A FORTRAN PROGRAM FOR CALCULATING NONLINEAR SEISMIC GROUND RESPONSE

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This report is preliminary and
has not been edited or reviewed
for conformity with Geological
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Introduction

The program described here was designed for calculating the non-linear seismic response of a system of horizontal soil layers underlain by a semi-infinite elastic medium representing bedrock. Excitation is a vertically incident shear wave in the underlying medium. The non-linear hysteretic behavior of the soil is represented by a model (Figure 1) proposed by Iwan (1967) consisting of simple linear springs and Coulomb friction elements arranged as shown. A boundary condition (Papastamatiou, written communication) is used which takes account of finite rigidity in the elastic substratum. The computations are performed by an explicit finite-difference scheme that proceeds step by step in space and time. A brief program description is provided here with instructions for preparing the input and a source listing. A more detailed discussion of the method is presented elsewhere (Joyner and Chen, 1975) as is the description of a different program employing implicit integration (Chen, 1975).

Soil Layers

The physical properties of the soil layers are specified on input cards. For the purposes of computation the layers are divided into sublayers such that the transit time, DTT, of a shear wave at low strain across the sublayer is a constant. The division into sublayers is done automatically in such a way that a sublayer may span the boundary between layers. Since an integral number of sub-layers is required, each with a fixed shear-wave transit time, the total thickness of the system of sublayers used in computation may differ slightly from the sum of layer thicknesses specified on the input cards. The transit time DTT is ordinarily taken the same as the finite-difference time step, DELT, but the user is given the option of specifying a different value (which must be larger than DELT to prevent instability).

In the coordinate system used the vertical dimension is taken as positive downward. This choice controls the sign of stress and strain.

The dynamic behavior of the soil is specified in terms of the natural density, RHOI, the low-strain shear modulus, GMAX, and the dynamic shear strength, TAU. RHOI is specified on the input cards, and GMAX and TAU can either be specified on the input cards or computed by the program. In the latter case the computations are done assuming GMAX and TAU are functions of effective stress. For normally consolidated soil the assumed relationships are (see Hardin and Drnevich, 1972)

GMAX = GCFN * PV ** 0.5 (1)

and

TAU = TCF * PV (2)

where GCFN and TCF are coefficients specified on the input cards and PV, the vertical effective stress, is computed as a function of depth from data specified on the input cards. If there is a continuous water phase present in the soil, PV is given by

PV = PVTL - SAT * 980 * (Z-PHREAT)

where PVTL is the total vertical stress, SAT is the fractional water saturation, and PHREAT is the depth of the water table from the ground surface. This is an approximation to the relation proposed by Bishop and others (1961). If a continuous water phase is not present PV is set equal to PVTL. For overconsolidated soil the relationships for TAU and GMAX are

GMAX = GCFN * OCR ** XQ * PV ** 0.5 (3)

and

TAU = TCF * OCR ** XT * PV (4)

where the overconsolidation ratio,

OCR = SCV/PV.

SCV is the preconsolidation vertical stress and is specified for a layer on the input card. The exponents XQ and XT are specified on the input card.

If the value of TAU for a sublayer is computed by the program rather than being specified on the input cards, the value assigned to the sublayer is the value computed by equation (2) or (4) for the point within the sublayer that represents the midpoint in terms of shear wave travel time at low strain. If the value of GMAX is computed by the program, the value assigned is a special kind of average which is equal to the shear modulus of a constant-modulus sublayer that would have the same thickness for the given shear wave transit time as implied by equation (2) or (4).

The stress-strain behavior of the soil in shear is that given by Iwan's (1967) model and is determined by specifying the initial loading curve. For convenience, stress and strain are normalized in the manner used by Hardin and Drnevich (1972). Stress is normalized by multiplying by 1/TAU and strain is normalized by multiplying by

GMAX/TAU. The stress-strain curve normalized in this way has a stress limit of 1.0 for high strain and a slope at the origin of 1.0. A hyperbolic initial loading curve (Hardin and Drnevich, 1972) is used, and normalized strain, e, is espressed in terms of normalized stress, s, by the equation

$$e = \frac{s}{1 - s} \quad .$$

The initial loading surve for Iwan's model is a series of straight line segments. These are determined by selecting 51 normalized stress values, solving the preceding equation for the corresponding normalized strain values, and connecting the resulting stress-strain points by straight line segments. The 51 normalized stress values used are

$$s_1 = 0$$

$$s_i = 0.025 * (0.5) ** (6 - i) \qquad 2 \leq i \leq 6$$

$$s_i = 0.025 * (i - 5) \qquad 6 < i < 44$$

$$s_i = 1.0 - 0.025 * (0.5) ** (i - 44) \qquad 45 < i < 51$$

The same normalized initial loading curve is used for all the soil sublayers. The differences in behavior from one sublayer to another result from differences in the values of GMAX and TAU assigned to the different sublayers.

