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TRANSFER FUNCTION SYNTHESIS AS A RATIO OF TWO COMPLEX POLYNOMIALS

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TRANSFER FUNCTION SYNTHESIS AS A RATIO OF TWO COMPLEX POLYNOMIALS

by

C. K. Sanathanan and Judith Koerner

ABSTRACT

Experimental data for frequency response obtained from a linear dynamic system is processed to obtain the transfer function as a ratio of two frequency-dependent polynomials. The difference between the absolute magnitudes of the actual function and the polynomial ratio is the error considered. The polynomial coefficients are evaluated as the result of minimizing the sum of the squares of the above errors at the experimental points. The magnitude and phase angle of the transfer function are evaluated at various frequencies by means of the computed polynomial ratio and are compared with the observed data.

The numerical solution of this problem was obtained by using an IBM 704 FORTRAN program.

The method presented here gives an analytic description of the complex transfer function superior to that given by minimization of the "weighted" sum of the squares of the errors in magnitude.

This method is applicable to both minimum and nonminimum phase systems.

I. INTRODUCTION

It is often desirable to express the transfer function G(s) of a linear dynamic system as a ratio of two frequency-dependent polynomials, namely,

$$\widetilde{G}(j\omega)^{*} \simeq \frac{\mathbf{p}_{n} + \mathbf{p}_{1}(j\omega) + \mathbf{p}_{2}(j\omega)^{2} + \dots}{1 + \mathbf{q}_{1}(j\omega) + \mathbf{q}_{2}(j\omega)^{2} + \dots}$$

$$= \frac{\mathbf{P}(j\omega)}{\mathbf{Q}(j\omega)} \qquad (1)$$

*Setting $q_0 = 1$, does not restrict the problem in any way.

Several methods (1-3) have been devised in the past to fit the experimental data with a function such as the above. In the following, one such method is presented briefly along with its deficiencies. A procedure is suggested to eliminate the deficiencies.

The error at frequency ω_k is given by

$$\epsilon_{\mathbf{k}} = \mathbf{G}(\mathbf{j}\boldsymbol{\omega}_{\mathbf{k}}) - \frac{\mathbf{P}(\mathbf{j}\boldsymbol{\omega}_{\mathbf{k}})}{\mathbf{Q}(\mathbf{j}\boldsymbol{\omega}_{\mathbf{k}})} \quad .$$
(2)

The problem becomes quite difficult to solve when the coefficients $p_0, p_1, p_2, \ldots, q_1, q_2, \ldots$ are evaluated as a result of simply minimizing the sum of $|\varepsilon_k|^2$ at all the experimental points. If Eq. (2) is multiplied by $Q(j\omega_k)$, the weighting function, the weighted error at point k is

$$\varepsilon'_{\mathbf{k}} = \varepsilon_{\mathbf{k}} \mathcal{Q}(j\omega_{\mathbf{k}}) = \mathcal{G}(j\omega_{\mathbf{k}}) \mathcal{Q}(j\omega_{\mathbf{k}}) - \mathcal{P}(j\omega_{\mathbf{k}}) \quad , \tag{3}$$

and the sum of $|\epsilon'_k|^2$ for all the experimental frequencies is

$$E(p_{0}, p_{1}, p_{2}, \ldots, q_{1}, q_{2}, q_{3}, \ldots) = \sum_{k=1}^{n} |\epsilon_{k}'|^{2} = \sum_{k=1}^{n} |\epsilon_{k}|^{2} |Q_{k}|^{2} ... (4)$$

The sum E is partially differentiated with respect to each polynomial coefficient and equated to zero. The resulting set of linear simultaneous algebraic equations are arranged in the matrix equation form

$$[A][X] = [B]$$
(5)

and solved to obtain the polynomial coefficients characterized by the "weighted" minimum mean-square-error criterion.

The above has the following deficiency:

The weighting function $|Q(j\omega_k)|^2$ may vary considerably as ω_k is increased through several decades, and at higher frequencies may attain values considerably higher than those at lower frequencies. Because of the heavy weighting of the errors at the higher frequencies, there is a general tendency for the contributions of the lower frequencies to E to become ineffective. Therefore, this method may be expected to give a poor fit at lower frequencies, which it actually does.

It is suggested that the above deficiency may be overcome by eliminating the weighting by an iterative procedure.

Equation (3) is modified such that

. .

$$\epsilon_{\mathbf{k}}^{"} = \frac{(\epsilon_{\mathbf{k}})_{\mathbf{L}}}{Q(j\omega\mathbf{k})_{\mathbf{L}-1}} = \frac{\epsilon_{\mathbf{k}}Q(j\omega_{\mathbf{k}})_{\mathbf{L}}}{Q(j\omega_{\mathbf{k}})_{\mathbf{L}-1}} = \frac{G(j\omega_{\mathbf{k}})Q(j\omega_{\mathbf{k}})_{\mathbf{L}}}{Q(j\omega_{\mathbf{k}})_{\mathbf{L}-1}} - \frac{P(j\omega_{\mathbf{k}})_{\mathbf{L}}}{Q(j\omega_{\mathbf{k}})_{\mathbf{L}-1}} \quad ,(6)$$

where the subscript L corresponds to the iteration number. As $Q(j\omega_k)$ is not known to begin with, it is set equal to 1. The subsequent iterations converge rapidly and ϵ''_k tends to be equal to ϵ_k , and the weighting ceases to exist.

II. ANALYSIS*

From Eq. (6),

$$\left|\epsilon_{\mathbf{k}}^{"}\right|^{2} = \left|G(j\omega_{\mathbf{k}}) Q(j\omega_{\mathbf{k}})_{\mathbf{L}} - P(j\omega_{\mathbf{k}})_{\mathbf{L}}\right|^{2} \left|Q(j\omega_{\mathbf{k}})_{\mathbf{L}-1}\right|^{2} \quad .$$
(7)

Substituting $W_{kL} = 1/|Q(j\omega_k)_{L-1}|^2$ in Eq. (6), summing for all k's, and calling the result E', there is obtained

$$E' = \sum_{k=1}^{n} |\epsilon_{k}''|^{2} = \sum_{k=1}^{n} |\epsilon_{k}'|^{2} W_{kL} , \qquad (8)$$

where ϵ'_k is a function of $p_0, p_1, p_2, \ldots, q_1, q_2, q_3, \ldots$ The sum E' is now partially differentiated with respect to each of the polynomial coefficients and equated to zero to evaluate the coefficients. This yields the following matrix equation:

														1
λο	0	-λ ₂	0	λ_4	8 6 Q	Tl	S_{Z}	-T3	S_4	0 0 0	Po		S ₀	
0	λ_2	0	$-\lambda_4$	0	* * *	$-S_2$	T_3	S_4	-T5	0 e q	Pı		T ₁	
λ_2	0	$-\lambda_4$	0	λ 6	8 8 0	T_3	S_4	-T5	-S ₆		Pz		S ₂	
0	λ_4	0	-λ6	0		$-S_4$	T_5	S_6	-T7		Pa		T ₃	
•	۰	٠	o	e		٠	٠	•	٠					
°	٥	۰	۰			8	۰	• •	ø		•		•	
•	0	۰	٠	•		٠	8	e	۰				•	
T ₁	-S ₂	$-T_3$	S_4			U2	0	- U4	0		qı		0	
S ₂	T_3	$-S_4$	$-T_5$		e e e	0	U_4	0	-U ₆		q ₂		U ₂	
T ₃	$-S_4$	$-T_5$	S_6			U_4	0	-U ₆	0	• • •	q		0	
S_4	T_5	-S6	-T7		\$ • •	0	U ₆	0	-U ₈		q4		U4	
•	٠	•	o	٠		٠	۰	٠	•		•		•	
•	۰	ø	٠	۰		٠	٠	٠	٠				•	
•	۰	•	ð	9		•	•	Ð	۰		•		•	
L.											J	-1	1	'(9)

*Since the analysis given here is quite brief, the reader may find it helpful to refer to Levy(2).

where

$$\lambda_{\hat{i}} = \sum_{k=1}^{n} (\omega_k)^{i} W_{kL} ; \qquad (10)$$

$$S_{i} = \sum_{k=1}^{n} (\omega_{k})^{i} R_{k} W_{kL}$$
; (11)

$$T_{i} = \sum_{k=1}^{n} (\omega_{k})^{i} I_{k} W_{kL} ; \qquad (12)$$

$$U_{i} = \sum_{k=1}^{n} (\omega_{k})^{i} (R_{k}^{2} + I_{k}^{2}) W_{kL} \qquad (13)$$

Here, R_k and I_k are the real and imaginary parts of the transfer function at ω_k obtained experimentally,

The coefficients $q_1 q_2, q_3, \ldots$ evaluated at iteration L - l are used to evaluate W_{L} for the next iteration.

III. EXAMPLE

The experimentally measured data for the transfer function of EBWR (Experimental Boiling Water Reactor) operated at a thermal power of 40 Mw and a pressure of 600 psi are fitted with the transfer functions obtained by the least mean-square-error criterion as well as the "weighted" least mean-square-error criterion.

As the reactor transfer function is believed to have an excess pole over the number of zeros, the numerator polynomial is made to be of one degree less than the denominator polynomial. In this example, the numerator polynomial is chosen to be of degree 6.

The experimental data consist of the magnitude and the phase angle of the transfer function at 24 frequencies ranging between 0.03 and 40 radians per second. The polynomial coefficients for the "weighted" minimum meansquare error are obtained at the end of the first iteration of Eq. (9), and those for the least mean-square error are obtained at the end of the tenth iteration. In general, the number of iterations depends largely upon the nature of the transfer function and the desired accuracy in the values of the coefficients. The magnitude and the phase angle of the transfer function are also computed at the experimental frequencies from the polynomial coefficients. The results are shown in Figs. 1 and 2 and in Table I. It is to illustrate the insufficiency of the "weighted" minimum mean-square-error criterion clearly that the authors have chosen the synthesis of a fairly large transfer function such as that of a nuclear reactor.



112-2074

Fig. 1. Magnitude of the Transfer Function vs Frequency



112-2073

Fig. 2. Phase Angle of the Transfer Function vs Frequency

POLYNOMIAL COEFFICIENTS

	Evaluated by the Weighted Error Criterion	Evaluated by the Minimum Mean-square-error Criterion
	(Iteration 1)	(Iteration 10)
P ₀	9.2894 · 10 ⁻¹	1.2768
p ₁	1.7123 · 10 ⁻¹	1.2803
P ₂	1.1254 · 10 ⁻¹	$7.8233 \cdot 10^{-1}$
Р ₃	1.0363 · 10 ⁻²	$7.9181 \cdot 10^{-2}$
P ₄	$1.6044 \cdot 10^{-3}$	$8.0884 \cdot 10^{-3}$
P5	$8.8747 \cdot 10^{-6}$	$2.8947 \cdot 10^{-4}$
P ₆	4.7145 · 10 ⁻⁶	$2.0136 \cdot 10^{-5}$
q ₀	1.0000	1.0000
q	2.1108 · 10 ⁻¹	2.5314
q ₂	8.7539 · 10 ⁻²	$4.2697 \cdot 10^{-1}$
q ₃	$5.6295 \cdot 10^{-3}$	$5.4644 \cdot 10^{-2}$
q_4	$1.0042 \cdot 10^{-3}$	$4.5364 \cdot 10^{-3}$
q ₅	1.1678 · 10 ⁻⁵	$1.9840 \cdot 10^{-4}$
q ₆	2.5212 · 10 ⁻⁶	$1.1446 \cdot 10^{-5}$
q ,	$2.2947 \cdot 10^{-8}$	$1.0519 \cdot 10^{-7}$

Note: Running time on the IBM 704 for the above problem was approximately one minute.

