=IROJ
EIROJ=VI/(SIO*T1+DELAY)**2
SIO=IRNJ
EIRNJ=VI/(SIO*T1+DELAY)**2
EIROJ=EIROJ-(4.0*(B1*EIROJ+B0*(EIROJ**1.5)))
EIRNJ=EIRNJ+(4.0*(B1*EIRNJ+B0*(EIRNJ**1.5)))
INT=((-SQRT(VI/EIRNJ)+SQRT(VI/EIROJ))/T1)
INT=INT*KI
IF((INT/2)*2-INT)201,202,203
203 GOTO284
201 INT=INT+1
202 EINT=INT
H=(-EIROJ+EIRNJ)/EINT
Y=EIROJ

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AREA0316
AREA0317
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AREA0358
AREA0359
AREA0360
AREA0361
AREA0362
AREA0363
AREA0364
AREA0365
AREA0366
AREA0367
AREA0368
AREA0369
AREA0370
AREA0371
AREA0372
AREA0373
AREA0374
AREA0375
AREA0376
AREA0377
AREA0378

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HH=H*H
HH2=HH+HH
H31=(H/2.0)
H32=H
INT1=INT+1
DO204 I=1,INT1
CON=1.0/SQRT(Y)
COM2=1.0/(COM1*2.0*Y)
COM3=COM1*CON
SIGMA=SIG*COM3
CON=6.52E5*CON
COM2=6.52E5*COM2
SUMJ=0.0
DO205 JY=1,M
SXI=COM3*(Y-EN(JY))
ETA=COM3*G(JY)/2.0
CALL PFCN(SXI,ETA,U,V,L)
SOM=(CON+COM2*SXI)*U-(COM2*ETA-COM4)*V
205 SUMJ=SUMJ+GN(JY)*SOM
ONE=EXP(SIGMA*SUMJ)
SIGTC(I)=ONE
204 Y=Y+H
DO206 I=IRNJ,IROJ
SIO=I
EI=VI/(SIO*T1+DELAY)**2
BI=B1*EI+B0*(EI**1.5)
BI2=BI*BI
CI=ZTT(1)
IF(IC-1)207,208,207
207 CI=CI+(ZTT(2)/(SQRT(EI)))
IF(IC-2)209,208,209
209 CI=CI+(ZTT(3)/EI)
208 ACI=CI*ONSIGP
CI=CI/(BI*1.772454)
EIRO=4.0*BI
EIRN=EI-EIRO
EIRO=EI+EIRO
IN=(EIRNJ-EIRN)/H
SIN=IN
EIRN=EIRNJ-SIN*H
INT=(EIRO-EIRN)/H
IF((INT/2)*2-INT)210,211,212
212 GOTO284
210 INT=INT-1
211 IJS=INT1-IN
IJM=IJS+INT
EA=EXP(-((EI-EIRN)/BI)**2)
EAH=EXP((2.0*(EI-EIRN)*H-HH)/BI2)
EHH2=EXP(-HH2/BI2)
TM1=0.0
DO213 IJ=IJS,IJM
IF(IJS-IJ)214,215,212
215 ONE=EA*H31
GOTO217
214 IF(IJ-IJM)216,215,212
216 ONE=EA*H32
217 TM1=TM1+SIGTC(IJ)*ONE
EA=EA*EAH
213 EAH=EAH*EHH2
TM1=TM1*CI*ONSIGP
TA(I)=TM1
AC(I)=ACI
206 CONTINUE

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AREA0379
AREA0380
AREA0381
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AREA0386
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AREA0441

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505	CONTINUE	AREA0442
	DO 750J=1,M	AREA0443
	IROJ=IRO(J)	AREA0444
	IRNJ=IRN(J)	AREA0445
	C2C1=IRNJ-IROJ+1	AREA0446
	TIROJ=T(IROJ)	AREA0447
	TIRNJ=T(IRNJ)	AREA0448
	IF(TIROJ-TIRNJ)387,387,388	AREA0449
388	TIRNJ=TIROJ	AREA0450
387	SIGMAT(J)=(PSA*TIRNJ*SQRT(C2C1))/DABS(AM(J,J))	AREA0451
750	CONTINUE	AREA0452
106	WRITE(6,105) IT	AREA0453
	WRITE(6,23)	AREA0454
	DO375J=1,M	AREA0455
	PCE=SIGMAT(J)/GN(J)	AREA0456
	GN01=GN(J)/FG1	AREA0457
	GN02=GN(J)/FG2	AREA0458
	ENJ=SQRT(EN(J))	AREA0459
	GN1=GN01*ENJ	AREA0460
	GN2=GN02*ENJ	AREA0461
	WRITE(6,24) IRO(J), IRN(J), G(J), EL(J), EN(J),	AREA0462
	IGN(J),GN01,GN02,PCE,GN1,GN2	AREA0463
375	CONTINUE	AREA0464
	WRITE(6,779)	AREA0465
779	FORMAT(// 'ORELATIVE ACCURACY (PER CENT) OF THE SOLUTION OF THE SYS	AREA0466
	ITEM OF LINEAR EQUATIONS')	AREA0467
	WRITE(6,777) (RELA(I),I=1,M)	AREA0468
777	FORMAT(15X,E15.7)	AREA0469
	SIO=IO	AREA0470
	SE=(SIO*T1+DELAY)/(72.3*DIST)	AREA0471
	E=SE**2	AREA0472
	RCF=(R*R-(ALOG(ZTT(1)+ZTT(2)*SE+ZTT(3)*E)/	AREA0473
	1(ON*12.566368)))	AREA0474
	IF(RCF)261,261,262	AREA0475
261	RCF=0.0	AREA0476
	GOTO263	AREA0477
262	RCF=SQRT(RCF)	AREA0478
263	SIO=IM	AREA0479
	SE=(SIO*T1+DELAY)/(72.3*DIST)	AREA0480
	E=SE**2	AREA0481
	RCL=(R*R-(ALOG(ZTT(1)+ZTT(2)*SE+ZTT(3)*E)/	AREA0482
	1(ON*12.566368)))	AREA0483
	IF(RCL)264,264,265	AREA0484
264	RCL=0.0	AREA0485
	GOTO266	AREA0486
265	RCL=SQRT(RCL)	AREA0487
266	WRITE(6,113) A,ZTT(1),ON,ZTT(2),AW,ZTT(3),	AREA0488
	IR,RCF,RCL,DIST,F,T1,G1,DELAY,G2,H0,FG1,B0,FG2,	AREA0489
	ZB1,IMN,IO,IM,M,KI,ITMAX,IC,RO,R1,PSA	AREA0490
	JJ1=0	AREA0491
	WRITE(6,1900)	AREA0492
	DO 1901 I=IO,IM	AREA0493
	WRITE(6,1902) T(I), TA(I), AC(I), I	AREA0494
	IF(I-IM) 1903,1901,1901	AREA0495
1903	JJ1=JJ1+1	AREA0496
	IF(JJ1/55-1) 1901,1907,1901	AREA0497
1907	JJ1=0	AREA0498
	WRITE(6,1900)	AREA0499
1901	CONTINUE	AREA0500
	L2=L1	AREA0501
	IF(L4-1) 1912,1911,1911	AREA0502
1912	WRITE(6,1913)	AREA0503
	GO TO 3	AREA0504

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C
C   CALCOMP PLOTTER
C
1911 INDEX=INDEX+1
    IF (INDEX/2*2-INDEX )1915,1916,284
1915 X1=CARRX
    CAR=AMAX1(X1,X2)
    CALL FINIM (CAR,CARRY)
    GO TO 1923
1916 X2=CARRX
    CALL FINIM (0.,30.)
    GO TO 1923
1923 CALL GRAPH(10,IM, F2A,VI,DELAY,T1,IMN)
    I01=(10/10)*10
    X=(10-I01)
    X=X*0.127
    DO397 I=10,IM
    Y=T(I)*12.7+2.54
    CALL KREUZ(X,Y,0.12)
397 X=X+0.127
    Y=AC(IM)*12.7+2.54
    X=(IM-I01)
    X=X*0.127
    CALL PLOT(X,Y,3)
    IMO=IM+1-I0
    DO 398 I=1,IMO
    IJ=IM+1-I
    Y=AC(IJ)*12.7+2.54
    IF(Y-19.05)240,240,241
240 CALL PLOT(X,Y,2)
398 X=X-0.127
    CALL PLOT(X,Y,3)
    DO399 J=1,M
    IF(J-1)230,231,230
231 IROJ=I0
    GOTO232
230 IROJ=IRN(J-1)+1
232 Y=TA(IROJ)*12.7+2.54
    IRNJ=IRO(J)-1
    X=(IROJ-I01)
    X=X*0.127
    IF(Y-19.05)242,242,241
242 CALL PLOT(X,Y,3)
    IF(IRNJ-IROJ)233,233,234
234 DO389 I=IROJ,IRNJ
    Y=TA(I)*12.7+2.54
    IF(Y-19.05)243,243,241
243 CALL PLOT(X,Y,2)
389 X=X+0.127
233 IROJ=IRO(J)
    Y=TA(IROJ)*12.7+2.54
    IRNJ=IRN(J)
    X=(IROJ-I01)
    X=X*0.127
    IF(Y-19.05)244,244,241
244 CALL PLOT(X,Y,3)
    DO235 I=IROJ,IRNJ
    Y=TA(I)*12.7+2.54
    IF(Y-19.05)245,245,241
245 CALL PLOT(X,Y,2)
235 X=X+0.127
399 CONTINUE
    IROJ=IRN(M)+1

```

```

AREA0505
AREA0506
AREA0507
AREA0508
AREA0509
AREA0510
AREA0511
AREA0512
AREA0513
AREA0514
AREA0515
AREA0516
AREA0517
AREA0518
AREA0519
AREA0520
AREA0521
AREA0522
AREA0523
AREA0524
AREA0525
AREA0526
AREA0527
AREA0528
AREA0529
AREA0530
AREA0531
AREA0532
AREA0533
AREA0534
AREA0535
AREA0536
AREA0537
AREA0538
AREA0539
AREA0540
AREA0541
AREA0542
AREA0543
AREA0544
AREA0545
AREA0546
AREA0547
AREA0548
AREA0549
AREA0550
AREA0551
AREA0552
AREA0553
AREA0554
AREA0555
AREA0556
AREA0557
AREA0558
AREA0559
AREA0560
AREA0561
AREA0562
AREA0563
AREA0564
AREA0565
AREA0566
AREA0567

```