Input Motion

The input motion is read in from punch cards and is the horizontal particle acceleration in <u>g</u> that would be expected at the bedrock interface if the soil layers were absent and the interface were a free surface. The acceleration values are given at a time interval DELT which is the same as the time step for the finite-difference computations. After the input acceleration values are read in, they are integrated to give particle velocity, which is used in the computations.

Resolution, Stability and Filtering

An important choice in setting up the input for a problem is the frequency resolution desired. Denote by f_R the highest frequency for which faithful representation is desired in the output. This requirement implies 8 to 10 sublayers per wavelength. At low strain 10 sublayers per wavelength means a value of DTT equal to $1/(10*f_R)$. In the ordinary case the programassigns to DTT a value equal to DELT, and the desired resolution at low strain can be obtained by specifying a value of $1/(10*f_R)$ for DELT on the input cards. At high strain levels the resolution will be somewhat less.

The stability requirement for the linear elastic case (Richtmyer and Morton, 1967, p. 263) is that DTT must be greater than or equal to DELT. There is no guarantee that this will insure stability in a nonlinear problem, but the writer has encountered no cases of instability in runs where DTT was equal to DELT. If the user should happen to encounter a case of instability he can probably cure it by specifying a larger value of DTT. Provision is made in the program for specifying DTT separately.

The finite difference computations generate numerical noise at frequencies in the vicinity of 1/(4*DELT). This noise is generally not noticeable on the surface particle velocity time history and it has little effect on response spectral values at lower frequencies, but it is conspicuous in the surface acceleration time history. In general it is desirable to filter out this noise, and the program provides the option of digitally filtering output time histories by a zero-phase-shift filter with response, R, given by

$$R(f) = 1 \qquad f \leq F1$$

$$R(f) = 0.5 * (1.0 + \cos(\pi*(f - F1) / (F2 - F1))) \qquad F1 \leq f \leq F2$$

$$R(f) = 0 \qquad f \geq F2$$

where f is frequency and F1 and F2 are parameters specified on an input card. If either F1 or F2 is zero no filtering is done. It is recommended that F1 be assigned a value equal to the desired frequency resolution f_R and that F2 be assigned the value $2f_R$. If filtering is done the number of points in the output time histories is reduced by 20.

General Description of Output

All output quantities are expressed in cgs units except for acceleration, which is given as a fraction of the acceleration of gravity. The printout lists the values of the input parameters. There is also a list of sublayers, giving sequence number and physical properties along with depth, effective vertical stress and total vertical stress evaluated at the bottom of the sublayer. The input parameters for the layers are inserted into the sublayer list at the appropriate place. Also indicated in sublayer list are those places where time histories will be saved as designated on the input cards. Up to three time histories may be saved. They may be of particle velocity, stress, or strain at the option of the user and they be located at any depth within the section.

The program as described here contains a dummy plot subroutine called SMPLT which simply lists time histories. The user may substitute a plot subroutine suitable for his installation that will produce graphic plots of the time histories.

Following the sublayer list the printout gives the maximum and minimum values of the input acceleration along with the sequence numbers of the time points at which the maximum and minimum occurred. This is followed by a listing of the input accleration from the dummy plot routine. Next is a list of sublayers giving the maximum absolute value of strain in each sublayer. These are unfiltered values and therefore may disagree slightly with subsequent listings which may be filtered. Following that, data are given in turn for surface particle velocity, surface acceleration and any time histories that are saved. For each the maximum and minimum values are given along with a listing from the dummy plot subroutine.

The output also includes a punch card deck for the surface acceleration. The cards have sequence numbers punched in columns 71 - 76, and the FORMAT is (5E14.8, I6).

For the output time histories, including both listings and punch card decks, the number of points, if no filtering is used, is NK, the same as the number of points on the input. If filtering is done the number of output points is (NK - 20).