IV. DISCUSSION

In the example cited above, $|Q(j\omega)|^2$ varied from 1.0 to 6.25 x 10⁷ through the frequency range.

The present method is not applicable to functions that have poles at the origin. However, the experimental data may be modified to have them fitted with a function that does not have poles at the origin, and, then, the required number of poles at the origin may be introduced to this function. This procedure is clearly illustrated by Levy.(2)

Suitable scaling of Eq. (9) was necessary for successful computation; namely, Eq. (9) was solved by writing

 $10^{-8} [A] [X] = 10^{-8} [B]$

The reciprocal of the geometric mean between the first and the last matrix elements is a reasonable scale factor. The expression for $G(j\,\omega)$ obtained after the first iteration corresponds to the minimization of the sum of the squares of the weighted errors, since $W_{\rm kl}$ is initially set equal to unity for all k's.

Table I shows that the polynomial coefficients are altered considerably in the subsequent iterations.

V. THE COMPUTER PROGRAM

An IBM 704 FORTRAN program, TRAFICORPORATION, was developed for the numerical solution of this problem. This program is given in its complete form in the following discussion.

A. Description of the Programming of the Computing Procedure

Symbols Used	
ALPA	Absolute value of the ratio between the imaginary and the real part of the numerator.
ALTER1	Absolute value of the calculated magnitude of the transfer func- tion in decibels.
ALTER2	Absolute value of the calculated phase of the transfer function in degrees.
AMDA	λ
BETA	Absolute value of the ratio between the imaginary and the real parts of the denominator.
CDBM	Calculated magnitude of the transfer function in decibels.
CEM	Calculated magnitude of the transfer function.
CONVI	Convergence criterion for the magnitude.
	$ $ ERMAG1 $ $ - $ $ ERMAG2 $ \le $ CONV1
CONV2	Convergence criterion for the phase.
	$ ERFAZ1 - ERFAZ2 \le CONV2$
СРН	Calculated phase of the transfer function in degrees.

Symbols Used	
CPHR	Calculated phase of the transfer function in radians.
CURNER	If the error in magnitude exceeds the value (CURNER • AL- TER1) at a given point, the calculated value of the magnitude is substituted for the experimental magnitude.
DBM	Experimental magnitude in decibels.
EM	Experimental magnitude.
ERFAZI	Maximum error in the phase for iteration L - 1.
ERFAZ2	Maximum error in the phase for iteration L.
ERMAG	Same as ERMAG2.
ERMAGI	Maximum error in magnitude for iteration L - 1.
ERMAG2	Maximum error in magnitude for iteration L.
ERORM	Absolute value of the difference between the experimental and calculated magnitudes in decibels.
ERORP	Absolute value of the difference between the experimental and calculated phases in degrees.
ERPASE	Same as ERFAZ2.
IDNO	Identification number of the problem.
L	The current iteration number
MAXPTl	Point at which the maximum error in magnitude has occurred in iteration L - 1.
MAXPT2	Point at which the maximum error in magnitude has occurred for iteration L_{α}
MAXPT3	Point at which the maximum error in phase has occurred in iteration L - 1.
MAXPT4	Point at which the maximum error in phase has occurred in iteration L.
N	The degree of the denominator,
NOLAMD	Number of lambdas in the matrix.

Symbols

U	sed	
	Contraction of the local data	

NOMEGA	Number of experimental points.
OMEGA	ω
PABS	Magnitude of the numerator.
PABS1	Real part of the numerator.
PABS2	Imaginary part of the numerator.
PABSQ	Square of the magnitude of the numerator.
PH	Experimental phase in radians.
PHE	Experimental phase in degrees.
QABS	Magnitude of the denominator.
QABS1	Real part of the denominator.
QABS2	Imaginary part of the denominator.
QABSQ	Square of the magnitude of the denominator.
R	Real part of the experimental transfer function.
SCALE	Scale factor, used to decrease the size of the matrix elements.
THETAL	tan ⁻¹ (ALPA).
THETA2	tan ⁻¹ (BETA).
UR	Imaginary part of the experimental transfer function.
W	Reciprocal of the square of the magnitude of the denominator.
WALT	If the error in phase exceeds the value (WALT \cdot ALTER2) at a given point, the calculated value of the phase is substituted for the experimental phase.
WX	Initial value of W.

B. The Computing Procedure

Initially, the required λ 's, S's, T's and U's are computed and substituted in the matrices [A] and [B]. The matrix-inversion subroutine,

ANF 402,* is used to solve the matrix equation [A][X] = [B] to obtain the polynomial coefficients $p_0, p_1, \ldots, p_{N-1}$, and q_1, q_2, \ldots, q_N . Here, q_0 is set equal to 1. The magnitude, the phase angle, and the errors of the transfer function are computed at each experimental point as follows:

1. Magnitude of the transfer function =
$$\left[\frac{(PABS1)^2 + (PABS2)^2}{(QABS1)^2 + (QABS2)^2}\right]^{\frac{1}{2}}$$

2. Phase of the transfer function =
$$\tan^{-1}\left(\frac{\text{PABS2}}{\text{PABS1}}\right) - \tan^{-1}\left(\frac{\text{QABS2}}{\text{QABS1}}\right)$$

3. The errors are computed as the absolute difference between the experimental and calculated values of the magnitude and phase of the transfer function. The maximum errors in magnitude and phase are located.

4. W =
$$\frac{1}{(QABS1)^2 + (QABS2)^2}$$
 is used for the next iteration. If,

at this time, the convergence criteria are met, the iterative procedure is ended and the output is obtained; if not, the matrix elements are recomputed and the above procedure is repeated.

Suitable scaling may be necessary for the successful solution of the matrix equation. The reciprocal of the geometric mean between the first and the last matrix elements is a reasonable value for SCALE.

C. Input Information

Number	
1	FORMAT (316, 2E12.5)
	IDNO, NOMEGA, N, CURNER, WALT
	Note: IDNO \leq 32, 768
	NOMEGA \leq 250
	$N \leq 12$
2	FORMAT (3E12.5)
	OMEGA (J), DBM (J), PHE (J) $J = 1, \ldots, NOMEGA$
	Note: The OMEGA's need not be in ascending or descending order.
3	FORMAT (4E12.5)
	WX, SCALE, CONV1, CONV2
	Note: WX = 1.0 gives the polynomial coefficients with the weighted mean square error criterion at the end of the first iteration.

*ANF 402, Matrix Inversion with Accompanying Solution of Linear Equations (FORTRAN II), Burton S. Garbow, February 23, 1959.

D. Output Information

The iteration at which the problem converged, the maximum error in magnitude and phase, the point at which each occurred, the polynomial coefficients, the calculated magnitude, the calculated phase, the errors in magnitude and phase, and the reciprocal of the square of the magnitude of the denominator for each frequency are written on-line on tape 6 for each problem.

E. Operating Instructions

A standard 72-72 reader board, a SHARE 2 printer board, and an underflow switch are necessary for running this program.

SENSE SWITCHES:

- 1,2,3,4 Not used
- 5 UP: Normal
- DOWN: ERMAG, the point at which ERMAG occurred; ERPASE, the point at which ERPASE occurred; the numerator and the denominator coefficients; and OMEGA, CDBM, CPH, ERORM, ERORP, and W at each point are printed on-line for the current iteration.
- 6 UP: Normal
- DOWN: The matrix elements as they appear in the matrix and the λ 's, S's, T's, and U's are printed on-line for the current iteration.

TAPES:

6 Blank for output

RUNNING PROCEDURE:

- 1. Mount and ready tape 6.
- 2. Depress the underflow switch and set the sense switches as desired,
- 3. Ready the program deck and the input cards in the card reader.
- 4. CLEAR and LOAD CARDS.
- 5. At the completion of a series of problems, write an EOF on tape 6 and remove for printing off-line on program control.

VI. THE FORTRAN PROGRAM LISTING

It is believed that the transfer function of a nuclear reactor has an excess pole over the number of zeros. Hence, the program RE 277A was written such that the numerator polynomial is of one degree less than the denominator polynomial.

If, in a problem, the form of the function is unknown, it is suggested that the observed data may be fitted by a ratio of two complex polynomials of equal degree. The program RE 277B was written to do this.

Both versions of the program use the same input information and have the same operating instructions.

The cutput for the sample problem cited in the article is also given. The results of the first iteration (the results obtained by the "weighted" mean square error criterion) were obtained by depressing sense switch 5.

	RE277A TRAFICORPORATION
C	TRANSFER FUNCTION EXPRESSED AS A RATIO OF TWO COMPLEX POLYNOMIALS
	WHERE THE NUMERATOR IS OF ONE DEGREE LESS THAN THE DENOMINATOR
C.	
	DIMENSION OMECA(250), DH(250), DBM(250), P(250), UP(250), W(250), AMDA/5
	DIMENSION ONEGALZSOIFFILZSOIFDHIZSOIFRIZSOIFULZSOIFMUZSOIFAMDALS
	101, V1501, S(251, 1(251, 01501, A(25, 251, B(251, EM(2501, PL15), Q(151, QABS
	21(250),QABS2(250),QABSQ(250),QABS(250),PABS1(250),PABS2(250),PABSQ
	3(250), PABS(250), CEM(250), COBM(250), ERORM(250), CPH(250), THETA1(250)
	4. THETA2(250). ERORP(250). ALPA(250). BETA(250). PHE(250). CPHR(250)
r	
Statements	
5	KEAD INPOT
C	
1005	FORMAT(6E12.5)
1006	FORMAT(316,4E12,5)
1000	READ 1096, IDNO, NOMEGA, N, CURNER, WALT
	DO 1010 J = 1.00MEGA
1010	
1010	
1200	KCAD JUDJIWAISCALEJUDIVIIIUDIVA
	ERMAGI=0.
	ERFAZI=0.
	MAXPTI=0
	ΜΔΧΡΤ 3=0
1510	XW = { { } { } { } { } { } { } { } { } { }
C	
С	CONVERSION OF EXPERIMENTAL G(J) INTO THE REAL AND IMAGINARY PARTS
C.	
	DO 500 L = 1.00MEGA
	b = 500 s $= 19000$ cm $= 1900$ cm $= 1$
	Pri(J) = Pre(J/2/201(4353)
	$EM(J) = EXPE(DBM(J)/8 \circ 0850890)$
	R(J) = EM(J) * COSF(PH(J))
500	UR(J) = EM(J) * SINF(PH(J))
	N2 = N*2
	QZFRQ = 1
~	
6	
C	COMPUTATION OF LAMBDA.U.T AND S
С	
7	D0 15 J = 1.02.2
5	TEMP = 0.
•	DO TO K = 1-NOMEGA
10	IEMP = OMEGA(K) * JEMIK) + IEMP
	AMDA(J) = TEMP
15	AMDA(J+1) = 0.
20	$DO_{35} = 1 \cdot N2 \cdot 2$
25	TEMP = 0.
line, red	
	DU SU K = 1, NUMEGA
30	TEMP = OMEGA(K)**(J1)*(R(K)**2+UR(K)**2)*W(K)+TEMP
الكنام معرف المراجع	U(J) = TEMP
35	$U(J+1) = 0_{\bullet}$
ũn	
10	
*)	
	UU DU K = I-NUMEGA
	J2 = J*2-}
50	TEMP = OMEGA(K) ** (J2) * UR(K) *W(K) + TEMP
55	T(J) = TEMP
~ •	1 = N - 1
<u>۸</u> ۸	
00 4 r	
00	