```
IF (IROJ-IM )1914,1914,236
1914 Y=TA(IROJ)*12.7+2.54
      IRNJ=IM
      X=(IROJ-I01)
      X=X*0.127
      IF(Y-19.05)246,246,241
246  CALLPLOT(X,Y,3)
      DO238I=IROJ,IRNJ
      Y=TA(I)*12.7+2.54
      IF(Y-19.05)247,247,241
247  CALLPLOT(X,Y,2)
238  X=X+0.127
236  CALLPLOT(X,Y,3)
      WRITE (6,781)
      CARRX =IMN/20
      CARRX =(CARRX +1.)*2.6+10.
      CARRY =-30.
241  GO TO 287
287  GO TO 3
      END
```

```
AREA0568
AREA0569
AREA0570
AREA0571
AREA0572
AREA0573
AREA0574
AREA0575
AREA0576
AREA0577
AREA0578
AREA0579
AREA0580
AREA0581
AREA0582
AREA0583
AREA0584
AREA0585
AREA0586
AREA0587
```

```

SUBROUTINE GRAPH (IO,IM,RUN,VI,DELAY,TI,IMN)
REAL*8 RUN
DIMENSION TRA (12)
DATA TRA/'T','R','A','N','S','M','I','S','S','I','O','N'/
IB=(IO/10)*10
IE=(IM/10+1)*10
N=(IE-IB)/20
IF(IB) 1,2,2
1 RETURN
2 X=-0.508
  FLOAT1=IB
  Y=-1.016
  DO 3 I=1,N
    CALL NUMBER (X,Y,0.508,0.0,FLOAT1,-1)
    X=X+0.508
    CALL PLOT (X,-0.381,3)
    CALL PLOT (X,0.0,2)
    X=X+2.54
    CALL PLOT (X,0.0,2)
    X=X-0.508
3  FLOAT1=FLOAT1+20.
  X=X+0.508
  CALL PLOT (X,-0.381,2)
  X=X-0.508
  CALL NUMBER (X,Y,0.508,0.0,FLOAT1,-1)
  X=X+0.508
  CALL PLOT (X,-2.54,3)
  CALL PLOT (0.,-2.54,2)
  X=0.0
  FLOAT1=IB
  DO 4 I=1,N
    FLOAT2=VI/(DELAY+FLOAT1*TI)**2
    CALL PLOT (X,-2.921,2)
    X=X-0.508
    CALL NUMBER (X,-3.302,0.254,0.0,FLOAT2,3)
    X=X+3.048
4  CALL PLOT (X,-2.54,3)
  FLOAT1=FLOAT1+20.
  X=X
  CALL PLOT (X,-2.921,2)
  X=X-0.508
  FLOAT2=VI/(DELAY+FLOAT1*TI)**2
  CALL NUMBER (X,-3.302,0.254,0.0,FLOAT2,3)
  X=IMN/20
  CALL SYMBL4 (X,-4.572,0.762,0.0,13HENERGY (EV),13)
  CALL SYMBL4 (X,-2.032,0.762,0.0,14HCHANNEL NUMBER,14)
  CALL PLOT (0.,2.54,3)
  CALL PLTIR (XE,2.54,2)
  CALL PLOT (XE,15.24,3)
  CALL PLTIR (0.,15.24,3)
  CALL PLOT (0.,0.,3)
  CALL PLOT (0.,15.24,2)
  Y=14.986
  DO 5 I=1,12
    I1=11-I
    FLOAT1=FLOAT (I1)/10.
    CALL NUMBER (-1.778,Y,0.508,0.0,FLOAT1,1)
    Y=Y+0.254
    CALL PLOT (-0.254,Y,3)
    CALL PLOT (0.0,Y,2)
5  Y=Y-1.524
  Y=0.508
  DO 6 I=1,12

```

```

GRAP0001
GRAP0002
GRAP0003
GRAP0004
GRAP0005
GRAP0006
GRAP0007
GRAP0008
GRAP0009
GRAP0010
GRAP0011
GRAP0012
GRAP0013
GRAP0014
GRAP0015
GRAP0016
GRAP0017
GRAP0018
GRAP0019
GRAP0020
GRAP0021
GRAP0022
GRAP0023
GRAP0024
GRAP0025
GRAP0026
GRAP0027
GRAP0028
GRAP0029
GRAP0030
GRAP0031
GRAP0032
GRAP0033
GRAP0034
GRAP0035
GRAP0036
GRAP0037
GRAP0038
GRAP0039
GRAP0040
GRAP0041
GRAP0042
GRAP0043
GRAP0044
GRAP0045
GRAP0046
GRAP0047
GRAP0048
GRAP0049
GRAP0050
GRAP0051
GRAP0052
GRAP0053
GRAP0054
GRAP0055
GRAP0056
GRAP0057
GRAP0058
GRAP0059
GRAP0060
GRAP0061
GRAP0062
GRAP0063

```



```
6 CALL SYMBL4(-3.91,Y,0.762,0.0,TRA(I),1)
  Y=Y+1.27
  X=IMN/20
  CALL SYMBL4(X,18.00,0.762,0.0,RUN,8)
  CALL FINIM(0.,0.)
  RETURN
  END
```

```
GRAP0064
GRAP0065
GRAP0066
GRAP0067
GRAP0068
GRAP0069
GRAP0070
```

```
SUBROUTINE KREUZ(X,Y,H)
  H1=H*0.5
  X1=X-H1
  X2=X+H1
  Y1=Y-H1
  Y2=Y+H1
  CALL PLOT(X1,Y,3)
  CALL PLOT(X2,Y,2)
  CALL PLOT(X,Y,2)
  CALL PLOT(X,Y1,2)
  CALL PLOT(X,Y2,2)
  RETURN
  END
```

```
KREU0001
KREU0002
KREU0003
KREU0004
KREU0005
KREU0006
KREU0007
KREU0008
KREU0009
KREU0010
KREU0011
KREU0012
KREU0013
```

```

SUBROUTINE DPZTZ (IO,M1,IRO,IRN,DELAY,T1,DIST,ZTZ)
DIMENSION IRO(21),IRN(20), ZTZ(3,3),SUME(5)
DOUBLE PRECISION SUME,ZTZ
DO 1 K=1,5
1 SUME(K)=0.
DO 2 J=1,M1
IF(J-1) 6,7,8
6 GO TO 20
7 IRNJ=IO
GO TO 9
8 IRNJ=IRN(J-1)
M2=J-1
DO 16 J1=1,M2
IF(IRNJ-IRN(J1))15,16,16
15 IRNJ=IRN(J1)
16 CONTINUE
9 IROJ=IRO(J)
IF(IROJ-IRNJ-1) 2,2,3
3 DO 13 I=IRNJ,IROJ
SI=I
DSE=(SI*T1+DELAY)/(72.3*DIST)
DE=DSE**2
SUME(1)=SUME(1)+1.
SUME(2)=SUME(2)+DSE
SUME(3)=SUME(3)+DE
SUME(4)=SUME(4)+DSE*DE
SUME(5)=SUME(5)+DE*DE
13 CONTINUE
2 CONTINUE
DO 20 L=1,3
DO 20 N=1,3
K=L+N-1
ZTZ(L,N)=SUME(K)
20 CONTINUE
RETURN
END

```

```

DPZT0001
DPZT0002
DPZT0003
DPZT0004
DPZT0005
DPZT0006
DPZT0007
DPZT0008
DPZT0009
DPZT0010
DPZT0011
DPZT0012
DPZT0013
DPZT0014
DPZT0015
DPZT0016
DPZT0017
DPZT0018
DPZT0019
DPZT0020
DPZT0021
DPZT0022
DPZT0023
DPZT0024
DPZT0025
DPZT0026
DPZT0027
DPZT0028
DPZT0029
DPZT0030
DPZT0031
DPZT0032
DPZT0033
DPZT0034
DPZT0035
DPZT0036

```

```

SUBROUTINE SIMIN (A,AT,N,ITER,LA)
IMPLICIT REAL*8 (A-H,O-Z),INTEGER (I-N)
DIMENSION A(LA,LA),AT(LA,LA),CHEC(LA,LA)
1 DO 2 I=1,N
DO 2 J=1,N
2 AT(I,J)=A(J,I)
DO 80 IL=1,ITER
DO 80 I=1,N
C=0.
DO 10 K=1,N
10 C=C+A(I,K)*AT(K,I)
IF(C) 20,333,20
20 CONTINUE
DO 30 J=1,N
30 AT(J,I)=AT(J,I)/C
DO 70 J=1,N
IF(J-I)40,70,40
40 H=0.
DO 50 K=1,N
50 H=H+A(I,K)*AT(K,J)
DO 60 K=1,N
60 AT(K,J)=AT(K,J)-H*AT(K,I)
70 CONTINUE
80 CONTINUE
DO 90 J=1,N
DO 91 JJ=1,N
CHEC (J,JJ)=0.0
DO 92 I=1,N
92 CHEC (J,JJ)=CHEC (J,JJ)+A(JJ,I)*AT(I,J)
91 CONTINUE
90 CONTINUE
RETURN
333 WRITE (6,666)
STOP
666 FORMAT (23H1(A) IS SINGULAR, C = 0)
END

```

```

SIMI0001
SIMI0002
SIMI0003
SIMI0004
SIMI0005
SIMI0006
SIMI0007
SIMI0008
SIMI0009
SIMI0010
SIMI0011
SIMI0012
SIMI0013
SIMI0014
SIMI0015
SIMI0016
SIMI0017
SIMI0018
SIMI0019
SIMI0020
SIMI0021
SIMI0022
SIMI0023
SIMI0024
SIMI0025
SIMI0026
SIMI0027
SIMI0028
SIMI0029
SIMI0030
SIMI0031
SIMI0032
SIMI0033
SIMI0034
SIMI0035
SIMI0036

```

```

SUBROUTINE SIMH(A,AT,B,X,N,ITER,LA,RELA)
IMPLICIT REAL*8 (A-H,O-Z),INTEGER (I-N)
DIMENSION A(LA,LA),AT(LA,LA),B(LA),X(LA),RELA(LA)
1 DO 2 I=1,N
DO 2 J=1,N
2 AT(I,J)=A(J,I)
DO 80 IL=1,ITER
DO 80 I=1,N
C=0.
DO 10 K=1,N
10 C=C+A(I,K)*AT(K,I)
IF(C) 20,333,20
20 CONTINUE
DO 30 J=1,N
30 AT(J,I)=AT(J,I)/C
DO 70 J=1,N
IF(J-I)40,70,40
40 H=0.
DO 50 K=1,N
50 H=H+A(I,K)*AT(K,J)
DO 60 K=1,N
60 AT(K,J)=AT(K,J)-H*AT(K,I)
70 CONTINUE
80 CONTINUE
DO 90 I=1,N
H=0.0
DO 91 J=1,N
91 H=H+B(J)*AT(I,J)
X(I)=H
90 CONTINUE
DO 100 I=1,N
BRE=0.0
DO 110 J=1,N
110 BRE=BRE+A(I,J)*X(J)
100 RELA(I)=(B(I)-BRE)/BRE*100.
RETURN
333 WRITE (6,666)
STOP
666 FORMAT (23H1(A) IS SINGULAR, C = 0)
END

```