Instructions for Preparing Input

As with the output, all input quantities are expressed in cgs units except for acceleration which is given as a fraction of the acceleration of gravity. The input cards are listed below with an explanation of the variables.

Card No. 1	FORMAT (20A4)	
ALPHA (J)		Any desired alphameric identification
Card No. 2	FORMAT (I5, F10.0, 2F5.0)	
NK		Number of points on input time history. NK must not exceed 5000.
DELT		Time intervals for input data points and time step for finite difference computations.
F1, F2		Parameters specifying response of filter. If either F1 or F2 is zero, no filtering is done.
Card No. 3	FORMAT (F10.0, E10.0, F10.0)	
RHON		Density of elastic substratum
VN		Shear velocity of elastic substratum
DTT		Shear wave transit time through a sublayer at low strain. Ordinarily this should be left blank and the program will assign to DTT the value specified for DELT.
Card No. 4	FORMAT (I1, 9X, 7(I1, E9.0))	
		Input variable list: LIM, (IOPS(L), DS(L), L = 1, LIM)
LIM		Number of time histories to be saved. May be zero or any number up to 3. (The limitation is imposed by dimension statements in the main program; the FORMAT statement above would allow for more.)

IOPS(L) — Code indicating kind of time history to be saved. IOPS(L) = 1 for strain, 2 for stress and 3 for particle velocity.

DS(L) — Depth for which time history is to be saved. If stress or strain is chosen, the time history saved applies to the sublayer containing the specified depth. If particle velocity is chosen the time history saved applies to the point at the top of the sublayer containing the specified depth.

Card(s) No. 5 — FORMAT (I1, E8.0, F5.0, 2E8.0, F3.0, I1, E8.0, F3.0, E8.0, F3.0, 3E8.0)

One card for each layer in the soil column. The total thickness of the column must be restricted so that the number of sublayers in the system does not exceed 200.

MORE — Code indicating whether additional layer cards follow. MORE = 1 for all layer cards except the last, for which it may be anything other than 1.

THICK — Thickness (in cm, remember) of the layer.

RHOI — Density

SCV — Preconsolidation vertical stress.

PHREAT — Depth of water table from ground surface.

SAT — Degree of saturation (as a fraction <u>not</u> a percentage).

IFPH — IFPH = 1 if a continuous water phase is present and 0 if not. (A value of 0 for IFPH causes effective stress to be set equal to total stress).

GCFN — Parameter for computing GMAX by equations (1) or (3). May be left blank if GMAX is specified on card.

XQ	Parameter for computing GMAX by equation (3). May be left blank if GMAX is specified on card.
TCF	Parameter for computing TAU by equations (2) or (4). May be left blank if TAU is specified on the card.
XT	Parameter for computing TAU by equation (4). May be left blank if TAU is specified on the card.
TAUC	Specified value for TAU. Must be blank or zero if TAU is to be computed by equation (2) or (4).
GMAXC	Specified value for GMAX. Must be blank or zero if GMAX is to be computed by equation (1) or (3).
VIC	Specified value for the low strain shear velocity of the layer. If VIC is not equal to zero, GMAX is set equal to RHOI*VIC**2 overriding any specification in the GMAXC field and any computation by equations (1) or (3).

Card(s) No. 6 FORMAT (5E14.8)

Cards giving the values of input acceleration. A total of NK values at a time interval DELT.

Memory and Time Requirements

The program as written requires 64,000 words of core storage on an IBM 370 - 155. For large problems the time requirement on the same machine is approximately one millisecond per sublayer per time step. Running time for large problems is essentially proportional to the product of the number of elements and the number of time steps.

Variables in Printer Output not Previously Defined

I	Index number for sublayer. Numbering is from the top down.
VOUT	Low-strain shear wave velocity for sublayer.
DELZ	Thickness of sublayer.
ER	Reference strain used in normalizing stress-strain curve, equals TAU/GMAX.
Z	Depth to base of sublayer.
PV1	Vertical effective stress at base of sublayer.
PVTL	Vertical total stress at the base of sublayer.
L	Index number for time history to be saved.
IS(L)	Index number of sublayer for which time history is to be saved.
ZTOP	Depth to the top of sublayer IS(L). If the time history to be saved is particle velocity, then the time history applies to the point at depth ZTOP.
ZBASE	Depth to the base of sublayer IS(L).
K	Index number for time values.