3070 K = 1, NOMEGAJ2 = J*2 70 TEMP = OMEGA(K) * * (J2) * R(K) * W(K) + TEMP75 S(J) = TEMP80 TEMP = 0.DO 81 K = 1.NOMEGA 81 TEMP = R(K) * W(K) + TEMPSZERO = IEMP_____ С C SUBSTITUTION OF PROPER MAGNITUDES IN THE MATRIX С DO 2000 J = 1,N DO 2000 I = 1, NK = I + J - I2000 A(I,J) = AMDA(K)MST1_= N+1___ DO 2020 J = MST1, N2DO 2020 I = $MST_{1}N_{2}$ K = I + J - 1 - N2 $2020 A(I_2J) = U(K)$ DO 6000 I = $1_{9}N$ 1Y = 2*1V(IV-1) = T(1)6000 V(IV) = S(I) $D0 \ 6005 \ I = MSTI, N2$ D0 6005 J = 1.NK = I + J - N - 1 $6005 A(I_{e,J}) = V(K)$ $DO \ 6010 \ I = 1.N$ $D0 \ 6010 \ J = MST1_{0}N2$ K = I + J - N - 16010 A(I,J) = V(K)C ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS C. С LL=N+2 L=N+1 J=2 8000 DO 8010 I=L,N2,2 $8010 A(I_{,J}) = -A(I_{,J})$ J=J+1 IF(N-J)8100,8020.8020 8020 DO 8030 I=1,N2 8030 $A(I_{*}J) = -A(I_{*}J)$ J=J+1 IF(N-J)8100.8035.8035 8035 DO 8040 I=2,N,2 $8040 \text{ A[I_s]} = -A(I_s]$ DO 8050 I=LL, N2,2 $8050 \ A(I,J) = -A(I,J)$ J=J+2IE(N-J)8100.8000.8000 8100 J=N+1 8105 DQ 8110 I=2.N.2 8110 A(I,J) = -A(I,J)J=J+2 **** IF(N2-J)8500,8120,8120 <u>8120 D0 8130 I=1,N,2</u> 8130 A(I,J) = -A(I,J)_____D0 8140 I=L,N2,2 8140 A(I,J) = -A(I,J)<u>_____</u>

IF(N2-J)8500,8150,8150 8150 D0 8160 I=1,N2 8160 A(I,J) = -A(I,J)1=1+1 IF(N2-J)8500,8105,8105 8500 B(1) = SZERODO 8501 I=2,N .8501 B(I) = V(I-1)B(N+1)=0.NTWO = N+2DO 8505 I=NTWO,N2 <u>K=I-N-1</u> ----. 8505 B(I) = U(K). C. PRINT MATRIX ELEMENTS ROW BY ROW IF SENSE SWITCH 6 IS DEPRESSED C <u>_</u> IF(SENSE SWITCH 5)8510,8520 8510 PRINT 3755, IDNO, ITER IF(SENSE SWITCH 6)8513,8520 8513 PRINT 8511 THE MATRIX ELEMENTS PRINTED ROW BY ROW/) 8511 FORMAT(42H DO 8512 I=1.N2 8512 PRINT3792, (A(I,J), J=1, N2) .C... C SCALE MATRIX ELEMENTS C. 8520 DO 8700 I=1,N2 DO 8700 J=1.N2 8700 A(I,J)=A(I,J)*SCALE<u>DO 8701 I=1.N2</u> 8701 B(I)=B(I)*SCALE £. SOLUTION OF MATRIX EQUATION C C CALL MATINV(A,N2,B,1,DETRM) IF ACCUMULATOR OVERFLOW 8540,8530 8530 IF QUOTIENT OVERFLOW 8550,8531 8540 PRINT 8545, IDNO, ITER 8545 FORMAT(9H)PROBLEM I6,42H HAD AN ACCUMULATOR OVERFLOW IN ITERATION 113) GO TO 1000 8550 PRINT 8555, 10NO, 1TER 8555 FORMAT(9H1PROBLEM I6,38H HAD A QUOTIENT OVERFLOW IN ITERATION I3) <u>GO TO 1000</u> 8531 PZERO = B(1)<u>N1=N-1</u> DO 2500 I=1,N1 2500 P(1) = B(1+1)N1=N+1DO 2505 I=N1,N2 IMN=I-N 2505 Q(IMN) = B(I)C C....CALCULATION OF THE MAGNITUDE, PHASE AND ERROR C IF (XMODF(N.2))2510.2510.2509 2509 NSTOP = (N-1)/2GO TO 2516 2510 NSTOP = N/22516 DO 2521 J = 1, NOMEGA 2515' TEMP = 1.0DO 2520 I = 1.NSTOP

K = 2 * I2520 TEMP = (-1.0)**I*OMEGA(J)**K*Q(K)+TEMP 2521 OABS1(J) = TEMP2525 IF (XMODF(N.2))2530,2530,2529 2529 NSTOP = (N+1)/2GO TO 2535 2530 NSTOP = N/2 2535 DO 2550 J = 1,NOMEGA 2540 TEMP = 0.D0 2545 I = 1, NSTOP $K = 2 \times [-1]$ 2545 TEMP = -(-1.)**I*OMEGA(J)**K*Q(K)+TEMP 2550 QABS2(J) = TEMPDO 2560 J = 1_{1} NOMEGA QABSQ(J) = CABS1(J) * * 2 + QABS2(J) * * 2W(J) = 1.0/OABSQ(J)2560 QABS(J) = SQRTF(QABSQ(J))2600 IF (XMODF(N,2))2605,2605,2610 2605 NSTOP = (N-2)/2GO TO 2620 2610 NSTOP = (N-1)/22620 DO 2626 J = 1.NOMEGA 2621 TEMP = PZERO00 2625 I = 1.NSTOP K = 2 * I2625 TEMP = (-).**I*OMEGA(J)**K*P(K)+TEMP_____ 2626 PABS1(J) = TEMP2630 IF (XMODF(N.2))2640.2640.2641 2640 NSTOP = N/2GO TO 2645 2641 NSTOP = (N-1)/2 2645 DO 2655 J = 1, NOMEGA 2646 TEMP = 0. $DO \ 2650 \ I = 1.NSTOP$ K = 2 * I - I2650 TEMP = -(-),)**I*OMEGA(J)**K*P(K)+TEMP 2655 PABS2(J) = TEMP2660 DO 2670 J = 1.NOMEGA PABSQ(J) = PARS1(J) * *2 + PABS2(J) * *2PABS(J) = SORTF(PABSO(J))CEM(J) = PABS(J)/OABS(J)CDBM(J)=8.6858896*L0GF(CEM(J)) ERORM(J) = ABSF(DBM(J) - CDBM(J))ALTER1 = ABSE(CDBM(J)) IF (ERORM(J)-CURNER*ALTER1)2661,2661,2663 2663 IF(ITER-1)2661,2661,2665 2665 DBM(J) = CDBM(J)PRINT 2664.J EXPERIMENTAL MAGNITUDE CHANGED TO CALCULATED MAGN 2664 FORMAT(///66H 1ITUDE AT J = I4/)2661 ALPA(J) = ABSF(PABS2(J)/PABS1(J))IF QUOTIENT OVERFLOW 7300,7301 7301 THETAI(J) = ATANF(ALPA(J))7304 BETA(J) = ABSF(QABS2(J)/QABS)(J) 1 F QUOTIENT OVERFLOW 7302,7303 7303 THETA2(J) = ATANF(BETA(J)) GO TO 7305 7300 THETA1(J)=1.570796425 GO TO 7304 7302 THETA2(J)=1,570796425 7305 IF(QABS2(J))2700,2701,2701