```

SIMH0001
SIMH0002
SIMH0003
SIMH0004
SIMH0005
SIMH0006
SIMH0007
SIMH0008
SIMH0009
SIMH0010
SIMH0011
SIMH0012
SIMH0013
SIMH0014
SIMH0015
SIMH0016
SIMH0017
SIMH0018
SIMH0019
SIMH0020
SIMH0021
SIMH0022
SIMH0023
SIMH0024
SIMH0025
SIMH0026
SIMH0027
SIMH0028
SIMH0029
SIMH0030
SIMH0031
SIMH0032
SIMH0033
SIMH0034
SIMH0035
SIMH0036
SIMH0037
SIMH0038
SIMH0039
SIMH0040

```

```

SUBROUTINE PFCN(X,Y,U,V,L)
IMPLICIT REAL*8 (A-H,O-Z),INTEGER (I-N)
DIMENSION W287(4),W283(4)
C DATA W283/1.65068012 ,0.524647623,-0.524647623,-1.65068012 /
C DATA W287/0.0258826794,0.256212112,0.256212112,0.0258826794/
W283(1)=1.65068012
W283(2)=0.524647623
W283(3)=-0.524647623
W283(4)=-1.65068012
W287(1)=0.0258826794
W287(2)=0.256212112
W287(3)=0.256212112
W287(4)=0.0258826794
II=1
ASSIGN 244 TO J
C5=X
C6=Y
IF(C5.LT.0.0) GO TO 8
IF(C6.LT.0.0) GO TO 287
GO TO 11
8 IF(C6.GE.0.0) GO TO 14
ASSIGN 245 TO I
GO TO 20
11 ASSIGN 257 TO I
GO TO 46
14 ASSIGN 255 TO I
GO TO 46
20 Z=C6*C6-C5*C5
CO=DEXP(Z)
C7=CO+CO
CO=C5*C6
C9=CO+CO
C8=-C7*DSIN(C9)
C7=C7*DCOS(C9)
46 C5=DABS(C5)
C6=DABS(C6)
IF(C5.GE.6.0) GO TO 219
50 IF(C6.LE.0.5) GO TO 65
IF(C6.LE.3.0) GO TO 61
IF(C6.GT.6.0) GO TO 219
C9=0.5
GO TO 73
61 IF(C6.LE.1.5) GO TO 71
C9=0.25
GO TO 73
65 C10=C6
C6=0.5
ASSIGN 128 TO J
71 C9=0.09375
73 C11=0.0
C17=0.0
C18=0.0
ASSIGN 123 TO K
79 C21=C5-C11
C19=C21*C21
C20=C6*C6+C19
T=C11*C11
C19=DEXP(-T)/C20*0.318309886*C9
C17=C19*C6+C17
C18=C21*C19+C18
107 GO TO K,(108,123)
108 II=3-II
IF(II.EQ.1) GO TO 114

```

```

PFCN0001
PFCN0002
PFCN0003
PFCN0004
PFCN0005
PFCN0006
PFCN0007
PFCN0008
PFCN0009
PFCN0010
PFCN0011
PFCN0012
PFCN0013
PFCN0014
PFCN0015
PFCN0016
PFCN0017
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PFCN0050
PFCN0051
PFCN0052
PFCN0053
PFCN0054
PFCN0055
PFCN0056
PFCN0057
PFCN0058
PFCN0059
PFCN0060
PFCN0061
PFCN0062
PFCN0063

```

```

C11=-C11
GO TO 79
114 IF(-C11-4.0.GT.0.0) GO TO J,(128,244)
C11=-C11+C9
GO TO 79
123 I1=1
ASSIGN 108 TO K
C11=C9
GO TO 79
128 C11=C17
C12=C18
C9=2.0
C6=C10-0.5
C6=C6+C6
C10=C11/2.0
C13=(C5*C12+C10-0.564189584)*C6
C10=C12/2.0
C14=(-C5*C11+C10)*C6
C17=C11+C13
C18=C12+C14
165 C10=C6/C9
C19=C13/2.0
C19=C5*C14+C19
C15=(C6/2.0*C11+C19)*C10
C17=C15+C17
T1=C5*C13
C19=(C6*C12+C14)/2.0
C16=(-T1+C19)*C10
C18=C16+C18
T1=C17+C15
IF((T1-C17).NE.0.0) GO TO 207
T1=C18+C16
207 IF((T1-C18).EQ.0.0) GO TO 244
C11=C13
C12=C14
C13=C15
C14=C16
C9=C9+1.0
GO TO 165
219 C17=0.0
C18=0.0
DO 230 M=1,4
C12=C5-W283(M)
C11=C12*C12
C11=C6*C6+C11
C11=W287(M)/C11
C17=C11*C6+C17
C18=C11*C12+C18
230 CONTINUE
244 GO TO I,(245,249,255,257)
245 C8=-C8
C18=-C18
249 C17=C7-C17
C18=C8-C18
255 C18=-C18
257 U=C17
V=C18
L=0
RETURN
287 C5=-C5
ASSIGN 249 TO I
GO TO 20
END

```

```

PFCN0064
PFCN0065
PFCN0066
PFCN0067
PFCN0068
PFCN0069
PFCN0070
PFCN0071
PFCN0072
PFCN0073
PFCN0074
PFCN0075
PFCN0076
PFCN0077
PFCN0078
PFCN0079
PFCN0080
PFCN0081
PFCN0082
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PFCN0089
PFCN0090
PFCN0091
PFCN0092
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PFCN0095
PFCN0096
PFCN0097
PFCN0098
PFCN0099
PFCN0100
PFCN0101
PFCN0102
PFCN0103
PFCN0104
PFCN0105
PFCN0106
PFCN0107
PFCN0108
PFCN0109
PFCN0110
PFCN0111
PFCN0112
PFCN0113
PFCN0114
PFCN0115
PFCN0116
PFCN0117
PFCN0118
PFCN0119
PFCN0120
PFCN0121
PFCN0122
PFCN0123
PFCN0124
PFCN0125
PFCN0126

```

PROGRAM: AREAT

Version IBM 1800

C
C

MONITOR CONTROL CARDS IBM 1800
AREA PROGRAM

```
// JOB      X      X      X
// XEQ AREAT
*FILES(9,ARTC,2),(10,ARS1,2),(11,ARS2,2),(12,ARS3,2)
*LOCAL(AREIN,DPZTZ,SIMIN),(ARMAT,EPFCN,ESIMH),(AROUT,EPFEN)
*CCEND
```

C
C
C
C
C

PROGRAM 'AREAT'
AREA ANALYSIS PROGRAM OF S.E. ATTA AND J.A. HARVEY
FORTRAN IV VERSION IBM 1800

```
AREA0001
AREA0002
AREA0003
AREA0004
AREA0005
AREA0006
AREA0007
AREA0008
AREA0009
AREA0010
AREA0011
AREA0012
AREA0013
AREA0014
AREA0015
AREA0016
AREA0017
AREA0018
AREA0019
AREA0020
AREA0021
AREA0022
AREA0023
AREA0024
AREA0025
AREA0026
AREA0027

DIMENSION GN(15),EN(15),G(15),EL(15),IRO(16),IRN(15),T(1000),ATI(3
1,3),ZTT(3),TM(15),XX(15),SGMAT(15),RELA(15),AM(15,15),TA(1000),AC(
21000),F2A(2)
COMMON IMN,IO,IM,M,KI,ITMAX,IC,F,G1,G2,A,ON,AW,R,DIST,T1,DELAY,H0,
1RO,R1,PSA,BO,B1,VI,SIGP,COM1,COM4,SIG,IT,OSIGP,JK,ITC,IT1,IT2,IT3
2,L1,L2,L3,L4,KUNIT
COMMON GN,EN,G,EL,IRO,IRN,T,ATI,ZTT,TM,XX,SGMAT,RELA,AM,TA,AC,F2A
DEFINE FILE 9(1000,3,U,ITC)
DEFINE FILE 10(1000,3,U,IT1)
DEFINE FILE 11(1000,3,U,IT2)
DEFINE FILE 12(1000,3,U,IT3)
L2=0
L3=0
L4=0
KUNIT=0
1 CALL AREIN
CALL ARMAT
CALL AROUT
L2=L1
GO TO 1
END
```