Other Important Variables

SIGY(J)	Normalized yield stress of friction element J in the Iwan soil model (equivalent to Y_i in Figure 1).
CF(M, I)	Normalized tangent shear modulus of the soil model for sublayer I where M is the index of the friction element with the largest yield stress of all the elements that are currently yielding. (As the program is now constituted the values of CF are the same for all sublayers. The I index

was included to facilitate program modifications that would permit different sets of of CF values for different sublayers).

NI	Total number of sublayers.
ERI(I)	Parameter for sublayer I; equal to DELT/(DELZ*ER).
SK(I)	Parameter for sublayer I; equal to TAU.
SL(I)	Parameter for sublayer I; equal to DELT/DELZ
TK(I)	Parameter characterizing the mass lumped at the boundary between sublayer I and the sublayer above; equal to 2*DELT/(UMASS + BMASS), where BMASS is equal to RHOI * DELZ for sublayer I and UMASS is the corresponding quantity for the sublayer above. When I = 1, UMASS = 0, and when I = NI + 1, BMASS = 0.
X(K)	An array containing, at different stages of program execution, the input acceleration time history, the surface particle velocity time history and the surface acceleration time history.
Y(K, L)	Time history to be saved for index L.
BRI	Shear impedance of bedrock; equal to RHON * VN.
MAX	Total number of series units in the Iwan soil model. Each unit consists of a linear spring and a Coulomb friction element in parallel. As the program is now constituted MAX is fixed at 50.
SIGYP	Normalized stress for the point with the highest normalized stress of the set of points used in defining the initial loading curve for the soil model.
VOK	Current value of input particle velocity, obtained by integrating the input acceleration time history.

V(I)	Current value of particle velocity at the top of sublayer I.
SIG(I)	Current value of the normalized stress in sublayer I.
SIGS(J, I)	Current value of the normalized stress for spring J of the soil model representing sublayer I.
STRN(I)	Current value of strain (not normalized) in sublayer I.
SMAX(I)	Maximum value of strain (not normalized) in sublayer I.
M	Index of the friction element (in the Iwan soil model) with the largest yield stress of all the elements that are currently yielding.
MH(I)	Value of M for sublayer I.
L	(In subroutine NONLI only). A logical variable with the value TRUE if the strain is increasing and FALSE if it is decreasing.
LH(I)	Value of L for sublayer I.
DELE	Increment of normalized strain.
SIGP	Trial value of normalized stress.

Description of Subroutines

The main program reads input cards numbers 1, 2, and 6 and controls the sequence of operations. Subroutine SECT, called by the main program, reads input cards numbers 3, 4, and 5 and sets up the system of sublayers used in the computations, assigning to the sublayers the parameters that define their physical properties. Subroutine SECT also makes the necessary provisions for saving time histories for output.

Subroutine SIGMA, called by SECT, specifies the 51 normalized stress values used in defining the initial loading curve for the soil model. Subroutine MODEL, also called by SECT, generates the array CF(M, I), which describes the tangent modulus of the soil model.

Subroutine NONLI, called by the main program, performs all the dynamic response calculations and saves the output time histories.

The remaining subroutines are all called by the main program and perform functions related to output. Subroutine FILTER does a low-pass filter operation on the output time histories. Subroutine SMPLT is a dummy plot routine that simply lists the output time histories. The user may substitute a routine suitable for his own installation to give a graphic display of the output. Subroutine PUNCH generates a punch-card deck of the surface acceleration time history. Subroutine XTRM finds and prints out the maximum and minimum values of the output time histories along with the index of the time points at which the maximum and minimum occurred.

Sample Problem

To assist the reader in using the program a simplified sample problem is presented with a listing of the input deck and a copy of the printer output. The problem involves a soil layer 2500 cm thick with a density of 2.0 gm/cm^3. The water table is at the surface and the soil is fully saturated and normally consolidated throughout. (The assumption of normal consolidation all the way up to the surface was made for simplicity and is actually unrealistic. Some degree of overconsolidation near the surface would be expected for most soil deposits.) GMAX and TAU are computed by the program using the following parameters:

GCFN = 0.9 E + 06 $(\text{dynes/cm}^2)^{1/2}$

TAU = 0.33

Values are given on the input card for XQ and XT but they are not needed because the soil is presumed to be normally consolidated.