2700 THETA2(J) = -THETA2(J)

0701	TE LOADERLIN 9710 9713 9711
2101	1F (QABSI(J))2/10,2/11,2/11
27.10	THETA2(J) = 3.1415927 - THETA2(J)
2711	IF (PABS2(J))2720,2721,2721
2720	THETAJ(1) = -THETAJ(1)
0701	
2121	
2(50	$\underline{\text{THEJA(J)}} = 3.141592(-1) + 161(J)$
2731	CPHR(J) = THETA1(J) - THETA2(J)
	CPH(J) = CPHR(J) * 57.2957795
	EPOPP(1) = ABSE(CPH(1) - PHE(1))
	ALIERZ - ADSPICERT(J)
	IF (ERORP(J)-WALT*ALTER2)2670,2670,2671
2671	IF(ITER-1)2670,2670,2673
2673	PHF(J) = CPH(J)
	DPINT 2672-1
AL 20	ERANG 201.210
2012	FURMATIV//SON EXPERIMENTAL PHASE CHANGED TO CALCULATED PHASE AT
amonti inventora antenno de la como	I = I 4 /
2670	CONTINUE
	ERMAG2= FRORM(1)
	MAYDT2 = 1
	DU 3700 1 = 2, NOMEGA
	IF(ERMAG2-ERORM(I))3710,3700,3700
3710	ERMAG2= ERORM(I)
montreat an	MAYDI2 = I
2700	
2176	CONTINUE
	ERFAZ2 = ERORP(1)
	MAXPT4 = 1
	DO 3720 I = 2.NOMEGA
	LE (EPEA72=EPOPP(1))3715,3720,3720
27995	
2112	ERFAZZ = EKORP(I)
	MAXPT4 = I
3720	CONTINUE
С	
<u>C</u>	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED
<u>c</u>	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED
<u>с</u> С с	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED
<u>C</u> C C	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1
<u>C</u> <u>C</u>	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000
c c c 3755	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 513750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE
c c c 3755	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1
<u>c</u> <u>c</u> 3755	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14()
C C 3755	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/)
C C 3755 3750	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2,MAXPT2,ERFAZ2,MAXPT4
C C 3755 <u>3750</u> 3760	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750.9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760.ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H
C C 3755 <u>3750</u> 3760	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 513750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4)
C C 3755 <u>3750</u> 3760	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2,MAXPT2,ERFAZ2,MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 14H ERPASE = F10.5,17H OCCURED AT J = I4) PRINT 3765
C C 3755 <u>3750</u> 3760	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2,MAXPT2,ERFAZ2,MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4) PRINT 3765 FORMAT(/50H NUMERATOR COEFEICIENTS P(0), P(1), P(2), ETC APE)
C C 3755 <u>3750</u> 3760 3765	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 14H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 FORMAT(/50H NUMERATOR COEFFICIENTS P(0),P(1),P(2),ETC. ARE)
C C 3755 <u>3750</u> 3760 3765	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H)1520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4) PRINT 3765 FORMAT(/50H NUMERATOR COEFFICIENTS P(0),P(1),P(2),ETC. ARE) PRINT 3766,PZER0,(P(1),I=1,NLESS1)
C C 3755 <u>3750</u> 3760 3765 <u>3765</u>	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H)1520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2.MAXPT2,ERFAZ2,MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5,17H OCCURED AT J = I4, PRINT 3765 FORMAT(/50H NUMERATOR COEFFICIENTS P(0),P(1),P(2),EIC. ARE) PRINT 3766,PZER0,(P(I),I=1,NLESS1) FORMAT(/1PE20.5,1P6E15.5)
C C 3755 3750 3760 3760 3765 3765	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750.9000 FORMAT(////111H1)520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760.ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 FORMAT(/50H NUMERATOR COEFFICIENTS P(0).P(1).P(2).ETC. ARE) PRINT 3766,PZER0,(P(I),I=1.NLESS1) FORMAT(/1PE20.5.1P6E15.5) PRINT 3770
C C C 3755 <u>3750</u> 3760 <u>3765</u> <u>3766</u> 3770	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER I4//1 21H ITERATION I4/) PRINT 3760,ERMAG2.MAXPT2.ERFAZ2,MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 14H ERPASE = F10.5.17H OCCURED AT J = I4) PRINT 3765 FORMAT(/18H NUMERATOR COEFFICIENTS P(0),P(1),P(2),EIC. ARE) PRINT 3766,PZER0,(P(I),I=1,NLESS1) FORMAT(/1PE20.5,1P6E15.5) PRINT 3770 FORMAT(/1924 DENOMINATOR COEFFICIENTS P(0),P(1),P(2),EIC. ARE)
C C C 3755 3750 3760 3765 3765 3766 3770	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE 1 PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2,MAXPT2,ERFAZ2,MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 FORMAT(/SOH NUMERATOR COEFFICIENTS P(0).P(1),P(2),EIC. ARE) PRINT 3766,PZERO,(P(I),I=1,NLESS1) FORMAT(/IPE20.5.1P6E15.5) PRINT 3770 FORMAT(/S2H DENOMINATOR COEFFICIENTS Q(0),Q(1),Q(2),ETC. ARE) PRINT 3760
C C C 3755 <u>3750</u> 3760 3765 <u>3765</u> <u>3766</u> 3770	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750.9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760.ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 FORMAT(/50H NUMERATOR COEFFICIENTS P(0).P(1).P(2).EIC. ARE) PRINT 3766,PZER0.(P(I).I=1.NLESS1) FORMAT(/1PE20.5.1P6E15.5) PRINT 3770 FORMAT(/52H DENOMINATOR COEFFICIENTS Q(0).Q(1).Q(2).EIC. ARE) PRINT 3766,QZER0.(Q(I).I = 1.N)
C C C 3755 <u>3750</u> 3760 3765 <u>3765</u> <u>3766</u> 3770	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = 14, 114H ERPASE = F10.5,17H OCCURED AT J = 14) PRINT 3765 FORMAT(/18H NUMERATOR COEFFICIENTS P(0),P(1),P(2),EIC. ARE) PRINT 3766,PZER0,(P(I),I=1,NLESS1) FORMAT(/1PE20.5,1P6E15.5) PRINT 3770 FORMAT(/52H DENOMINATOR COEFFICIENTS Q(0),Q(1),Q(2),EIC. ARE) PRINT 3766,QZER0,(Q(I),I = 1,N) PRINT 3775
C C C 3755 3750 3760 3760 3765 3765 3766 3775	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2.MAXPT2.ERFAZ2,MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = 14, 114H ERPASE = F10.5,17H OCCURED AT J = 14) PRINT 3765 FORMAT(/50H NUMERATOR COEFFICIENTS P(0),P(1),P(2),ETC. ARE) PRINT 3766,PZERO,(P(I),I=1,NLESS1) FORMAT(/52H DENOMINATOR COEFFICIENTS Q(0),Q(1),Q(2),ETC. ARE) PRINT 376,QZERO,(Q(I),I = 1,N) PRINT 3775 FORMAT(/88H OMEGA
C C C 3755 3750 3760 3760 3765 3765 3766 3770	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750.9000 FORMAT(////111H)1520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760.ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 FORMAI(/SOH NUMERATOR COEFFICIENTS P(0).P(1),P(2).ETC. ARE) PRINT 3766,PZER0,(P(I),I=1,NLESS1) FORMAT(/IPE20.5.1P6E15.5) PRINT 3766,QZER0,(Q(I),I = 1,N) PRINT 3770 FORMAT(/88H J OMEGA CDBM CPH 1ERORM ERORP W/)
C C C 3755 3750 3760 3760 3765 3766 3775	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750.9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE 1 PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760.FRMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 FORMAT(/18H NUMERATOR COEFFICIENTS P(0).P(1).P(2).EIC. ARE) PRINT 3766, PZERO, (P(I), I=1,NLESS1) FORMAT(/19E20.5.1P6E15.5) PRINT 3770 FORMAT(/25H DENOMINATOR COEFFICIENTS Q(0).Q(1).Q(2).ETC. ARE) PRINT 3766, QZERO, (Q(I), I = 1,N) PRINT 3775 FORMAT(/88H J OMEGA CDBM CPH 1ERORM ERORP W/) PRINT 3770 PRINT 3770 PRINT 3770 PRINT 3775 FORMAT(/88H J OMEGA CDBM CPH
C C C 3755 3750 3760 3760 3765 3766 3776 3775	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750.9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760.ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = 14, 14H ERPASE = F10.5.17H OCCURED AT J = 14) PRINT 3765 FORMAT(/18H NUMERATOR COEFFICIENTS P(0).P(1),P(2).EIC. ARE) PRINT 3766,PZER0,(P(I),I=1,NLESS1) FORMAT(/1PE20.5.1P6E15.5) PRINT 3766,QZER0,(Q(I),I = 1,N) PRINT 3765 FORMAT(/88H J OMEGA CDBM CPH 1ERORM ERORP W/) PRINT 3780,(J,OMEGA(J),CDBM(J),CPH(J),ERORM(J),ERORP(J),W(J),J = 1 NOMECA)
C C C 3755 3750 3760 3765 3765 3766 3775 3775	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760, FRMAG2, MAXPT2, ERFAZ2, MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 FORMAT(/SOH NUMERATOR COEFFICIENTS P(0),P(1),P(2),EIC. ARE) PRINT 3766,PZERO,(P(I),I=1,NLESS1) FORMAT(/1PE20.5.1P6E15.5) PRINT 3770 FORMAT(/S2H DENOMINATOR COEFFICIENTS Q(0),Q(1),Q(2),ETC. ARE) PRINT 3776 FORMAT(/S2H DENOMINATOR COEFFICIENTS Q(0),Q(1),Q(2),ETC. ARE) PRINT 3776 FORMAT(/S8H J OMEGA CDBM CPH 1ERORM ERORP W/) PRINT 3780,(J,OMEGA(J),CDBM(J),CPH(J),ERORM(J),ERORP(J),W(J),J = 1 1,NOMEGA)
C C C 3755 3750 3760 3765 3765 3766 3770 3775 3775	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 513750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE 1 PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 14H ERPASE = F10.5.17H OCCURED AT J = I4, 14H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 EQRMAI(/50H NUMERATOR COEFFICIENTS P(0),P(1),P(2),EIC. ARE) PRINT 3766,PZER0,(P(I),I=1,NLESS1) FORMAT(/1PE20.5.1P6E15.5) PRINT 3766,QZER0,(Q(I),I = 1,N) PRINT 3766,QZER0,(Q(I),I = 1,N) PRINT 3766,QZER0,(Q(I),I = 1,N) PRINT 3780,(J,OMEGA(J),CDBM(J),CPH(J),ERORM(J),ERORP(J),W(J),J = 1 1.NQMEGA1 FORMAT(/14,1P6E15.5)
C C C 3755 3750 3760 3760 3765 3765 3766 3775 3775 3775	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 513750.9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE 1 PROBLEM NUMBER 14//1 21H ITERATION 14/1 PRINT 3760.ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5.17H OCCURED AT J = I4, 114H ERPASE = F10.5.17H OCCURED AT J = I4) PRINT 3765 EORMAT(/50H NUMERATOR COEFFICIENTS P(0).P(1).P(2).EIC. ARE) PRINT 3766.PZER0.(P(I).I=1.NLESS1) FORMAT(/1PE20.5.1P6E15.5) PRINT 3765 FORMAT(/1E20.5.1P6E15.5) PRINT 3765 FORMAT(/28H J OMEGA CDBM CPH 1ERORM ERORP W/) PRINT 3780.(J.OMEGA(J).CDBM(J).CPH(J).ERORM(J).ERORP(J).W(J).J = 1 1.NOMEGA) FORMAT(/14.1P6E15.5) IF (SENSE SWITCH 6) 3781.9000
C C C 3755 3750 3760 3760 3765 3765 3766 3775 3775 3775 3775	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE_SWITCH_5)3750,9000 FORMAT(////111H)1520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760,FRMAG2.MAXPT2.FRFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = 14, 114H ERPASE = F10.5.17H OCCURED AT J = 14) PRINT 3765 FORMAT(/18H ERMAG COEFFICIENTS P(0).P(1).P(2).FIC. ARE) PRINT 3766,PZER0,(P(I).I=1.NLESS1) FORMAT(/1220.5.1P6E15.5) PRINT 3766,0ZER0,(Q(I).I = 1.N) PRINT 3766,0ZER0,(Q(I).I = 1.N) PRINT 3766,0ZER0,(Q(I).I = 1.N) PRINT 3775 FORMAT(/88H J OMEGA CDBM CPH 1ERORM ERORP W/) PRINT 3780,(J.OMEGA(J).CDBM(J).CPH(J).ERORM(J).ERORP(J).W(J).J = 1 1.NOMEGA) FORMAT(/14.1P6E15.5) IF (SENSE_SWITCH_6)_3781.9000 PRINT 3782
C C C 3755 3750 3760 3760 3765 3766 3775 3775 3775 3775 3780 3781 3781	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF. (SENSE_SWITCH_513750.9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE 1 PROBLEM_NUMBER_14//1 21H ITERATION 14/) PRINT 3760.FRMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 14H ERPASE = F10.5.17H OCCURED AT J = I4, 14H ERPASE = F10.5.17H OCCURED AT J = I4, 14H PRINT 3765 FORMAT(/50H NUMERATOR_COEFFICIENTS P(0).P(1).P(2).FIC. ARE) PRINT 3766,PZERO,(P(I),I=1.NLESS1) FORMAT(/1PE20.5.1P6E15.5) PRINT 3770 FORMAT(/28H J OMEGA CDEFFICIENTS Q(0).Q(1).Q(2).FTC. ARE) PRINT 3775 FORMAT(/88H J OMEGA CDBM CPH 1ERORM ERORP W/) PRINT 3780,(J,OMEGA(J).CDBM(J).CPH(J).ERORM(J).ERORP(J).W(J).J = 1 NOMEGA. FORMAT(/14,1P6E15.5) IF. (SENSE_SWITCH_6)_3781.9000 PRINT 3782 FORMAT(/28H LAMDAS ARE THE FOLLOWING)
C C C 3755 3750 3760 3760 3765 3765 3766 3775 3775 3775 3780 3781 3781	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESSI=N-1 IF (SENSE SWITCH 513750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760, ERMAG2, MAXPT2, ERFAZ2, MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = 14, 14H ERPASE = F10.5,17H OCCURED AT J = 14) PRINT 3765 EORMAT(/50H NUMERATOR COEFFICIENTS P(0),P(1),P(2),ETC, ARE) PRINT 3765 FORMAT(/1PE20.5,1P6E15.5) PRINT 3770 FORMAT(/1PE20.5,1P6E15.5) PRINT 3766,QZERO,(Q(1),I = 1,N) PRINT 3766,QZERO,(Q(1),I = 1,N) PRINT 3766,QZERO,(Q(1),I = 1,N) PRINT 3760,(J,OMEGA (J),CDBM(J),CPH(J),ERORM(J),ERORP(J),W(J),J = 1 1,NOMEGA) FORMAT(/14,1P6E15.5) IF (SENSE SWITCH 6) 3781.9000 PRINT 3762 FORMAT(/28H LAMDAS ARE THE FOLLOWING) PRINT 3762 FORMAT(/28H LAMDAS ARE THE FOLLOWING)
C C C 3755 3750 3760 3760 3765 3765 3766 3775 3775 3775 3780 3781 3781	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750.9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760.ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = 14, 114H ERPASE = F10.5.17H OCCURED AT J = 14, PRINT 3765 FORMAT(/50H NUMERATOR COEFFICIENTS P(0).P(1).P(2).EIC. ARE) PRINT 3766, DZERO.(P(1).I=1.NLESS1) FORMAT(/JPE20.5.1P6E15.5) PRINT 3770 FORMAT(/22H DENOMINATOR COEFFICIENTS Q(0).Q(1).Q(2).EIC. ARE) PRINT 3775 FORMAT(/88H J OMEGA CDBM CPH 1ERORM ERORP W/) PRINT 3780.(J.OMEGA(J).CDBM(J).CPH(J).ERORM(J).ERORP(J).W(J).J = 1 1.NOMEGA. FORMAT(/14.1P6E15.5) IF (SENSE SWITCH 6). 3781.9000 PRINT 3766.(AMDA(J).J=1.NOLAMD) PRINT 3760.
C C C 3755 3750 3760 3760 3765 3765 3766 3775 3775 3775 3775 3780 3781 3781	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750,9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE 1 PROBLEM NUMBER 14//1 2) PRINT 3760,ERMAG2.MAXPT2,ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4, 1)4H ERPASE = F10.5,17H OCCURED AT J = I4, PRINT 3765 FORMAT(/15DH NUMERATOR COEFFICIENTS P(0),P(1),P(2),EIC. ARE) PRINT 3770 FORMAT(/14,10615,5) IF (SENSE SWITCH 6) 3781,9000 PRINT 3762 FORMAT(/28H LAMDAS ARE THE FOLLOWING) PRINT 3764, (AMDA(J),J=1,NOLAMD) PRINT 3764.
C C C 3755 3750 3760 3765 3765 3765 3766 3775 3780 3781 3781 3782 3784	PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED NLESS1=N-1 IF (SENSE SWITCH 5)3750.9000 FORMAT(////111H11520/RE277 COMPLEX CURVE FITTING ROUTINE PROBLEM NUMBER 14//1 21H ITERATION 14/) PRINT 3760.ERMAG2.MAXPT2.ERFAZ2.MAXPT4 FORMAT(/18H ERMAG = F10.5,17H OCCURED AT J = I4,]14H ERPASE = F10.5.17H OCCURED AT J = I4,]14H ERPASE = F10.5.17H OCCURED AT J = I4,]14H ERPASE = F10.5.17H OCCURED AT J = I4, PRINT 3765 FORMAT(/SOH NUMERATOR COEFFICIENTS P(0).P(1),P(2).FIC. ARE) PRINT 3766,PZERO,(P(I),I=1.NLESS1) FORMAT(/SH DENOMINATOR COEFFICIENTS Q(0),Q(1),Q(2),ETC. ARE) PRINT 3766,QZERO,(Q(I),I = 1.N) PRINT 3765 FORMAT(/88H J OMEGA CDBM CPH IERORM ERORP W/) PRINT 3780,(J,OMEGA(J),CDEM(J),CPH(J),ERORM(J),ERORP(J),W(J),J = 1 I.NOMEGA] FORMAT(/14,1P6E15.5) IF.(SENSE SWITCH 6).3781.9000 PRINT 3764,(AMDAS ARE THE FOLLOWING) PRINT 3766,(AMDA(J),J=1,NOLAMD) PRINT 3766,(AMDA(J),S(2),ETC. ARE)