```

SUBROUTINE AREIN
DIMENSION GN(15),EN(15),G(15),EL(15),IRO(16),IRN(15),T(1000),ATI(3
1,3),ZTT(3),TM(15),XX(15),SGMAT(15),RELA(15),AM(15,15),TA(1000),AC(
21000),F2A(2)
DIMENSION FE(2),ZTZ(3,3),CHEC(3,3),S(1000)
COMMON IMN,IO,IM,M,KI,ITMAX,IC,F,G1,G2,A,ON,AW,R,DIST,T1,DELAY,HO,
1RO,R1,PSA,B0,B1,VI,SIGP,COM1,COM4,SIG,IT,OSIGP,JK,ITC,IT1,IT2,IT3
2,L1,L2,L3,L4,KUNIT
COMMON GN,EN,G,EL,IRO,IRN,T,ATI,ZTT,TM,XX,SGMAT,RELA,AM,TA,AC,F2A
EQUIVALENCE (T(1),S(1))
READ (5,2) L1,L4,F2A,FE
2 FORMAT(2I6,2A4,2A4)
IF(L1)4,4,3
4 IF(L3) 22,22,23
22 CALL EXIT
23 WRITE(KUNIT,99)L1
99 FORMAT(I5)
END FILE KUNIT
CALL EXIT
3 WRITE (6,1) F2A
1 FORMAT(35H1AREA ANALYSIS OF TRANSMISSION DATA/4HORUN,4X,2A4)
READ (5,6) IMN,IO,IM,M,KI,ITMAX,IC,F,G1,G2
6 FORMAT(7I5,3E12.6)
FG1=F*G1
FG2=F*G2
IF(IC)46,45,46
45 READ (5,47) (ZTT(K) ,K=1,3)
47 FORMAT(3E12.6)
46 READ (5,7) (IRO(J), IRN(J),G(J), EL(J), GN(J),J=1,M)
7 FORMAT(2I5,3E12.6)
IT=0
IF(L2-L1)251,252,251
251 READ (5,8) A,ON,AW,R,DIST,T1,DELAY,HO,RO,R1, PSA
8 FORMAT(6E12.6)
B0=(RO*T1-R1*DELAY)/(72.3*DIST*.8325)
B1=R1/.8325
READ(5,9)(S(I),I=1,IMN)
9 FORMAT(2(I2X,E12.5,12X))
DO 70 K=1,IMN
T(K)=EXP(-ON*S(K))
70 CONTINUE
252 VI=(72.3*DIST)**2
WRITE (6,260) FE
260 FORMAT(8HOELEMENT,2X,2A4)
WRITE (6,31)
31 FORMAT(//)14X,' INITIAL GUESSES OF GNO'//)
WRITE (6,32) ( GN(J),J=1,M)
32 FORMAT ( 20X,E12.5)
CALL CLOCK(ITIME)
KHOUR=ITIME/1000
KMINU=ITIME-KHOUR*1000
KMINU=KMINU*.06
WRITE(6,911)KHOUR,KMINU
911 FORMAT(/,' TIME AT THE BEGIN OF CYCLE 1 ',I4,'.',I2,/)
DO15J=1,M
SGMAT(J)=0.0
SIO=EL(J)
EN(J)=VI/(SIO*T1+DELAY)**2
IROJ=IRO(J)
IRNJ=IRN(J)
DO10I=IROJ,IRNJ
SGMAT(J)=T(I)+SGMAT(J)
10 CONTINUE

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AREI0050
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AREI0055
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AREI0057
AREI0058
AREI0059
AREI0060
AREI0061
AREI0062
AREI0063

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	IF(GN(J))12,11,15	AREI0064
12	GOTO284	AREI0065
11	ILJ=EL(J)	AREI0066
	EI=EN(J)	AREI0067
	BI=B1*EI+B0*(EI**1.5)	AREI0068
	DELTA=HO*SQRT (EI/AW)	AREI0069
	GNJ=0.62+(1.66*SQRT (DELTA*DELTA+BI*BI))/G(J)	AREI0070
	TIROJ=T(IROJ)	AREI0071
	TIRNJ=T(IRNJ)	AREI0072
	IF(TIROJ-TIRNJ)17,17,18	AREI0073
18	TIRNJ=TIROJ	AREI0074
17	TILJ=T(ILJ)	AREI0075
	IF(TILJ)13,13,14	AREI0076
13	TILJ=0.001	AREI0077
	GO TO 16	AREI0078
14	IF(TILJ-0.001)13,16,16	AREI0079
16	GN(J)=-((SQRT (EN(J)))*G(J)*(ALOG (TILJ)-ALOG(TIRNJ)))/(ON* 12.608E6))*(GNJ)	AREI0080
15	CONTINUE	AREI0081
	IF(KI)286,220,286	AREI0082
220	DO218J=1,M	AREI0083
	K3=3.0/(RO+EL(J)*R1)	AREI0084
	IF(KI-K3)221,222,222	AREI0085
221	KI=K3	AREI0086
222	K3=6.0*T1*EN(J)/((EL(J)*T1+DELAY)*(1.665*HO*SQRT (EN(J)/AW)+G(J)))	AREI0087
	IF(KI-K3)223,218,218	AREI0088
223	KI=K3	AREI0089
218	CONTINUE	AREI0090
	KI=KI+1	AREI0091
286	KIF=KI	AREI0092
219	IFL=(1000/KI)	AREI0093
	DO267J=1,M	AREI0094
	K3=5.0/(RO+EL(J)*R1)	AREI0095
	IF((IRN(J)-IRO(J)+1)-(IFL-K3))267,267,268	AREI0096
268	KI=KI-1	AREI0097
	IF(KI)280,280,219	AREI0098
267	CONTINUE	AREI0099
	IF(KI-KIF)283,281,281	AREI0100
280	WRITE (6,282)	AREI0101
282	FORMAT(16HOCOMPUTED I.F.=0)	AREI0102
	GO TO 284	AREI0103
283	WRITE (6,269) KIF	AREI0104
269	FORMAT(36HOTHERE HAS BEEN A REDUCTION IN I.F.=13)	AREI0105
281	SIGP=12.566368*R*R	AREI0106
	OSIGP=EXP (-ON*SIGP)	AREI0107
	COM1=SQRT (AW)/HO	AREI0108
	COM4=A*2.86239E3	AREI0109
	SIG=(-2.0*ON*1.7724538)	AREI0110
	IRO(M+1)=IM	AREI0111
	M1=M+1	AREI0112
	IF(IC)21,48,21	AREI0113
21	CALLDPZTZ(I0,M1,IRO,IRN,DELAY,T1,DIST,ZTZ)	AREI0114
	IF(IC-1)12,225,224	AREI0115
225	ATI(1,1)=1.0/ZTZ(1,1)	AREI0116
	GO TO 48	AREI0117
224	CALL SIMIN (ZTZ,ATI,IC,40,CHEC)	AREI0118
48	RETURN	AREI0119
284	WRITE (6,285)	AREI0120
285	FORMAT(52HOCOMPUTATIONS STOPPED DUE TO DETECTION OF ERROR NR.1)	AREI0121
	CALL EXIT	AREI0122
	END	AREI0123
		AREI0124

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SUBROUTINE ARMAT
DIMENSION GN(15),EN(15),G(15),EL(15),IRO(16),IRN(15),T(1000),ATI(3
1,3),ZTT(3),TM(15),XX(15),SGMAT(15),RELA(15),AM(15,15),TA(1000),AC
21000),F2A(2)
DIMENSION SIGTC(200),SIGT1(200),SIGT2(200),SIGT3(200),AT(15,15),Z
13)
COMMON IMN,IO,IM,M,KI,ITMAX,IC,F,G1,G2,A,ON,AW,R,DIST,T1,DELAY,HO,
1RO,R1,PSA,B0,B1,VI,SIGP,COM1,COM4,SIG,IT,OSIGP,JK,ITC,IT1,IT2,IT3
2,L1,L2,L3,L4,KUNIT
COMMON GN,EN,G,EL,IRO,IRN,T,ATI,ZTT,TM,XX,SGMAT,RELA,AM,TA,AC,F2A
M1=M+1
19 DO41L=1,3
ZTT(L)=0.0
41 CONTINUE
DO50J=1,M1
IF(J-1)51,52,53
51 GOTO284
52 IRNJ1=IO
GOTO54
53 IRNJ1=IRN(J-1)
M2=J-1
DO 34 J1=1,M2
IF(IRNJ1-IRN(J1))37,34,34
37 IRNJ1=IRN(J1)
34 CONTINUE
54 IROJ=IRO(J)
IF(IROJ-IRNJ1-1)50,50,55
55 DO57I=IRNJ1,IROJ
SIO=I
SE=(SIO*T1+DELAY)/(72.3*DIST)
E=VI/(SIO*T1+DELAY)**2
EI=6.52E5*SE
GE=0.0
DO56K=1,M
ENE=EN(K)-E
GE=GE+(GN(K)*(EI*G(K)-5.72478E3*ENE*A)/(ENE**2+(G(K)/2.0)**2))
56 CONTINUE
TE=T(1)*EXP(ON*(SIGP+GE))
ZTT(1)=ZTT(1)+TE
IF(IC-1)702,57,700
700 ZTT(2)=ZTT(2)+(TE*SE)
IF(IC-2)702,57,701
702 GOTO284
701 ZTT(3)=ZTT(3)+(TE/E)
57 CONTINUE
50 CONTINUE
Z(1)=ZTT(1)
Z(2)=ZTT(2)
Z(3)=ZTT(3)
ZTT(1)=ATI(1,1)*Z(1)+ATI(1,2)*Z(2)+ATI(1,3)*Z(3)
IF(IC-1)350,48,353
350 GOTO284
353 ZTT(2)=ATI(2,1)*Z(1)+ATI(2,2)*Z(2)+ATI(2,3)*Z(3)
IF(IC-2)350,48,355
355 ZTT(3)=ATI(3,1)*Z(1)+ATI(3,2)*Z(2)+ATI(3,3)*Z(3)
48 DO70J=1,M
IROJ=IRO(J)
IRNJ=IRN(J)
TM(J)=0.0
DO75JJ=1,M
AM(J,JJ)=0.0
75 CONTINUE
SIO=IROJ

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	EIROJ=VI/(SIO*T1+DELAY)**2	ARMA0064
	SIO=IRNJ	ARMA0065
	EIRNJ=VI/(SIO*T1+DELAY)**2	ARMA0066
	EIROJ=EIROJ+(4.0*(B1*EIROJ+B0*(EIROJ**1.5)))	ARMA0067
	EIRNJ=EIRNJ-(4.0*(B1*EIRNJ+B0*(EIRNJ**1.5)))	ARMA0068
	INT=((SQRT(VI/EIRNJ)-SQRT(VI/EIROJ))/T1)	ARMA0069
	INT=INT*K1	ARMA0070
	IF((INT/2)**2-INT)77,78,76	ARMA0071
76	GOTO284	ARMA0072
77	INT=INT+1	ARMA0073
78	EINT=INT	ARMA0074
	H=(EIROJ-EIRNJ)/EINT	ARMA0075
	Y=EIRNJ	ARMA0076
	HH=H*H	ARMA0077
	HH2=HH+HH	ARMA0078
	H31=(H/2.0)	ARMA0079
	H32=H	ARMA0080
	INT1=INT+1	ARMA0081
	KPAR=1	ARMA0082
	ITC=1	ARMA0083
	IT1=1	ARMA0084
	IT2=1	ARMA0085
	IT3=1	ARMA0086
611	INTP=INT1	ARMA0087
	IF(INTP-200)607,607,608	ARMA0088
607	INT2=INTP	ARMA0089
	GO TO 609	ARMA0090
608	INT2=200	ARMA0091
609	DO80IJ=1,INT2	ARMA0092
	CON=1.0/SQRT(Y)	ARMA0093
	COM2=1.0/(COM1*2.0*Y)	ARMA0094
	COM3=COM1*CON	ARMA0095
	SIGMA=SIG*COM3	ARMA0096
	CON=6.52E5*CON	ARMA0097
	COM2=6.52E5*COM2	ARMA0098
	L=0	ARMA0099
	SUMJ=0.0	ARMA0100
	DO84JY=1,M	ARMA0101
	SXI=COM3*(Y-EN(JY))	ARMA0102
	ETA=COM3*G(JY)/2.0	ARMA0103
	CALL EPFCN(SXI,ETA,U,V,L)	ARMA0104
	SOM=(CON+COM2*SXI)*U-(COM2*ETA-COM4)*V	ARMA0105
	SUMJ=SUMJ+GN(JY)*SOM	ARMA0106
	IF(J-1)81,82,83	ARMA0107
81	GOTO284	ARMA0108
83	IF(JY-(J-1))84,85,82	ARMA0109
85	F1=SIGMA*SOM	ARMA0110
	GOTO84	ARMA0111
82	IF(JY-J)84,88,89	ARMA0112
88	F2=SIGMA*SOM	ARMA0113
	GOTO84	ARMA0114
89	IF(JY-(J+1))84,87,84	ARMA0115
87	F3=SIGMA*SOM	ARMA0116
84	CONTINUE	ARMA0117
	ONE=EXP(SIGMA*SUMJ)	ARMA0118
	SIGTC(IJ)=ONE	ARMA0119
	SIGT1(IJ)=ONE*F1	ARMA0120
	SIGT2(IJ)=ONE*F2	ARMA0121
	SIGT3(IJ)=ONE*F3	ARMA0122
	Y=Y+H	ARMA0123
80	CONTINUE	ARMA0124
	IF(INTP-200)613,613,614	ARMA0125
613	INTF=1	ARMA0126