The bedrock beneath the soil layer is assigned a density of 2.6 gm/cm^3 and a shear wave velocity of 2.0×10^5 cm/sec. The input acceleration is a positive triangular spike of amplitude 0.5g and duration 0.2 sec followed by a negative triangular spike of the same amplitude and duration (Figure 2). The input acceleration values are specified at intervals, DELT, of 0.01 seconds. A value of 300 was chosen for NK in order to allow sufficient time for the main features of the surface time histories to develop. The input acceleration just described is padded at the end with zeros to make up 300 points.

The output is filtered with F1 - 10 Hz and F2 - 20 Hz. Time histories of stress, strain, and particle velocity are saved at a depth of about 1250 cm.

The input acceleration for the problem is shown in Figure 2 and the surface particle velocity and surface acceleration are given in Figures 3 and 4 respectively.

References

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Chen, A. T. F. (1975). MULAP: A Multilinear analysis program for ground motion studies of horizontally layered systems, Report No. WSGS-GD-76-004, NTIS No. PB 251-286/AS, Clearinghouse, Springfield, VA 22151

Hardin, B. O., and V. P. Drnevich (1972). Shear modulus and damping in soils: Design equations and curves, Proc. Am. Soc. Civil Eng., J. Soil Mech. Found. Div. 98, 667-692.

Iwan, W. D. (1967). On a class of models for the yielding behavior of continuous and composite systems, J. Appl. Mech. 34, 612-617.

Joyner, W. B. and A. T. F. Chen (1975). Calculation of nonlinear ground response in earthquakes, Bull. Seism. Soc. Am. 65, 1315-1336.

Richtmyer, R. D., and K. W. Morton (1967). Difference Methods for Initial Value Problems, 2nd edition, Interscience, New York.

Figure 1. - Model for nonlinear soil behavior. Model consists of simple elastic springs with spring constants G_i and Coulomb friction elements with yield stresses Y_i. Y_1 equals zero.

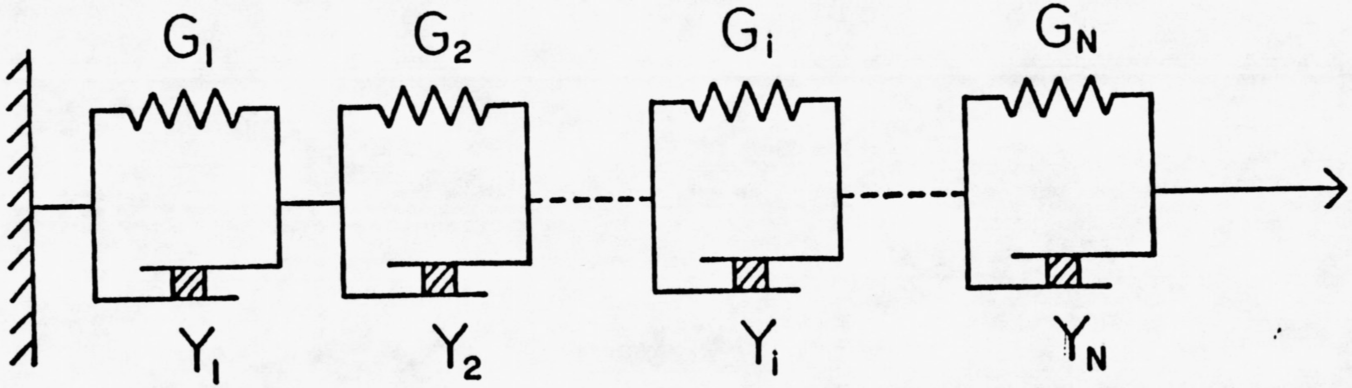

G1
G2
Gi
GN
Y1
Y2
Yi
YN

Figure 2. - Input acceleration for sample problem.