	PRINT 3786
.3786	FORMAT(/27H T(1),T(2),T(3),ETC. ARE)
	PRINT 3766, (T(J), J=1, N)
	PRINT 3788
3788	FORMAT(/27H U(1),U(2),U(3),ETC. ARE)
	PRINT 3766, $(U(J), J=1, N2)$
3792	FORMAT(/1P8E15.5/)
C	
С	TEST FOR CONVERGENCE
<u>C</u>	
9000	IF(MAXPT1-MAXPT2)9100,9050,9100
9050	TEST=ABSF(ERMAG1-ERMAG2)
	IF(TEST-CONV1)9051,9051,9100
.9051	IF(MAXPT3-MAXPT4)9100.9052.9100
9052	TEST=ABSF(ERFAZ1-ERFAZ2)
and the state of the	IF(TEST-CONV2)9010,9010,9100
9100	MAXPTI=MAXPT2
	MAXPT3=MAXPT4
	ERMAG1=ERMAG2
	ERFAZ1=ERFAZ2
	ITER=ITER+1
and the second states of the	GO TO 7
C	
£	WRITE_OUTPUT_TAPE_6
C	
.9010	WRITE OUTPUT TAPE 6,3755,10N0,11ER
	WRITE OUTPUT TAPE 6,3760, ERMAG2, MAXPT2, ERFAZ2, MAXPT4
Contraction Contraction of the State	WRITE OUTPUT TAPE 6.3/65
	WRITE OUTPUT TAPE 6,3766,PZERO,(P(I),I=I,NLESSI)
• - •	WRITE OUIPUI TAPE 6,3/70
	WRITE OUTPUT TAPE 6,3766, $QZERO$, $(Q(1), 1 = 1, N)$
	WRITE OUTPUT TAPE 6,3(75
	WRITE OUTPUT TAPE 6,3780, (J, OMEGA(J), CDBM(J), CPH(J), ERORM(J), ERORP
	1(J), W(J), J=1, NUMEGA)
9999	