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GO TO 615
614 WRITE(9,ITC) (SIGTC(KA),KA=1,200)
    WRITE(10,IT1)(SIGT1(KA),KA=1,200)
    WRITE(11,IT2)(SIGT2(KA),KA=1,200)
    WRITE(12,IT3)(SIGT3(KA),KA=1,200)
    INTP=INTP-200
    IF(INTP) 610,610,611
610 INTF=ITC-200
    ITC=INTF
    IT1=INTF
    IT2=INTF
    IT3=INTF
    READ(9,ITC) (SIGTC(KA), KA=1,200)
    READ(10,IT1)(SIGT1(KA), KA=1,200)
    READ(11,IT2) (SIGT2 (KA), KA=1,200)
    READ(12,IT3) (SIGT3 (KA), KA=1,200)
615 DO90I=IROJ,IRNJ
    SIO=I
    EI=VI/(SIO*T1+DELAY)**2
    BI=B1*EI+B0*(EI**1.5)
    BI2=BI*BI
    CI=ZTT(1)
    IF(IC-1)303,304,303
303 CI=CI+(ZTT(2)/(SQRT (EI)))
    IF(IC-2)305,304,305
305 CI=CI+(ZTT(3)/EI)
304 ACI=CI*OSIGP
    CI=CI/(BI*1.772454)
    EIRO=4.0*BI
    EIRN=EI-EIRO
    EIRO=EI+EIRO
    IN=(EIROJ-EIRN)/H
    SIN=IN
    EIRN=EIROJ-SIN*H
    INT=(EIRO-EIRN)/H
    IF((INT/2)*2-INT)401,402,400
400 GOTO284
401 INT=INT-1
402 INTK=INTF-1
    IJS=INT1-INTK-IN
    IJM=IJS+INT
    IF(IJS)606,606,612
606 I=I-1
    GO TO 605
612 EA=EXP (-((EI-EIRN)/BI)**2)
    EAH=EXP ((2.0*(EI-EIRN)*H-HH)/BI2)
    EHH2=EXP (-HH2/BI2)
    TM1=0.0
    AM1=0.0
    AM2=0.0
    AM3=0.0
    DO 95 IJ=IJS,IJM
    IF(IJS-IJ)68,64,86
86 GOTO284
64 ONE=EA*H31
    GOTO 407
68 IF(IJ-IJM)406,64,86
406 ONE=EA*H32
407 TM1=TM1+SIGTC(IJ)*ONE
    IF(J-1)93,92,91
91 AM1=AM1+SIGT1(IJ)*ONE
92 AM2=AM2+SIGT2(IJ)*ONE
    AM3=AM3+SIGT3(IJ)*ONE

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	EA=EA*EAH	ARMA0190
	EAH=EAH*EHH2	ARMA0191
95	CONTINUE	ARMA0192
	TM(J)=TM(J)+TM1*CI	ARMA0193
	TM1=TM1*CI*OSIGP	ARMA0194
	IF(J-1)93,96,97	ARMA0195
97	AM(J,J-1)=AM(J,J-1)+AM1*CI	ARMA0196
96	AM(J,J)=AM(J,J)+AM2*CI	ARMA0197
	IF(J+1-M)110,110,112	ARMA0198
110	AM(J,J+1)=AM(J,J+1)+AM3*CI	ARMA0199
112	TA(1)=TM1	ARMA0200
	AC(1)=AC1	ARMA0201
	IF(IJS-10)604,604,617	ARMA0202
604	IF(INTF-1)284,617,605	ARMA0203
617	GO TO 90	ARMA0204
605	INTF=INTF-100	ARMA0205
	ITC=INTF	ARMA0206
	IT1=INTF	ARMA0207
	IT2=INTF	ARMA0208
	IT3=INTF	ARMA0209
	READ(9,ITC)(SIGTC(KA),KA=1,200)	ARMA0210
	READ(10,IT1)(SIGT1(KA),KA=1,200)	ARMA0211
	READ(11,IT2)(SIGT2(KA),KA=1,200)	ARMA0212
	READ(12,IT3)(SIGT3(KA),KA=1,200)	ARMA0213
90	CONTINUE	ARMA0214
	TM(J)=SGMAT(J)-OSIGP*TM(J)	ARMA0215
	IF(J-1)93,98,99	ARMA0216
99	AM(J,J-1)=OSIGP*AM(J,J-1)	ARMA0217
98	AM(J,J)=OSIGP*AM(J,J)	ARMA0218
	IF(J+1-M)111,111,70	ARMA0219
111	AM(J,J+1)=OSIGP*AM(J,J+1)	ARMA0220
70	CONTINUE	ARMA0221
	DO 800 JR=1,M	ARMA0222
	IROJ=IRO(JR)	ARMA0223
	IRNJ=IRN(JR)	ARMA0224
	SRJ=IRNJ-IROJ+1	ARMA0225
	SRJ=SQRT(SRJ)	ARMA0226
	TIROJ=T(IROJ)	ARMA0227
	TIRNJ=T(IRNJ)	ARMA0228
	IF(TIROJ-TIRNJ)385,385,386	ARMA0229
386	TIRNJ=TIROJ	ARMA0230
385	IF(ABS(TM(JR))-0.001*PSA*SRJ*TIRNJ)800,800,100	ARMA0231
93	GOTO284	ARMA0232
800	CONTINUE	ARMA0233
	JK=1	ARMA0234
	RETURN	ARMA0235
100	IF(IT-ITMAX)101,501,501	ARMA0236
501	JK=2	ARMA0237
	RETURN	ARMA0238
101	IT=IT+1	ARMA0239
	IF(M-1)93,107,108	ARMA0240
107	XX(1)=TM(1)/AM(1,1)	ARMA0241
	GOTO109	ARMA0242
108	CALL ESIMH(AM,AT,TM,XX,M,40,RELA)	ARMA0243
109	DO102J=1,M	ARMA0244
	GN(J)=GN(J)+XX(J)	ARMA0245
102	CONTINUE	ARMA0246
	WRITE(6,911)IT	ARMA0247
911	FORMAT(//,10X,'GNO VALUES AFTER ITERATION',I2/)	ARMA0248
	WRITE(6,910)(GN(J),J=1,M)	ARMA0249
910	FORMAT(20X,E12.5)	ARMA0250
	CALL CLOCK(ITIME)	ARMA0251
	KHOUR=ITIME/1000	ARMA0252

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KMINU=ITIME-KHOUR*1000
KMINU=KMINU*.06
WRITE(6,912)KHOUR,KMINU
912 FORMAT( /, ' TIME AT THE END OF THIS ITERATION',I4,'.',I2,/)
DO 270 J=1,M
IF(GN(J))271,270,270
270 CONTINUE
IF(IC)19,48,19
271 JK=3
RETURN
284 WRITE (6,285)
285 FORMAT(52HOCOMPUTATIONS STOPPED DUE TO DETECTION OF ERROR NR.2)
CALL EXIT
END
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ARMA0253
ARMA0254
ARMA0255
ARMA0256
ARMA0257
ARMA0258
ARMA0259
ARMA0260
ARMA0261
ARMA0262
ARMA0263
ARMA0264
ARMA0265
ARMA0266
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SUBROUTINE AROUT
DIMENSION GN(15),EN(15),G(15),EL(15),IRO(16),IRN(15),T(1000),ATI(3
1,3),ZTT(3),TM(15),XX(15),SGMAT(15),RELA(15),AM(15,15),TA(1000),AC(
21000),F2A(2)
DIMENSION SIGTC(1000)
COMMON IMN,IO,IM,M,KI,ITMAX,IC,F,G1,G2,A,ON,AW,R,DIST,T1,DELAY,HO,
IRO,R1,PSA,B0,B1,VI,SIGP,COM1,COM4,SIG,IT,OSIGP,JK,ITC,IT1,IT2,IT3
2,L1,L2,L3,L4,KUNIT
COMMON GN,EN,G,EL,IRO,IRN,T,ATI,ZTT,TM,XX,SGMAT,RELA,AM,TA,AC,F2A
FG1=F*G1
FG2=F*G2
GO TO (504,501,271),JK
271 DO 272 J=1,M
GN(J)=GN(J)-XX(J)
272 CONTINUE
IT=IT-1
WRITE (6,274)
274 FORMAT(31H0 STOPPED ON NEGATIVE GAMMA N 0)
WRITE (6,273)
273 FORMAT(17H0 DELTA GAMMA N 0)
WRITE (6,278) ( TM(J),J=1,M)
278 FORMAT(1E14.6)
GO TO 504
501 WRITE (6,500)
500 FORMAT(41H0 STOPPED ON MAXIMUM NUMBER OF ITERATIONS)
504 M1=M+1
DO505J=1,M1
IF(J-1)284,390,391
390 IRNJ=IO
GOTO392
391 IRNJ=IRN(J-1)
M2=J-1
DO393J1=1,M2
IF(IRNJ-IRN(J1))394,393,393
394 IRNJ=IRN(J1)
393 CONTINUE
392 IROJ=IRO(J)
IF(IROJ-IRNJ-1)505,396,396
396 SIO=IROJ
EIROJ=VI/(SIO*T1+DELAY)**2
SIO=IRNJ
EIRNJ=VI/(SIO*T1+DELAY)**2
EIROJ=EIROJ-(4.0*(B1*EIROJ+B0*(EIROJ**1.5)))
EIRNJ=EIRNJ+(4.0*(B1*EIRNJ+B0*(EIRNJ**1.5)))
INT=((-SQRT (VI/EIRNJ)+SQRT (VI/EIROJ))/T1)
INT=INT*KI
IF((INT/2)*2-INT)201,202,203
203 GOTO284
201 INT=INT+1
202 EINT=INT
H=(-EIROJ+EIRNJ)/EINT
Y=EIROJ
HH=H*H
HH2=HH+HH
H31=(H/2.0)
H32=H
INT1=INT+1
DO204I=1,INT1
CON=1.0/SQRT (Y)
COM2=1.0/(COM1*2.0*Y)
COM3=COM1*CON
SIGMA=SIG*COM3
CON=6.52E5*CON