SAMPLE PROBLEM 2

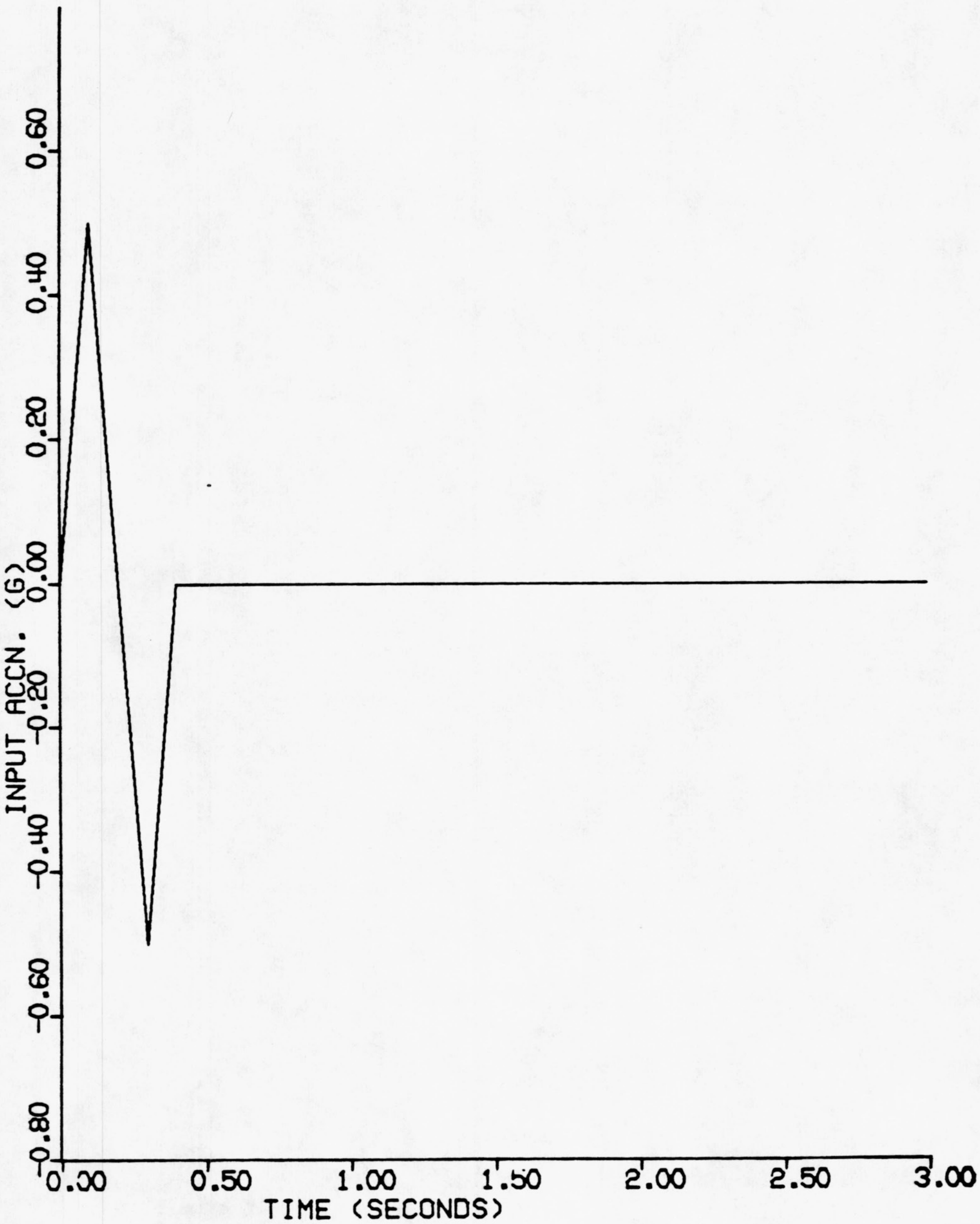


Figure 3. - Surface particle velocity for sample problem.