B. RE 277B

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RE277B TRAFICORPORATION
      TRANSFER FUNCTION EXPRESSED AS A RATIO OF TWO COMPLEX POLYNOMIALS.
C
      WHERE THE NUMERATOR AND THE DENOMINATOR ARE OF EQUAL DEGREE
C
      DIMENSION OMEGA(250), PH(250), DBM(250), R(250), UR(250), W(250), AMDA(5)
     10),V(50),S(25),T(25),U(50),A(25,25),B(25),EM(250),P(15),Q(15),QABS
     21(250), QABS2(250), QABSQ(250), QABS(250), PABS1(250), PABS2(250), PABSQ
     3(250), PABS(250), CEM(250), CDBM(250), FRORM(250), CPH(250), THETA1(250)
     4.THETA2(250).ERORP(250).ALPA(250).BETA(250).PHE(250).CPHR(250)
С
      READ INPUT
C
С
 1005 FORMAT(6E12.5)
 1006 FORMAT(316,4E12.5)
 1000 READ 1006, IDNO, NOMEGA, N, CURNER, WALT
     DO 1010 J = 1, NOMEGA
 1010 READ 1005, OMEGA(J), DBM(J), PHE(J)
 1500 READ 1005, WX, SCALE, CONV1, CONV2
      ERMAG1=0.
      ERFAZ1=0.
      MAXPT1=0
     MAXPI3=0
      ITER=1
      DO 1510 J =_ 1.NOMEGA
 1510 W(J) = WX
C
                     _____
      CONVERSION OF EXPERIMENTAL G(J) INTO THE REAL AND IMAGINARY PARTS
C
C
      DO 500 J = 1, NOMEGA
     PH(J) = PHE(J)*0.0174533
     EM(J) = EXPF(DBM(J)/8.6858896)
      R(J) = EM(J) * COSF(PH(J))
  500 \text{ UR}(J) = \text{EM}(J) * \text{SINF}(\text{PH}(J))
    <u>N2 = N*2</u>
     NOLAMD = N2+1
     NOUS = N2-1____
      NPONE = N+1
      QZERO = 1
C
    COMPUTATION OF LAMBDA, U.T AND S
C
C
   7 \text{ DO } 15 \text{ J} = 1.00 \text{ AMD} 2
                                          5 \text{ TEMP} = 0.
     DO_{10} K = 1, NOMEGA
      JI = J-I
  10 \text{ TEMP} = OMEGA(K) * * J] * W(K) + TEMP
      AMDA(J) = TEMP
   15 \text{ AMDA}(J+1) = 0
                                                             -----
   20 DO 35 J = 1, N2, 2
  25 \text{ TEMP} = 0_{e}
     DO 30 \text{ K} = 1, \text{NOMEGA}
      JJ = J+1
   30 TEMP = OMEGA(K)**(J])*(R(K)**2+UR(K)**2)*W(K)+TEMP
     U(J) = TEMP
   35 U(J+1) = 0.
  40 D0.55 J = 1.N
  45 \text{ TEMP} = 0.
     DO 50 K = 1 \cdot NOMEGA
J2 = J*2-1
   50 TEMP = OMEGA(K)**(J2)*UR(K)*W(K)+TEMP
   55 T(J) = TEMP
   60 D0 75 J = 1.N
```

65	TEMP = 0.
	DO.70.K = 1,NOMEGA
	J2 = J*2
	TEMP = OMEGA(K) + (.12) + R(K) + W(K) + TEMP
75	S(J) = TEMP
80	J = D = D = D = D = D = D = D = D = D =
21	$UU SI K = 1_{9} NUMEGA$ $TEMD = D(K) = U(K) + TEMD$
91	SZERO = TEMP
C	
C	SUBSTITUTION OF PROPER MAGNITUDES IN THE MATRIX
<u>.</u>	
	DO 2000 $J = 1$, NPONE
er weinen weinen weinen bei im ont	DQ.2000 I = 1, NPONE
0000	K = [+j-]
2000	$\frac{A11_{0}JJ}{MST} = \frac{AMDA1KJ}{MST}$
	$\frac{1}{100} = \frac{1}{100} = \frac{1}$
	$DO 2020 I = MSTI \cdot NOI AMD$
	K = I + J - 3 - N2
2020	A(I,J) = U(K)
gymania gradinija sa sing sa sa sa	DO 6000 I = 1.N
	IV = 2*I
	V(IV-1) = I(I)
0000	V(1V) = S(1)
	$DO_{0}OOS \cdot I = 1. NDONE$
	K = 1 + 1 - N - 2
6005	A(I,J) = V(K)
	DO 6010 I = $1.NPONE$
	$DMAION_{I} = I_{I} OIO_{I} OIO_{I$
-	K = I + J - N - 2
6010	K = I + J - N - 2 A(I,J) = V(K)
6010 c	K = I + J - N - 2 $A(I,J) = V(K)$ Assignment of the matrix elements
6010 C C	K = I+J-N-2 $A(I,J) = V(K)$ ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS
6010 C C C	K = I + J - N - 2 $A(I, J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$
6010 C C 8000	K = I + J - N - 2 $A(I, J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$ $D0 8010 I=MST1.NOLAMD.2$
6010 C C 8000 8010	K = I+J-N-2 $A(I,J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$ $D0 8010 I=MST1,NOLAMD,2$ $A(I,J)=-A(I,J)$
6010 C C 8000 8010	K = I+J-N-2 $A(I,J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$ $D0 8010 I=MST1,N0LAMD,2$ $A(I,J)=-A(I,J)$ $J=J+1$
6010 C C 8000 8010	$K = I+J-N-2$ $A(I,J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$ $D0 \ 8010 \ I=MST1.NOLAMD.2$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF(NPONE-J)8100,8020,8020$
6010 C C 8000 8010	$K = I+J-N-2$ $A(I,J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$ $D0 \ 8010 \ I=MST1.NOLAMD.2$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF(NPONE-J)8100,8020,8020$ $D0 \ 8030 \ I=1,NOLAMD$ $A(I,J)=-A(I,J)$
6010 C C 8000 8010 	$K = I+J-N-2$ $A(I,J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$ $D0 \ 8010 \ I=MST1,N0LAMD,2$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF(NPONE-J)8100,8020,8020$ $D0 \ 8030 \ I=1,N0LAMD$ $A(I,J)=-A(I,J)$ $I=J+1$
6010 C C 8000 8010 	$K = I+J-N-2$ $A(I,J) = V(K)$ ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS $J=2$ $D0 \ 8010 \ I=MST1,NOLAMD,2$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF (NPONE-J)8100,8020,8020$ $D0 \ 8030 \ I=1,NOLAMD$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF (NPONE-J)8100,8035,8035$
6010 C C 8000 8010 	$K = I+J-N-2$ $A(I,J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$ $D0 \ 8010 \ I=MSII,NOLAMD,2$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF (NPONE-J)8100,8020,8020$ $D0 \ 8030 \ I=1,NOLAMD$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF (NPONE-J)8100,8035,8035$ $D0 \ 8040 \ I=2,NPONE,2$
6010 C C 8000 8010 8020 8030 	$K = I+J-N-2$ $A(I,J) = V(K)$ $ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS$ $J=2$ $D0 \ 8010 \ I=MST1,NOLAMD,2$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF(NPONE-J)8100,8020,8020$ $D0 \ 8030 \ I=1,NOLAMD$ $A(I,J)=-A(I,J)$ $J=J+1$ $IF(NPONE-J)8100,8035,8035$ $D0 \ 8040 \ I=2,NPONE,2$ $A(I,J)=-A(I,J)$
6010 C C 8000 8010 8020 8030 8035 8040	<pre>K = I+J-N-2 A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010 I=MST1.NOLAMD.2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 8030 I=1.NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0 8040 I=2.NPONE.2 A(I,J)=-A(I,J) D0 8050 I=NTHREE.NOLAMD.2</pre>
6010 C C 8000 8010 	K = I+J-N-2 A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010 I=MST1.NOLAMD.2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 8030 I=1.NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0 8040 I=2.NPONE.2 A(I,J)=-A(I,J) D0 8050 I=NTHREE.NOLAMD.2 A(I,J)=-A(I,J)
6010 C C 8000 8010 	K = I+J-N-2 A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010_I=MSI1*NOLAMD*2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0_B030_I=1*NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0_8040_I=2*NPONE*2 A(I,J)=-A(I,J) D0_8050_I=NTHREE*NOLAMD*2 A(I,J)=-A(I,J) D0_8050_I=NTHREE*NOLAMD*2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8020,2000
6010 C C 8000 8010 8020 8030 	<pre>K = I+J-N-2 A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010 I=MST1.NOLAMD.2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 B030 I=1.NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0 8040 I=2.NPONE.2 A(I,J)=-A(I,J) D0 8050 I=NIHREE.NOLAMD.2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8000,8000 I=MST3</pre>
6010 C C 8000 8010 8020 8030 8035 8040 8050 8100 8100	BOD SOLUTION AND
6010 C C 8000 8010 8020 8030 8035 8040 8050 8100 8105 8110	BOD SOLID AND TO TO TO TO TO TO THE MATRIX A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010_I=MST1*NOLAMD*2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0.8030_I=1*NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0.8040_I=2*NPONE*2 A(I,J)=-A(I,J) D0.8050_I=NTHREE*NOLAMD*2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8000,8000 J=J+2 IF(NPONE-J)6100,8000,8000 J=J+2 IF(NPONE-J)6100,8000,8000 J=MSI1 D0.810_I=2*NPONE*2 A(I,J)=-A(I,J)
6010 C C 8000 8010 8020 8030 8035 8040 8050 8100 8105 8110	A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010 I=MST1.NOLAMD.2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 8030 I=1.NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0 8040 I=2.NPONE.2 A(I,J)=-A(I,J) D0 8050 I=NIHREE.NOLAMD.2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8000,8000 J=MSL1 D0 8110 I=2.NPONE.2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)6100,8000,8000 J=MSL1 D0 8110 I=2.NPONE.2 A(I,J)=-A(I,J) J=J+2 J=J+2 J=J+2 A(I,J)=-A(I,J) A(I,J)=-A(I,J) J=J+2 A(I,J)=-A(I,J) A(I,J
6010 C C 8000 8010 8020 8030 8035 8040 8050 8100 8105 8110	A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010 I=MST1*NOLAMD*2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 8030 I=1*NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 8030 I=1*NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0 8040 I=2*NPONE*2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8000,8000 J=J+2 IF(NPONE-J)8100,8000,8000 J=J+2 IF(NPONE-J)8100,8000,8000 J=MSI1 D0 8110 I=2*NPONE*2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8120,8120
6010 C C 8000 8010 	A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 A I + J - N - 2 D 8010 I = MSTI + NOLAMD + 2 A I + J - A (I + J) J = J + 1 I + I - A (I + J) I = A + 1 - A (I + J) I + J + A - A + A + A + A + A + A + A + A + A
6010 C C 8000 8010 	A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010 I=MST1+NOLAMD+2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0.8030 I=1,NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0.8040 I=2.NPONE+2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8035,8035 D0 8050 I=NTHREE+NOLAMD+2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)6100,8000,8000 J=MSI1 D0 8110 I=2,NPONE+2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)6100,8000,8000 J=MSI1 D0 8110 I=2,NPONE+2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8500,8120,8120. D0 8140 I=1,NPONE+2 A(I,J)=-A(I,J) J=J+2 IF(NQLAMD-J)8500,8120,8120. D0 8150 I=1,NPONE+2 A(I,J)=-A(I,J)
6010 C C 8000 8010 8020 8030 8035 8040 8050 8100 8105 8110 8120 8130	A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010_I=MST1;NQLAMD;2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020;8020 D0_B030_I=1;NQLAMD; A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0_B040_I=2;NPONE; A(I,J)=-A(I,J) D0_B050_I=NITHEE;NOLAMD; A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8000,8000 J=J+2 IF(NPONE-J)6100,8000,8000 J=J+2 IF(NPONE-J)6100,8000,8000 J=J+2 IF(NPONE-J)8100,8120,8120 O0_8150_I=1,NPONE;2 A(I,J)=-A(I,J) J=J+2 IF(NOLAMD-J)8500,8120,8120 O0_8150_I=1,NPONE;2 A(I,J)=-A(I,J) D0_8140_I=MST1,NOLAMD;2
6010 C C 8000 8010 8020 8030 8030 8035 8040 8050 8100 8105 8110 8120 8130 8140	A(I,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010 I=MST1.NOLAMD.2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 8030 I=1.NOLAMD. A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 8040 I=2.NDOLAMD. A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0 8040 I=2.NPONE.2 A(I,J)=-A(I,J) D0 8050 I=NIHREE.NOLAMD.2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)5100,8000,8000 J=MSI1 D0 8110 I=2.NPONE.2 A(I,J)=-A(I,J) J=J+2 IF(NOLAMD-J)8500,8120,8120. D0 8130 I=1.NPONE.2 A(I,J)=-A(I,J) J=J+2 IF(NOLAMD-J)8500,8120,8120. D0 8140 I=NST1.NOLAMD.2 A(I,J)=-A(I,J) D0 8140 I=NST1.NOLAMD.2 A(I,J)=-A(I,J)
6010 C C 8000 8010 8020 8030 8035 8040 8050 8105 8105 8110 8120 8130 8140	S0: 00:100 A(1,J) = V(K) A(1,J) = V(K) ASSIGNING CORRECT SIGNS TO THE MATRIX ELEMENTS J=2 D0 8010_I=MST1+NOLAMD+2 A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8020,8020 D0 8040_I=1,NOLAMD A(I,J)=-A(I,J) J=J+1 IF(NPONE-J)8100,8035,8035 D0 8040_I=2.NPONE+2 A(I,J)=-A(I,J) D0 8050_I=NIHREE+NOLAMD+2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8000,8000 J=MSI1 D0 8110_I=2.NPONE+2 A(I,J)=-A(I,J) J=J+2 IF(NPONE-J)8100,8000,8000 J=MSI1 D0 8110_I=2.NPONE+2 A(I,J)=-A(I,J) J=J+2 IF(NOLAMD-J)8500,8120,8120. D0 8140_I=NNENE+2 A(I,J)=-A(I,J) D0 8140_I=NNENE+2 A(I,J)=-A(I,J) D0 8140_I=NNENI,*0LAMD,2 A(I,J)=-A(I,J) J=J+1 J=L+0