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AROU0050
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AROU0055
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AROU0059
AROU0060
AROU0061
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AROU0063

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COM2=6.52E5*COM2
L=0
SUMJ=0.0
DO205 JY=1,M
SXI=COM3*(Y-EN(JY))
ETA=COM3*G(JY)/2.0
CALL EPFEN(SXI,ETA,U,V,L)
SOM=(CON+COM2*SXI)*U-(COM2*ETA-COM4)*V
205 SUMJ=SUMJ+GN(JY)*SOM
ONE=EXP(SIGMA*SUMJ)
SIGTC(I)=ONE
204 Y=Y+H
DO206 I=IRNJ,IROJ
SIO=I
EI=VI/(SIO*T1+DELAY)**2
BI=B1*EI+B0*(EI**1.5)
BI2=BI*BI
CI=ZTT(1)
IF(IC-1)207,208,207
207 CI=CI+(ZTT(2)/(SQRT(EI)))
IF(IC-2)209,208,209
209 CI=CI+(ZTT(3)/EI)
208 ACI=CI*OSIGP
CI=CI/(BI*1.772454)
EIRO=4.0*BI
EIRN=EI-EIRO
EIRO=EI+EIRO
IN=(EIRNJ-EIRN)/H
SIN=IN
EIRN=EIRNJ-SIN*H
INT=(EIRO-EIRN)/H
IF((INT/2)*2-INT)210,211,212
212 GOTO284
210 INT=INT-1
211 IJS=INT1-IN
IJM=IJS+INT
EA=EXP(-((EI-EIRN)/BI)**2)
EAH=EXP((2.0*(EI-EIRN)*H-HH)/BI2)
EHH2=EXP(-HH2/BI2)
TM1=0.0
DO213 IJ=IJS,IJM
IF(IJS-IJ)214,215,212
215 ONE=EA*H31
GOTO217
214 IF(IJ-IJM)216,215,212
216 ONE=EA*H32
217 TM1=TM1+SIGTC(IJ)*ONE
EA=EA*EAH
213 EAH=EAH*EHH2
TM1=TM1*CI*OSIGP
TA(I)=TM1
AC(I)=ACI
206 CONTINUE
505 CONTINUE
DO 750 J=1,M
IROJ=IRO(J)
IRNJ=IRN(J)
C2C1=IRNJ-IROJ+1
TIROJ=T(IROJ)
TIRNJ=T(IRNJ)
IF(TIROJ-TIRNJ)387,387,388
388 TIRNJ=TIROJ
387 SGMAT(J)=(PSA*TIRNJ*SQRT(C2C1**2/ABS(AM(J,J)))

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AROU0080
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AROU0115
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AROU0121
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AROU0123
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AROU0125
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750 CONTINUE
WRITE (6,105) IT
105 FORMAT(24H0 NUMBER OF ITERATIONS I2)
WRITE (6,23)
23 FORMAT(120H0 C1 C2 GAMMA CO E0
1FGXGNO GNO(FG1) GNO(FG2) O/D ERROR GN(FG1) GN(FG2))
DO375J=1,M
PCE=SGMAT (J)/GN(J)
GN01=GN(J)/FG1
GN02=GN(J)/FG2
ENJ=SQRT (EN(J))
GN1=GN01*ENJ
GN2=GN02*ENJ
WRITE (6,24) IRO(J), IRN(J), G(J), EL(J), EN(J),
1GN(J),GN01,GN02,PCE,GN1,GN2
24 FORMAT(1H02I6,E12.4,2E13.5,3E12.4,E09.2,2E12.4)
375 CONTINUE
WRITE (6,779)
7790FORMAT(//'ORELATIVE ACCURACY (PER CENT) OF THE SOLUTION OF THE SYS
ITEM OF LINEAR EQUATIONS')
WRITE (6,777) (RELA(I),I=1,M)
777 FORMAT (15X,E15.7)
SIO=IO
SE=(SIO*T1+DELAY)/(72.3*DIST)
E=SE**2
RCF=(R*R-(ALOG (ZTT(1)+ZTT(2)*SE+ZTT(3)*E)/
1(ON*12.566368)))
IF(RCF)261,261,262
261 RCF=0.0
GOTO263
262 RCF=SQRT (RCF)
263 SIO=IM
SE=(SIO*T1+DELAY)/(72.3*DIST)
E=SE**2
RCL=(R*R-(ALOG (ZTT(1)+ZTT(2)*SE+ZTT(3)*E)/
1(ON*12.566368)))
IF(RCL)264,264,265
264 RCL=0.0
GO TO 266
265 RCL=SQRT (RCL)
266 WRITE(6,113) A,ZTT(1),ON,ZTT(2),AW,ZTT(3),R,RCF,RCL,DIST,F,T1,G1,D
1ELAY,G2,H0,FG1,B0,FG2,B1,IMN,IO,IM,M,K1,ITMAX,IC
1130FORMAT ('OA=',E12.5,20X,'KO=',E14.6/' N=',E12.5,20X,'K1=',E14.6/'
1AW=',E12.5,19X,'K2=',E14.6/' R=',E12.5,8X,'CORRECTED R(CF)',E12.5,
2', CORRECTED R(CL)',E12.6/' DIST=',E12.5,17X,'F=',E12.5/' T=',
3E12.5,20X,'G1=',E12.5/' T DELAY=',E12.5,14X,'G2=',E12.5/' DO=',E12
4.5,19X,'FG1=',E12.5/' B0=',E12.5,19X,'FG2=',E12.5/' B1=',E12.5/'
5CN=',14/' CF=',14/' CL=',14/' NO=',14/' IF=',14/' IM=',14/' K=',14)
WRITE(6,114)RO,R1,PSA
114 FORMAT(' RO=',E12.5/' R1=',E12.5/' PSA=',E12.5)
JJ1=0
WRITE (6,1900)
1900 FORMAT (1H1/8X,4HOBBS.,16X,5HCALC.,15X,5HBASIS,15X,4HCHAN///)
DO 1901 I=10,IM
WRITE (6,1902) T(I), TA(I), AC(I), I
1902 FORMAT (5X,F10.4,10X,F10.4,10X,F10.4,10X,I10)
IF (I-IM) 1903,1901,1901
1903 JJ1=JJ1+1
IF (JJ1/55-1) 1901,1907,1901
1907 JJ1=0
WRITE (6,1900)
1901 CONTINUE
IF(L4)1911,1911,1909

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AROU0128
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AROU0188
AROU0189

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1909 L3=L4
      IF(KUNIT)1913,1913,1914
1913 READ(5,1) KUNIT
      1 FORMAT(I5)
1914 WRITE(KUNIT,1)L1
      WRITE (KUNIT,2)IMN,IO,IM,M,VI,DELAY,T1,F2A
      2 FORMAT(4I5,3E12.5,2A4)
      WRITE(KUNIT,3) (IRO(I),I=1,M)
      3 FORMAT(20I4)
      WRITE(KUNIT,3) (IRN(I),I=1,M)
      WRITE(KUNIT,4) (T(I),I=IO,IM)
      4 FORMAT(8E10.3)
      WRITE(KUNIT,4)(TA(I),I=IO,IM)
      WRITE(KUNIT,4) (AC(I),I=IO,IM)
      WRITE (6,5)
      5 FORMAT (///' DATA FOR PLOT READY ON TAPE'////)
      GO TO 1908
1911 WRITE(6,6)
      6 FORMAT (///' NO PLOT IS DEMANDED'////)
1908 RETURN
284 WRITE (6,285)
285 FORMAT(52HOCOMPUTATIONS STOPPED DUE TO DETECTION OF ERROR NR.3)
      CALL EXIT
      END

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AROU0190
AROU0191
AROU0192
AROU0193
AROU0194
AROU0195
AROU0196
AROU0197
AROU0198
AROU0199
AROU0200
AROU0201
AROU0202
AROU0203
AROU0204
AROU0205
AROU0206
AROU0207
AROU0208
AROU0209
AROU0210
AROU0211
AROU0212
AROU0213