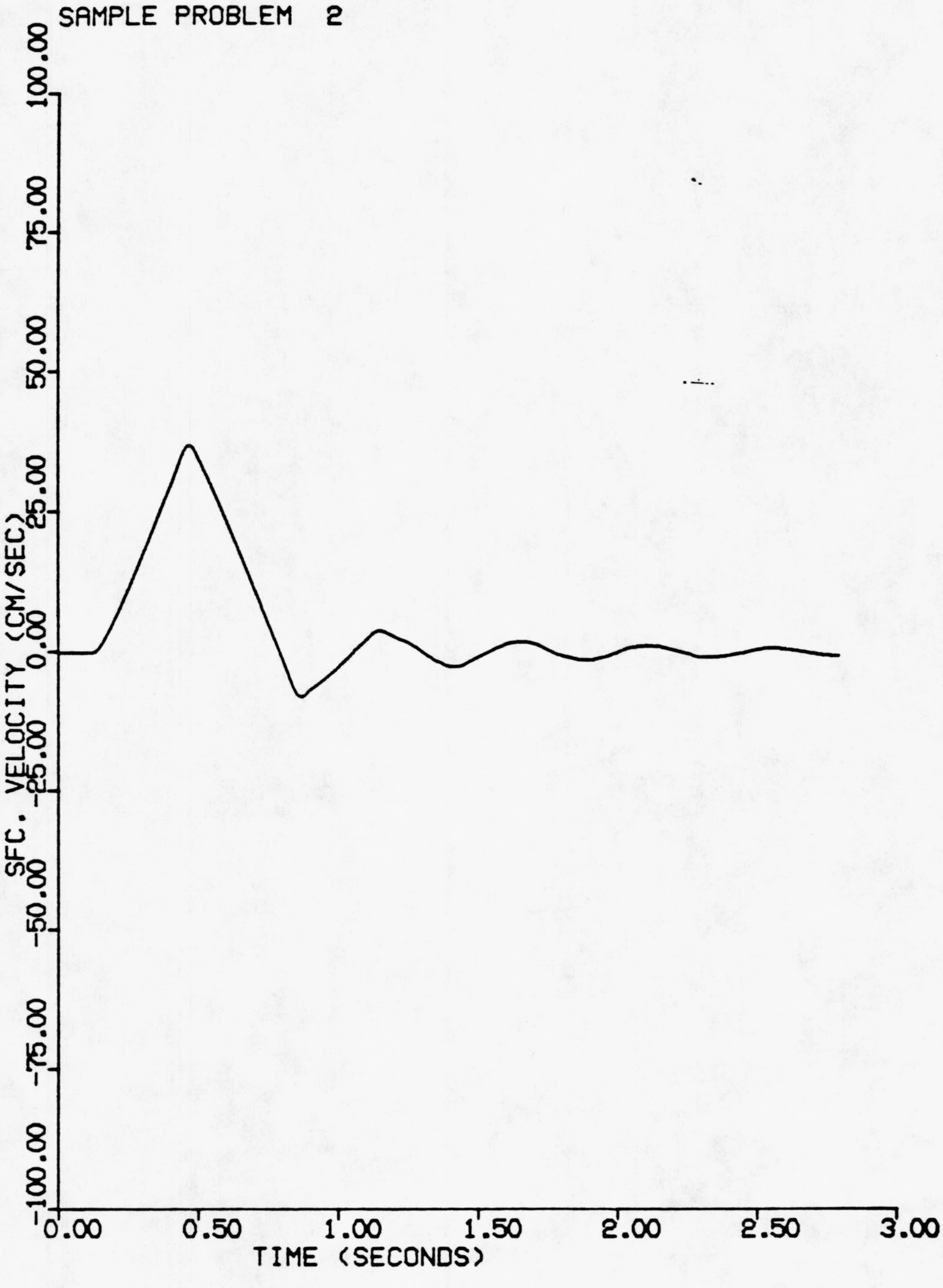
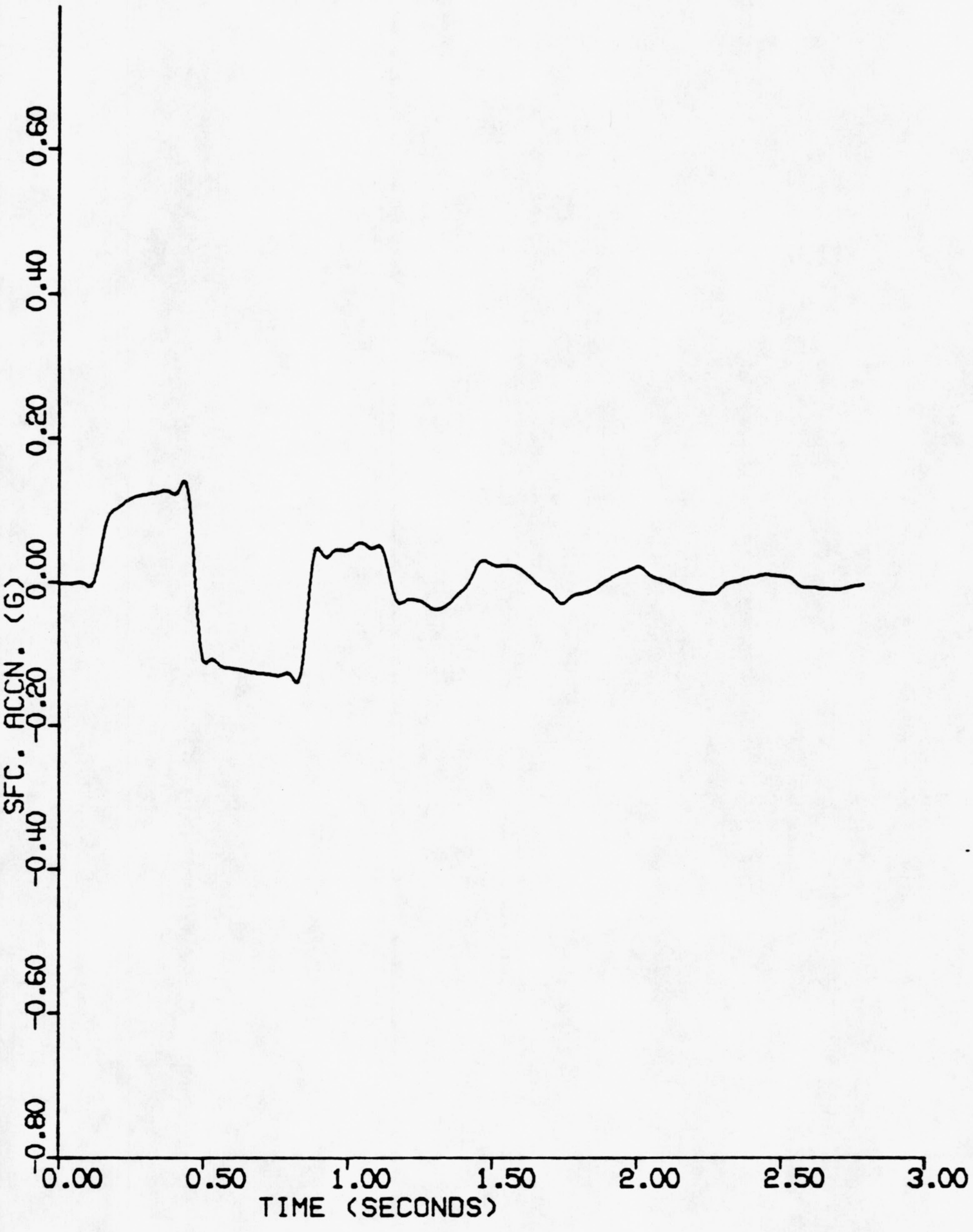