```
8150 DO 8160 I=1, NOLAMD
 8160 A(I,J) = -A(I,J)
                                                          -----
      I + L = L
      IF(NOLAMD-J)8500.8105.8105
 8500 B(1) = SZERO
      DO 8501 I = 2, NPONE
 8501 B(I) = V(I-1)
      B(N+2) = 0.
                        -----
      NTHREE = N+3
      DO_{8505} I = NTHREE, NOLAMD
      K = I - N - 2
 8505 B(I) = U(K)
C
      PRINT MATRIX ELEMENTS ROW BY ROW IF SENSE SWITCH 6 IS DEPRESSED
С
С
      IF(SENSE SWITCH 5)8510.8520
 8510 PRINT 3755, IDNO, ITER
      IF(SENSE SWITCH 6)8513,8520
 8513 PRINT 8511
                   THE MATRIX ELEMENTS PRINTED ROW BY ROW/)
 8511 FORMAT(42H
      DO 8512 I=1, NOLAMD
 8512 PRINT3792, (A(I, J), J=1, NOLAMD)
С
С
      SCALE MATRIX ELEMENTS
                             ~
C
 8520 DO 8700 I=1, NOLAMD
      DO 8700 J=1, NOLAMD
 8700 A(I,J)=A(I,J)*SCALE
      DO 8701 I=1,NOLAMD
 8701 B(I)=B(I)*SCALE
С
С
      SOLUTION OF MATRIX EQUATION
C
     CALL MATINV(A, NOLAMD, B, 1, DETRM)
      IF ACCUMULATOR OVERFLOW 8540,8550
 8530 IF QUOTIENT OVERFLOW 8550,8531
 8540 PRINT 8545, IDNO, ITER
 8545 FORMAT(9H1PROBLEM I6,42H HAU AN ACCUMULATOR OVERFLOW IN ITERATION
     113)
     <u>GO TO 1000</u>
 8550 PRINT 8555, IDNO, ITER
 8555 FORMAT(9H1PROBLEM I6,38H HAD A QUOTIENT OVERFLOW IN ITERATION I3)
      GO TO 1000
 8531 PZERO = B(1)
      DO 2500 I = 1.N
 2500 P(I) = B(I+1)
      DO 2505 I=MST1,NOLAMD
      IMN=I-N-1
 2505 O(IMN) = B(I)
С
      CALCULATION OF THE MAGNITUDE, PHASE AND ERROR
C
C
      IF (XMODF(N,2))2510,2510,2509
 2509 \text{ NSTOP} = (N-1)/2
      GO TO 2516
 2510 \text{ NSTOP} = N/2
 2516 DO 2521 J = 1,NOMEGA
 2515 \text{ TEMP} = 1.0
      DO 2520 I = 1, NSTOP
      K = 2*1
 2520 TEMP = (-1.0) ** I*OMEGA(J) ** K*Q(K) + TFMP
 2521 \text{ QABS}(J) = \text{TEMP}
```

2525 IF (XMODF(N,2))2530,2530,2529 2529 NSTOP = (N+1)/2 GO TO 2535 2530 NSTOP = N/22535 DO 2550 J = 1,NOMEGA 2540 TEMP = 0. DO 2545 I = 1,NSTOP K = 2*I-1 K = 2*I-]2545 TEMP = -(-1.)**I*OMEGA(J)**K*Q(K)+TEMP 2550 QABS2(J) = TEMPDO 2560 J = 1, NOMEGA QABSQ(J) = QABST(J) * *2 + QABS2(J) * *2270 FM 74 W(J) = 1.0/QABSQ(J)2560 QABS(J) = SORTF(QABSQ(J))-2600 IF (XMODF(N,2))2605,2605,2610 2605 NSTOP = N/2GO TO 2620 2610 NSTOP = (N-1)/2_____ 2620 DO 2626 J = 1,NOMEGA 2621 TEMP = PZERO DO 2625 I = 1,NSTOP K = 2 * I2625 TEMP = (-1.)**I*OMEGA(J)**K*P(K)+TEMP 2626 PABS1(J) = TEMP 2630 IF (XMODF(N,2))2640,2640,2641 2640 NSTOP # N/2_____ GO TO 2645 2641 NSTOP = (N+1)/2 2645 DO 2655 J = 1, NOMEGA TEMP = Q, DO 2650 I = 1,NSTOP 2646 TEMP = 0,- --K = 2*I-1 2650 TEMP = -(-1.)**I*OMEGA(J)**K*P(K)+TEMP 2655 PABS2(J) = TEMP2660 DO 2670 J = 1, NOMEGAPABSQ(J) = PABS1(J) **2+PABS2(J) **2 PABS(J) = SQRTF(PABSQ(J))CEM(J) = PABS(J)/QABS(J)CDBM(J) = 20.*LOGF(CEM(J))*0.43429468 ERORM(J) = ABSF(DBM(J)-CDBM(J))ALTER1 = ABSF(CDBM(J))IF (ERORM(J)-CURNER*ALTER]12661.2661.2663 2663 IF(ITER-1)2661,2661,2665 2665 DBM(J) = CDBM(J)PRINT 2664,J EXPERIMENTAL MAGNITUDE CHANGED TO CALCULATED MAGN 2664 FORMAT(///66H 1ITUDE AT J = I4/) 2661 ALPA(J) = ABSF(PABS2(J)/PABS1(J))IF QUOTIENT OVERFLOW 7300,7301 7301 THETA1(J) = ATANF(ALPA(J))7304 BETA(J) = ABSF(QABS2(J)/QABS1(J))IF QUQTIENT OVERFLOW 73C2.7303 7303 THETA2(J) = ATANF(BETA(J))GO TO 7:05 7300 THETA1(J)=1.570796425 GO TO 7304 7302 THETA2(J)=1.570796425 7305 IF (QABS2(J))2700,2701,2701 2700 THETA2(J) = -THETA2(J)2701 IF (QABS1(J))2710,2711,2711 - - ----2710 THETA2(J) = 3.1415927 - THETA2(J)2711 IF (PABS2(J))2720,2721,2721

```
2720 THETA1(J) = -THETA1(J)
 2721 IF (PABS)(J))2730,2731,2731
 2730 THETA1(J) = 3.1415927-THETA1(J)
 2731 CPHR(J) = THETA1(J) - THETA2(J).
      CPH(J) = CPHR(J) * 57.2957795
      ERORP(J) = ABSF(CPH(J)-PHE(J))
      ALTER2 = ABSF(CPH(J))
      IF (EPORP(J)-WALT*ALTER2)2670,2670,2671
 2671 IF(ITER-1)2670,2670,2673
 2673 \text{ PHE}(J) = CPH(J)
      PRINT 2672,J
                      EXPERIMENTAL PHASE CHANGED TO CALCULATED PHASE AT
 2672 FORMAT(///58H
     ] J = [4/]
 2670 CONTINUE
      ERMAG2=ERORM(1)
      MAXPT2=1
      DO 3700 I = 2, NOMEGA
      IF(ERMAG2-ERORM(I))3710,3700,3700
 3710 ERMAG2=ERORM(I)
      MAXPT2=I
 3700 CONTINUE
      ERFAZ2 = ERORP(1)
      MAXPT4 = 1
      DO 3720 I = 2, NOMEGA
      IF(ERFAZ2-ERORP(I))3715,3720,3720
 3715 ERFAZ2=EKORP(I)
      MAXPT4=I
3720 CONTINUE
С
      PRINT RESULTS OF CURRENT ITERATION IF SENSE SWITCH 5 IS DEPRESSED
С
C
      IF (SENSE SWITCH 5)3750,9000
 3755 FORMAT(////11)H1)520/RE277 COMPLEX CURVE FITTING ROUTINE
     Į.
                                                     PROBLEM NUMBER 14//1
     21H ITERATION 14/)
3750 PRINT 3760, ERMAG2, MAXPT2, ERFAZ2, MAXPT4
 3760 FORMAT(/18H
                           ERMAG = F10.5, 17H OCCURED AT J = I4,
              ERPASE = F10.5.17H OCCURED AT J = I4)
     114H
      PRINT 3765
                    NUMERATOR COEFFICIENTS P(0), P(1), P(2), ETC. ARE)
3765 FORMAT(/50H
      PRINT 3766, PZERO, (P(I), I = 1, N)
3766 FORMAT(/1PE20.5,1P6E15.5)
      PRINT 3770
3770 FORMAT(/52H____DENOMINATOR_COEFFICIENTS Q(0),Q(1),Q(2),ETC. ARE)
      PRINT 3766, QZERO, (G(I), I = 1, N)
      PRINT 3775
                                                            CPH
3775 FORMAT(/88H
                            OMEGA
                                             CDBM
                    .1
                   __ERORP___
     1ERORM
                                       W/Y
      PRINT 3780, (J, OMEGA(J), CDBM(J), CPH(J), ERORM(J), FRORP(J), W(J), J = 1
     1, NOMEGA)
 3780 FORMAT(/14,1P6E15.5)
      IF(SENSE_SWITCH_6)3781,9000
 3781 PRINT 3782
3782 FORMAT(/28H LAMDAS ARE THE EOLLOWING)
      PRINT 3766, (AMDA(J), J=1, NOLAMD)
      PRINT 3784_____
3784 FORMAT(/27H
                    S(0), S(1), S(2), ETC. ARE)
      PRINT 3766.SZERO. (S(J). J=1.N)
      PRINT 3786
 3786 FORMAT(/27H ______, T(1), T(2), T(3), ETC, ARE)
      PRINT 3766, (T(J), J=1, N)
      PRINT 3788
```