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SUBROUTINE DPZTZ (IO,M1,IRO,IRN,DELAY,T1,DIST,ZTZ)
DIMENSION IRO(16),IRN(15), ZTZ(3,3),SUME(5)
DO 1 K=1,5
1 SUME(K)=0.
DO 2 J=1,M1
IF(J-1) 6,7,8
6 GO TO 20
7 IRNJ=IO
GO TO 9
8 IRNJ=IRN(J-1)
M2=J-1
DO 16 J1=1,M2
IF(IRNJ-IRN(J))15,16,16
15 IRNJ=IRN(J1)
16 CONTINUE
9 IROJ=IRO(J)
IF(IROJ-IRNJ-1) 2,2,3
3 DO 13 I=IRNJ,IROJ
SI=I
DSE=(SI*T1+DELAY)/(72.3*DIST)
DE=DSE**2
SUME(1)=SUME(1)+1.
SUME(2)=SUME(2)+DSE
SUME(3)=SUME(3)+DE
SUME(4)=SUME(4)+DSE*DE
SUME(5)=SUME(5)+DE*DE
13 CONTINUE
2 CONTINUE
DO 20 L=1,3
DO 20 N=1,3
K=L+N-1
ZTZ(L,N)=SUME(K)
20 CONTINUE
RETURN
END

```

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DPZT0001
DPZT0002
DPZT0003
DPZT0004
DPZT0005
DPZT0006
DPZT0007
DPZT0008
DPZT0009
DPZT0010
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DPZT0012
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DPZT0030
DPZT0031
DPZT0032
DPZT0033
DPZT0034
DPZT0035

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SUBROUTINE SIMIN (A,AT,N,ITER,CHEC)
DIMENSION A(3,3),AT(3,3),CHEC(3,3)
1 DO 2 I=1,N
  DO 2 J=1,N
2 AT(I,J)=A(J,I)
DO 80 IL=1,ITER
DO 80 I=1,N
  C=0.
  DO 10 K=1,N
10 C=C+A(I,K)*AT(K,I)
  IF(C) 20,333,20
20 CONTINUE
  DO 30 J=1,N
30 AT(J,I)=AT(J,I)/C
  DO 70 J=1,N
  IF(J-I) 40,70,40
40 H=0.
  DO 50 K=1,N
50 H=H+A(I,K)*AT(K,J)
  DO 60 K=1,N
60 AT(K,J)=AT(K,J)-H*AT(K,I)
70 CONTINUE
80 CONTINUE
  DO 90 J=1,N
  DO 91 JJ=1,N
  CHEC (J,JJ)=0.0
  DO 92 I=1,N
92 CHEC (J,JJ)=CHEC (J,JJ)+A(JJ,I)*AT(I,J)
91 CONTINUE
90 CONTINUE
  RETURN
333 WRITE (6,666)
666 FORMAT (23H1(A) IS SINGULAR, C = 0)
  CALL EXIT
  END

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SIMI0001
SIMI0002
SIMI0003
SIMI0004
SIMI0005
SIMI0006
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SIMI0033
SIMI0034
SIMI0035

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SUBROUTINE ESIMH(A,AT,B,X,N,ITER,RELA)
DIMENSION A(15,15),AT(15,15),B(15),X(15),RELA(15)
1 DO 2 I=1,N
DO 2 J=1,N
2 AT(I,J)=A(J,I)
DO 80 IL=1,ITER
DO 80 I=1,N
C=0.
DO 10 K=1,N
10 C=C+A(I,K)*AT(K,I)
IF(C) 20,333,20
20 CONTINUE
DO 30 J=1,N
30 AT(J,I)=AT(J,I)/C
DO 70 J=1,N
IF(J-1)40,70,40
40 H=0.
DO 50 K=1,N
50 H=H+A(I,K)*AT(K,J)
DO 60 K=1,N
60 AT(K,J)=AT(K,J)-H*AT(K,I)
70 CONTINUE
80 CONTINUE
DO 90 I=1,N
H=0.0
DO 91 J=1,N
91 H=H+B(J)*AT(I,J)
X(I)=H
90 CONTINUE
DO 100 I=1,N
BRE=0.0
DO 110 J=1,N
110 BRE=BRE+A(I,J)*X(J)
100 RELA(I)=(B(I)-BRE)/BRE*100.
RETURN
333 WRITE (6,666)
STOP
666 FORMAT (23H1(A) IS SINGULAR, C = 0)
END

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ESIM0001
ESIM0002
ESIM0003
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ESIM0036
ESIM0037
ESIM0038
ESIM0039

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C
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C

PFCN YIELDS REAL AND IMAGINARY PART OF THE COMPLEX
PROBABILITY INTEGRAL

```
SUBROUTINE EPFEN (X,Y,U,V,L)
DIMENSION W287(4),W283(4)
DATA W283/1.65068012,0.524647623,-0.524647623,-1.65068012 /
DATA W287/0.0258826794,0.256212112,0.256212112,0.0258826794/
II=1
J=2
C5=X
C6=Y
300 IF(C5)8,300,300
8 IF(C6)287,11,11
301 IF(C6)301,14,14
I=1
GO TO 20
11 I=4
GO TO 46
14 I=3
GO TO 46
20 Z=C6*C6-C5*C5
CO=EXP(Z)
C7=CO+CO
CO=C5*C6
C9=CO+CO
C8=-C7*SIN(C9)
C7=C7*COS(C9)
46 C5=ABS(C5)
C6=ABS(C6)
IF(C5- 6.0)50,219,219
50 IF(C6- 0.5)65,65,302
302 IF(C6- 3.0)61,61,303
303 IF(C6- 6.0)304,304,219
304 C9=0.5
GO TO 73
61 IF(C6- 1.5)71,71,305
305 C9=0.25
GO TO 73
65 C10=C6
C6=0.5
J=1
71 C9=0.09375
73 C11=0.0
C18=0.0
K=2
C17=0.0
79 C21=C5-C11
C19=C21*C21
C20=C6*C6+C19
T=C11*C11
C19=EXP(-T)/C20*0.318309886*C9
C17=C19*C6+C17
C18=C21*C19+C18
GO TO (108,123),K
108 II=3-II
IF(II- 1)306,114,306
306 C11=-C11
GO TO 79
114 IF(-C11-4.0) 307,307,308
308 GO TO (128,244),J
307 C11=-C11+C9
GO TO 79
```

EPFE0001
EPFE0002
EPFE0003
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EPFE0059
EPFE0060
EPFE0061
EPFE0062
EPFE0063

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123 II=1
    K=1
    C11=C9
    GO TO 79
128 C11=C17
    C12=C18
    C9=2.0
    C6=C10-0.5
    C6=C6+C6
    C10=C11/2.0
    C13=(C5*C12+C10-0.564189584)*C6
    C10=C12/2.0
    C14=(-C5*C11+C10)*C6
    C17=C11+C13
    C18=C12+C14
165 C10=C6/C9
    C19=C13/2.0
    C19=C5*C14+C19
    C15=(C6/2.0*C11+C19)*C10
    C17=C15+C17
    T1=C5*C13
    C19=(C6*C12+C14)/2.0
    C16=(-T1+C19)*C10
    C18=C16+C18
    T1=C17+C15
    IF((T1-C17))207,309,207
309 T1=C18+C16
    IF(T1-C18)207,244,207
207 C11=C13
    C12=C14
    C13=C15
    C14=C16
    C9=C9+1.0
    GO TO 165
219 C17=0.0
    C18=0.0
    DO 230 M=1,4
    C12=C5-W283(M)
    C11=C12*C12
    C11=C6*C6+C11
    C11=W287(M)/C11
    C17=C11*C6+C17
    C18=C11*C12+C18
230 CONTINUE
244 GO TO (245,249,255,257),I
245 C8=-C8
    C18=-C18
249 C17=C7-C17
    C18=C8-C18
255 C18=-C18
257 U=C17
    V=C18
    L=0
    RETURN
287 C5=-C5
    I=2
    GO TO 20
    END

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EPFE0064
EPFE0065
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EPFE0067
EPFE0068
EPFE0069
EPFE0070
EPFE0071
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EPFE0121

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PFCN YIELDS REAL AND IMAGINARY PART OF THE COMPLEX
PROBABILITY INTEGRAL

```
SUBROUTINE EPFCN (X,Y,U,V,L)
DIMENSION W287(4),W283(4)
DATA W283/1.65068012,0.524647623,-0.524647623,-1.65068012 /
DATA W287/0.0258826794,0.256212112,0.256212112,0.0258826794/
II=1
J=2
C5=X
C6=Y
300 IF(C5)8,300,300
8 IF(C6)287,11,11
301 IF(C6)301,14,14
I=1
GO TO 20
11 I=4
GO TO 46
14 I=3
GO TO 46
20 Z=C6*C6-C5*C5
CO=EXP(Z)
C7=CO+CO
CO=C5*C6
C9=CO+CO
C8=-C7*SIN(C9)
C7=C7*COS(C9)
46 C5=ABS(C5)
C6=ABS(C6)
IF(C5- 6.0)50,219,219
50 IF(C6- 0.5)65,65,302
302 IF(C6- 3.0)61,61,303
303 IF(C6- 6.0)304,304,219
304 C9=0.5
GO TO 73
61 IF(C6- 1.5)71,71,305
305 C9=0.25
GO TO 73
65 C10=C6
C6=0.5
J=1
71 C9=0.09375
73 C11=0.0
C18=0.0
K=2
C17=0.0
79 C21=C5-C11
C19=C21*C21
C20=C6*C6+C19
T=C11*C11
C19=EXP(-T)/C20*0.318309886*C9
C17=C19*C6+C17
C18=C21*C19+C18
GO TO (108,123),K
108 II=3-II
IF(II- 1)306,114,306
306 C11=-C11
GO TO 79
114 IF(-C11-4.0) 307,307,308
308 GO TO (128,244),J
307 C11=-C11+C9
GO TO 79
```

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```

123 II=1
    K=1
    C11=C9
128 GO TO 79
    C11=C17
    C12=C18
    C9=2.0
    C6=C10-0.5
    C6=C6+C6
    C10=C11/2.0
    C13=(C5*C12+C10-0.564189584)*C6
    C10=C12/2.0
    C14=(-C5*C11+C10)*C6
    C17=C11+C13
    C18=C12+C14
165 C10=C6/C9
    C19=C13/2.0
    C19=C5*C14+C19
    C15=(C6/2.0*C11+C19)*C10
    C17=C15+C17
    T1=C5*C13
    C19=(C6*C12+C14)/2.0
    C16=(-T1+C19)*C10
    C18=C16+C18
    T1=C17+C15
309 IF((T1-C17))207,309,207
    T1=C18+C16
    IF(T1-C18)207,244,207
207 C11=C13
    C12=C14
    C13=C15
    C14=C16
    C9=C9+1.0
    GO TO 165
219 C17=0.0
    C18=0.0
    DO 230 M=1,4
    C12=C5-W283(M)
    C11=C12*C12
    C11=C6*C6+C11
    C11=W287(M)/C11
    C17=C11*C6+C17
    C18=C11*C12+C18
230 CONTINUE
244 GO TO (245,249,255,257),I
245 C8=-C8
    C18=-C18
249 C17=C7-C17
    C18=C8-C18
255 C18=-C18
257 U=C17
    V=C18
    L=0
    RETURN
287 C5=-C5
    I=2
    GO TO 20
END

```

```

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PROGRAM: SHAPL

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PROGRAM 'SHAPL'
 PLOT-PROGRAM FOR SHAPE-PROGRM ATTA AND HARVEY
 THE PROGRAM PERFORMS A PLOT OF THE PUNCHED RESULTS
 OF THE 360/65 PROGRAM VERSION.

```

DIMENSION E(1000),S(1000),SA(1000),TITEL(18)
DIMENSION EBCX(3),EBCY(3)
DATA EBCX/ '(EV)', 'RGY ', ' ENE '//,EBCY/'ARN')', 'A (B', 'SIGM'/'
3 READ(5,1)L1
1 FORMAT(15)
  IF(L1-1)99,2,2
2 READ(5,1910) (TITEL(I),I=1,18)
1910 FORMAT(18A4)
  READ(5,1911) SIZX,SIZY,IX,IY
1911 FORMAT(2F10.0,2I5)
  READ(5,1912) IO,IM,VI,DELAY,T1
1912 FORMAT(2I5,3E12.5)
  IMO=IM-IO+1
  READ(5,1913) (S(I),I=1,IMO)
1913 FORMAT(8E10.4)
  READ(5,1913) (SA(I),I=1,IMO)
  DO 100 I=1,IM
100 E(I)=VI/(DELAY+I*T1)**2
  DO 200 K=1,IMO
200 E(K)=E(IO)
  IO=IO+1
  DO 1914 I=1,9
  ARRAN=TITEL(I)
  I1=19-I
  TITEL(I)=TITEL(I1)
  TITEL(I1)=ARRAN
1914 CONTINUE
  ORX=SIZX/3.
  ORY=SIZY+3.
  CALL FINIM(0.,0.)
  CALL SYMBL (ORX,ORY,.3,0.,TITEL(18),72)
  CALL DESLG(E,S,IMO,1,1,1,0,0,SIZX,SIZY,IX,IY,EBCX(3),-12,EBCY(3),1
12,-1)
  CALL DESLG(E,SA,IMO,1,1,1,0,0,SIZX,-SIZY,IX,IY,EBCX(3),-12,EBCY(3)
1,12,0)
  ORX=SIZX+5.
  CALL FINIM(ORX,0.)
  GO TO 3
99 CALL FINTR
  CALL EXIT
  END

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PROGRAM: ARPLO

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PROGRAM 'ARPLO'
PLOT-PROGRAM FOR THE AREA ANALYSIS PROGRAMS OF ATTA AND HARVEY
VALID FOR THE PROGRAM VERSIONS IBM 1800 AND IBM 360/65

```
DIMENSION T(2000),TA(2000),AC(2000),TRA(12),F2A(2),CHA(4),ENG(3)
DIMENSION IRO(20),IRN(20)
DATA TRA/'N','O','I','S','S','I','M','S','N','A','R','T'/
DATA ENG/('(EV)','GY','ENER')/
DATA CHA/'ER','NUMB','NEL','CHAN'/
X2=0.0
INDEX=0
CARRX=0.0
CARRY=0.0
READ(5,7) KOPT,KUNIT
7 FORMAT(2I5)
28 GO TO (25,31),KOPT
25 READ(KUNIT,26) L1
26 FORMAT(I5)
IF(L1) 11,11,12
11 IF( INDEX/2*2-INDEX) 18,19,18
18 CALL FINIM (CARRX,0.)
GO TO 20
19 IF (X2-X1) 21,21,22
21 CAR=X1
GO TO 23
22 CAR=X2
23 CALL FINIM (CAR,CARRY)
20 CALL FINTR
CALL EXIT
12 READ (KUNIT,9) IMN,IO,IM,M,VI,DELAY,TI,F2A
9 FORMAT(4I5,3E12.5,2A4)
READ (KUNIT,27) (IRO(I),I=1,M)
27 FORMAT(20I4)
READ (KUNIT,27) (IRN(I),I=1,M)
READ (KUNIT,34) (T(I),I=IO,IM)
34 FORMAT(8E10.3)
READ (KUNIT,34) (TA(I),I=IO,IM)
READ (KUNIT,34) (AC(I),I=IO,IM)
GO TO 33
31 READ (5,26) L1
IF(L1) 11,11,29
29 READ (5,9) IMN,IO,IM,M,VI,DELAY,TI,F2A
READ (5,27) (IRO(I),I=1,M)
READ (5,27) (IRN(I),I=1,M)
READ (5,34) (T(I),I=IO,IM)
READ (5,34) (TA(I),I=IO,IM)
READ (5,34) (AC(I),I=IO,IM)
33 F2AA=F2A(1)
F2A(1)=F2A(2)
F2A(2)=F2AA
INDEX=INDEX+1
IF( INDEX/2*2-INDEX)13,14,13
13 X1=CARRX
IF( X2-X1)15,15,16
15 CAR=X1
GO TO 17
16 CAR=X2
17 CALL FINIM(CAR,CARRY)
GO TO 24
14 X2=CARRX
CALL FINIM (0.,30.)
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24 IB=(IO/10)*10
   IE=(IM/10+1)*10
   N=(IE-IB)/20
   IF(IB) 25,2,2
2  X=-0.508
   FOAT1=IB
   Y=-1.016
   DO 3 I=1,N
   CALL NUMBR (X,Y,0.508,0.0,FOAT1,-1)
   X=X+0.508
   CALL PLOT(X,-0.381,3)
   CALL PLOT(X,0.0,2)
   X=X+2.54
   CALL PLOT(X,0.0,2)
   X=X-0.508
3  FOAT1=FOAT1+20.
   X=X+0.508
   CALL PLOT(X,-0.381,2)
   X=X-0.508
   CALL NUMBR (X,Y,0.508,0.0,FOAT1,-1)
   X=X+0.508
   CALL PLOT(X,-2.54,3)
   CALL PLOT(0.,-2.54,2)
   X=0.0
   FOAT1=IB
   DO 4 I=1,N
   FOAT2=VI/(DELAY+FOAT1*TI)**2
   CALL PLOT(X,-2.921,2)
   X=X-0.508
   CALL NUMBR (X,-3.302,0.254,0.0,FOAT2,3)
   X=X+3.048
   CALL PLOT(X,-2.54,3)
4  FOAT1=FOAT1+20.
   XE=X
   CALL PLOT(X,-2.921,2)
   X=X-0.508
   FOAT2=VI/(DELAY+FOAT1*TI)**2
   CALL NUMBR (X,-3.302,0.254,0.0,FOAT2,3)
   X=IMN/20
   CALL SYMBL (X,-4.572,0.762,0.0,ENG(3),12)
   CALL SYMBL (X,-2.032,0.762,0.0,CHA(4),16)
   CALL PLOT(0.,2.54,3)
   CALL PLTIR(XE,2.54,2)
   CALL PLOT(XE,15.24,3)
   CALL PLTIR(0.,15.24,3)
   CALL PLOT(0.,0.,3)
   CALL PLOT(0.,15.24,2)
   Y=14.986
   DO 5 I=1,12
   I1=I1-1
   FOAT1=FLOAT(I1)/10.
   CALL NUMBR (-1.778,Y,0.508,0.0,FOAT1,1)
   Y=Y+0.254
   CALL PLOT(-0.254,Y,3)
   CALL PLOT(0.0,Y,2)
5  Y=Y-1.524
   Y=0.508
   DO 6 I=1,12
   CALL SYMBL (-3.91,Y,0.762,0.0,TRA(I),1)
6  Y=Y+1.27
   X=IMN/20
   CALL SYMBL (X,18.00,0.762,0.0,F2A(2),8)
   CALL FINIM(0.,0.)

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I01=(I0/10)*10
X=(I0-I01)
X=X*0.127
DO397I=I0,IM
Y=T(I)*12.7+2.54
397 CALL KREUZ(X,Y,0.12)
X=X+0.127
Y=AC(IM)*12.7+2.54
X=(IM-I01)
X=X*0.127
CALLPLOT(X,Y,3)
IMO=IM+1-I0
DO 398 I=1,IMO
IJ=IM+1-I
Y=AC(IJ)*12.7+2.54
240 IF(Y-19.05)240,240,241
CALLPLOT(X,Y,2)
398 X=X-0.127
CALL PLOT(X,Y,3)
DO399J=1,M
IF(J-1)230,231,230
231 IROJ=I0
GOTO232
230 IROJ=IRN(J-1)+1
232 Y=TA(IROJ)*12.7+2.54
IRNJ=IRO(J)-1
X=(IROJ-I01)
X=X*0.127
IF(Y-19.05)242,242,241
242 CALLPLOT(X,Y,3)
IF(IRNJ-IROJ)233,233,234
234 DO389I=IROJ,IRNJ
Y=TA(I)*12.7+2.54
IF(Y-19.05)243,243,241
243 CALLPLOT(X,Y,2)
389 X=X+0.127
233 IROJ=IRO(J)
Y=TA(IROJ)*12.7+2.54
IRNJ=IRN(J)
X=(IROJ-I01)
X=X*0.127
IF(Y-19.05)244,244,241
244 CALLPLOT(X,Y,3)
DO235I=IROJ,IRNJ
Y=TA(I)*12.7+2.54
IF(Y-19.05)245,245,241
245 CALLPLOT(X,Y,2)
235 X=X+0.127
399 CONTINUE
IROJ=IRN(M)+1
IF (IROJ-IM )1914,1914,236
1914 Y=TA(IROJ)*12.7+2.54
IRNJ=IM
X=(IROJ-I01)
X=X*0.127
IF(Y-19.05)246,246,241
246 CALLPLOT(X,Y,3)
DO238I=IROJ,IRNJ
Y=TA(I)*12.7+2.54
IF(Y-19.05)247,247,241
247 CALLPLOT(X,Y,2)
238 X=X+0.127
236 CALLPLOT(X,Y,3)

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```
781 WRITE (6,781)
    FORMAT ('1 PLOT READY'//)
    CARRX = IMN/20
    CARRX = (CARRX + 1.) * 2.6 + 10.
    CARRY = -30.
241 GO TO 28
    END
```

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ARPL0191
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ARPL0194
ARPL0195
ARPL0196
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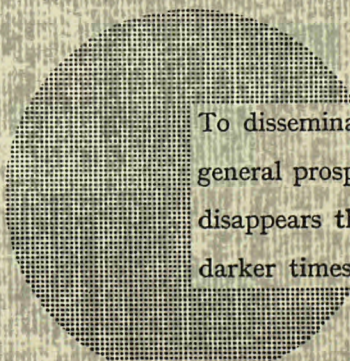
```
SUBROUTINE KREUZ(X,Y,H)
H1=H*0.5
X1=X-H1
X2=X+H1
Y1=Y-H1
Y2=Y+H1
CALL PLOT(X1,Y,3)
CALL PLOT(X2,Y,2)
CALL PLOT(X,Y,2)
CALL PLOT(X,Y1,2)
CALL PLOT(X,Y2,2)
RETURN
END
```

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Alfred Nobel

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