```
3788 FORMAT(/27H U(1),U(2),U(3),ETC. ARE)
             PRINT <u>3766, (U(1), J=1, NOUS)</u>
  3792 FORMAT(/1P8F15.5/)
C
С
             TEST FOR CONVERGENCE
С
                                                                                  -----
                                                                                                                                 9000 IF(MAXPT1-MAXPT2)9100,9050,9100
  9050 TEST=ABSF(ERMAG1-ERMAG2)
                                                                                                                                 IF(TEST-CONV1)9051,9051,9100
  9051 IF(MAXPT3-MAXPT4)9100,9052,9100
                                                                                                 9052 TEST=ABSF(ERFAZ1-ERFAZ2)
              IF(TEST-CONV2)9010,9010,9100
  9100 MAXPT1=MAXPT2
              MAXPT3=MAXPT4
                                                                                               . .. ..
                                                                                                              ....
                                                                                                                                  ERMAG1=ERMAG2
              ERFAZ1=ERFAZ2
                                                  an a station of the second station of the se
              ITER=ITER+1
              GO TO 7
                                 С
              WRITE OUTPUT TAPE 6
С
                                                                                                                                    С
  9010 WRITE OUTPUT TAPE 6.3755. IDNO. ITER
              WRITE OUTPUT TAPE 6,3760, ERMAG2, MAXPT2, ERFAZ2, MAXPT4
              WRITE OUTPUT TAPE 6,3765
              WRITE OUTPUT TAPE 6,3766,PZERO,(P(I),I =1,N)
              WRITE OUTPUT TAPE 6,3770
              WRITE OUTPUT TAPE 6, 3766, 07 \text{ ERO}, (Q(I), I = 1, N)
              WRITE OUTPUT TAPE 6, 3775
              WRITE OUTPUT TAPE 6,3780, (J,OMEGA(J), CDBM(J), CPH(J), ERORM(J), ERORP
            1(J), W(J), J=1, NOMEGA)_____
   9999 GO TU 1000
              END(0,1,0,0,)
```

C. MATINV

С		MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS	ANF40201
С			E4020002
		SUBROUTINE MATINV(A,N,B,M,DETERM)	F4020003
С			<u>E4020004</u>
		DIMENSION IPIVOT(25), A(25,25), B(25,1), INDEX(25,2), PIVOT(25)	F4020005
		COMMON PIVOL, INDEX, IPIVOL	F4020000
r		EQUIVALENCE (IKUW; JKUW); (ICUEDH; JCUEDH); (AMAA; I; SWAP)	EPU20001
с С			<u>C402000</u> 0
C r		INTIALIZATION	F4020009
6	10	DETERM-1.0	FL020010
	10		Fk020017
	20		FL020013
	20		FL020013
r	~~		FL020015
č		SEARCH FOR PIVOT FLEMENT	F4020016
č			F4020017
Ť	40	AMAX=0.0	F4020018
	45	DO 105 J=1,N	F4020019
	50	IF $(IPIVOT(J)-1)$ 60, 105, 60	F4020020
	60	DO 100 K=1.N	F4020021
	70	IF (IPIVOT(K)-1) 80, 100, 740	F4020022
	80	IF (AESF(AMAX)-ABSF(A(J,K))) 85, 100, 100	F4020023
	85	IROW=J	F4020024
	90	ICOLUM=K	F4020025
	95	AMAX=A(J,K)	F4020026
	100	CONTINUE	F4020027
	105		F4020028
-	110	IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1	F4C20029
С			F4020030
Ċ		INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL	F4020031
Ċ			F4020032
*	150	IF (IROW-ICOLUM) 140, 260, 140	F4020033
	140	DETERM=-DETERM	F4020034
	150	DO 200 L=1,N	F4020035
	160	SWAP=A(IROW,L)	F4020036
	170	A(IROW, L) = A(ICOLUM, L)	F4C20037
	200	A (ICOLUM, L) = SWAP	F4020038
	205	IF(M) 260, 260, 210	F4020039
	210	DO 250 L=1. M	F4020040
	220	SWAP=B(IROW,L)	F4020041
	230	B(IROW,L)=B(ICOLUM,L)	F4C20042
	250	B(ICOLUM,L)=SWAP	F4020043
	260	INDEX(1,1)=IROW	E4020044
	270	INDEX(I,2)=ICOLUM	F4020045
	310	PIVOT(I)=A(ICOLUM,ICOLUM)	F4020046
	320	DETERM=DETERM*PIVOT(I)	F4020047
C			E4020048
C		DIVIDE PIVOT ROW BY PIVOT ELEMENT	F4020049
C			F4020050
	330	A(ICOLUM,ICOLUM)=1.0	F4020051
	. 340	DO 350 L=1.N	F4020052
	350	A(ICOLUM,L)=A(ICOLUM,L)/PIVOT(I)	F4020053
	355	IF(M) 380, 380, 360	F4020054
	360	DO 370 L=1,M	F4020055
	370	B(ICOLUM,L)=B(ICOLUM,L)/PIVOT(L)	E <u>4020056</u>
C			F4020057
Ç		REDUCE NON-PIVOT ROWS	F4020058
C			F4020059
	380	D0 550 L1=1.N	F4020060
	390	IF(L1-ICOLUM) 400, 550, 400	F4020061
	400	T=A(L1.ICOLUM)	E4020062

420) A(L1, ICOLUM)=0.0	F4020063
430) DO 450 L=1.N	<u>F4020064</u>
450) A(L1,L)=A(L1,L)-A(ICOLUM,L)*T	F4020065
455	i IF(M) 550, 550, 460	F4020066
460) DO 500 L=1,M	F4020067
500) B(L1,L)=B(L1,L)-B(ICOLUM,L)+T	F4C20068
550	CONTINUE	F4020069
C		F4020070
С	INTERCHANGE COLUMNS	F4020071
C		F4026072
600) DO 710 I=1,N	F4020073
610) L=N+1-I	F4020074
620) IF (INDEX(L,1)-INDEX(L,2)) 630, 710, 630	F4020075
630). JROW=INDEX(L,1)	F4020076
640) JCOLUM=INDEX(L,2)	F4020077
650	<u>) DO 705 K=1.N</u>	<u>F4020078</u>
66() SWAP=A(K, JROW)	F4020079
6.7 () A(K, JROW)=A(K, JCOLUM)	F4020080
700) A(K, JCOLUM)=SWAP	F4020081
	5 CONTINUE	F4020082
710) CONTINUE	F4020083
740) RETURN	F4020084
750) END (2,2,2,2,0)	F4020085

VII. SAMPLE PROBLEM

	5 24	7 1.0 +06	1.0	+06				
4.2	-02 3.5	8.2						
5.6	-02 2.4	3.7					an may lost you have been talk talk this that to	
7.5	-02 3.3	2.9						
1.0	-01.2.0	-6.2						
1.3	-01 2.8	-5.1						
1.8	-01 1.4	-2.64	+01					
2.4	-01 3.0	-01-2.57	+01					
3.2	-01-2.3	-1.74	+01					
4.2	-01-2.1	-1.77	+01					
5.6	-01-3.1	-2,16	+01					
7.5	-01-6.2	-9.7						
1.0	-5.6	+9.2				and the second		
1.3	-4.5	1.34	+01					
1.8	-4.8	2,63	+0.1					
2.4	-3.4	3.63	+01					
3.2	-1.3	6,83	+01				un ann dar inn bad ant bill fait Mil Mil in	
4.2	1.2	5.28	+01					
5.6	4.4	5.22	+01					
7.6	8.0	4.18	+01					
1.0	+01 9.8	1.26	+01			-		
1.3	2 +01 7.7	-6.1						
1.8	+01 6.8	-1.39	+01			17 The state and state and state		n man man man tan ana kan ang man man man ang man kan kan kan ta
2.30	5 +01 6.2	-],4]	+01					
3.10	9 +01 5.6	-1.76	+01					
1.0	1.0	-09 1.0	-03	1.0	-03			

SAMPLE PROBLEM INPUT DATA

.

EPMAG = 6.44429 JCCULED AT J = 16 FLPASE = 361.606562 JCCURED AT J = 20NUMERATOR COLEFFICIENTS P(0),P(1),P(2),ETC. ARE

9.28940E-01 1.71232E-01 1.12532E-01 1.03626E-02 1.60442E-02 8.37055E-05 4.71453E-06 DENOMINATOR CUEFFICIENTS Q(U).0(1).0(2).571C. APE

1.00000E 06 2.11077E-01 8.75386E-02 5.62947E-02 1.00421E-03 1.16778E-07 2.52117E-66 2.29472E-08

J	OMEGA	CDBM	СРЧ	ERORI	ERORP	17
1	4.20000E-02	-0.4 846E-01	-6.40634E-02	4.14085E CO	5€26436F 00	1.0 123 (0
2	5.00000E-02	-0.41309E-01	-3.532185-02	3.04131F (0	3.78582F 00]•00∪41⊢ 00
٦	7.5:000E-02	-6.42151E-01	-1.14946F-01	3.94215F 00	3.014955 00]•10 72- ((
4	10.00005-02	-6.43631E-01	-1.53277E-01	∠•64363E 00	6•04672F 00	1.001315 06
5	1.3000E-01	-0.45767E-01	-1.79275F-01	3•445≠7F ∩0	4•90071F 00	1.00221F 00
6	1.800005-01	-6.51225E-01	-2.76042F-01	2.05123F 00	2.61240F 01	1 , 004245 00
7	2.40000E-01	-0.59803E-01	-3.68263F-01	9.59803F-01	2.53317F 01	1.00755F OC
8	3.20000E-01	-0.75141E-01	-4.91495F-01	1.62486F 00	1.69085F 01	1.013475 00
9	4.20000F-01	-7.00729E-01	-6.460595-01	1.39927F 00].70539F 01	1.023335 00
10	5.60000E-01	-/.49018E-01	-8.63538E-01	2•35098F 00	2•07365F 01	1.04190= 00
11	/.50000E-01	-8•39528E-∩1	-1.16035F 00	5.36047E 00	8.53965F 00	1.07659F ())
12	1.00000F 00	-1.00826E 00	-1.549675 00	4.59174F 00	1•07497F (1)] . 14073F 00
] 4	1.30000E 00	-1.30197E 00	-1.9927(E 00	3.19803E 00	1•53927F 01	1.25148E 00
14	1.80000E 00	-2.11175E 00	-2.43025F 00	2.68825E 10	2.873025 01	1.54102F ()0
15	2.40070F of	-4.04197E 00	-2.39834E-01	6.419015-01	3.65398⊑ 01	2.15490= 00
16	3.2 000 UL	-7.74429E U.	3.85394E 01	6.44429E CC	2.97607F 01	2 ₀47 992⊑ ()()
ר ן	- ° COOOF OO		, FOI	₀((F~_`	1.11786F 01	5°383(PF 0)

PROPLEM NUMBER 5

18	2.6€ 100E 10	+.22933E N	5.17112F 01	1.60665F-01	4.88209F-01	1.31191F 00
19	7.60 OUF (7.65440E 00	4.26551F 01	3.45597F-01	8•54994F-01	5.59958E-01
20	1.00 00F (1	4•60360E 00	-3.47460E 02	1•96395F-01	3.60066F 02	1.48971F-01
21	1.32 E 01	1.16476E CU	-6.47094F nn	6.97637F-02	3•70937E-01	1.70708F-02
22	1.84 OF (1	6.79505F 00	-1.º39535F 01	4.95142F-03	5•35231F-02	1.52538F-03

23	2.36000E 01	6•19953F 00	-1.40971F 01	4.65751F-04	2.91491F-03	2•81940E-05
24	3.19.00F 01	5.60001E CO	-1.76000F 01	6.97374F-06	2.78950F-05	3.10352E-07

ERMAG = 2.38248 OCCURED AT J = 8 ERPASE = 18.77125 OCCURED AT J = 12 NUMERATOR COEFFICIENTS P(0),P(1),P(2),ETC. ARE

1.27675E 00 1.28033E 00 7.82329E-01 7.91805E-02 8.08841E-03 2.89473E-04 2.01356E-05 DENCMINATOR COEFFICIENTS Q(0),Q(1),Q(2),ETC. ARE

1.00000E 00 2.53138E 00 4.26968E-01 5.46436E-02 4.53640E-03 1.98396E-04 1.14464E-05 1.05189E-07

J	OMEGA	CDBM	СРН	ERORM	ERORP	N	
1	4.20000E-02	2.0781CE 00	-3.65899E 00	1.42190E 00	1.18590E 01	9.90298E-01	
2	5.60000E-02	2.C4415E 00	-4.85873E 00	3.55849E-01	8.55873E 00	9.82882E-01	
3	7.50000E-02	1.98319E 00	-6.45939E 00	1.31681E 00	9.35939E 00	9.69708E-01	
4	10.0000CE-/2	1.87797E 00	-8.50277E 00	1.22032E-01	2.30277E 00	9.47390E-01	
5	1.30000E-01	1.71676E 00	-1.08361E 01	1.08324E 00	5.73608E 00	9.14213E-01	
6	1.80000E-01	1.37398E 00	-1.43692E 01	2.60163E-02	1.20308E 01	8.47559E-01	
7	2.40000E-01	8.66108E-01	-1.79244E 01	5.66108E-01	7.77558E 00	7.57791E-01	
8	3.20000E-01	8.24834E-02	-2.14155E 01	2.38248E 00	4.01553E 00	6.37824E-01	
9	4.20000E-01	-9.73049E-01	-2.38418E 01	1.12695E 00	6.14179E 00	5.05801E-01	
10	5.60000E-01	-2.43625E 00	-2.41286E 01	6.63753E-01	2.52863E 00	3.65853E-01	
11	7.50000E-01	-4.18381E 00	-2.00665E 01	2.01619E 00	1.03665E 01	2.44073E-01	
12	1.00000E 10	-5.81407E 00	-9.57125E 00	2.14068E-01	1.87713E 01	1.54589E-01	
13	1.30000E 00	-6.58800E 00	6.10798E 00	2.08800E 00	7.29202E 00	9.85887E-02	
14	1.800"0E D	-5.77078E 00	2.78866E 01	9.70779E-01	1.58664E 00	5.52373E-02	
15	2.40000E GG	-3.72762E 0r	4.21772E 01	3.27623E-01	5.87723E 00	3.31256E-02	
16	3.20070E CO	-1.17640E 00	5.03271E 01	1.23599E-01	1.79729E 01	2.03603E-02	
17	4.20090E 00	1.42988E 00	5.34745E 01	2.29882E-01	6.74522E-01	1.35774E-02	

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PROBLEM NUMBER

18	5.000 8 CD	4.44769E OL	5.22161E 01	4.76949E-02	1.60542E-02	9.94545E-03
19	7.000 E *)	8.11098E 0.	4.10505E 01	1.10976E-01	7.49498E-01	8.67957E-03
20	1.0000 E 01	9.86425E 0J	1.30109E 01	6.42477E-02	4.10889E-01	5.82577E-03
21	1.3200 E 31	7.65339E 00	-5.98689E 00	4.66133E-02	1.13110E-01	2.39006E-03
22	1.8407 E (1	6.80158E 00	-1.39296E 01	1.58048E-03	2.95832E-02	1.41981E-04

23	2.3600 E 01	6.10519E 00	-1.39577E 01	9.48080E-02	1.42254E-01	1.27420E-06
24	3.1900 E C1	5.75582E 00	-1.76388E 01	1.55817E-01	3.87533E-02	1.59849E-08

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