SAMPLE PROBLEM 2
SFC. VELOCITY (CM/SEC)
100.00
75.00
50.00
25.00
0.00
-25.00
-50.00
-75.00
-100.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
TIME (SECONDS)

Figure 4. - Surface acceleration for sample problem.

SAMPLE PROBLEM 2



FORTRAN
PROGRAM

```
0001          REAL ALPHA(20)
0002          REAL SIGY(50),CF(50,200)
0003          REAL ERI(200),SK(200),SL(200)
0004          REAL TK(201)
0005          REAL X(5000),Y(5000,3)
0006          INTEGER IS(3),IOPS(3)
        C     MAIN FOR NONLI3C - VERSION 1
0007      501 FORMAT(20A4)
0008      502 FORMAT('1',20A4/)
0009      503 FORMAT(I5,F10.0,2F5.0)
0010      504 FORMAT(5X,'NK=',I6/5X,'DELT=',F9.5/5X,'F1=',
         * F6.2/5X,'F2=',F6.2/)
0011      507 FORMAT(5E14.8)
0012      511 FORMAT(//1X,'INPUT ACCELERATION'/)
0013      512 FORMAT(//1X,'SURFACE VELOCITY'/)
0014      513 FORMAT(//1X,'SURFACE ACCELERATION'/)
0015      514 FORMAT(//1X,'OUTPUT - I=',I4,3X,'IOPS=',I2/)
0016          G=980.0
0017          READ(5,501) (ALPHA(J),J=1,20)
0018          WRITE(6,502) (ALPHA(J),J=1,20)
0019          READ(5,503) NK,DELT,F1,F2
0020          WRITE(6,504) NK,DELT,F1,F2
0021          CALL SECT(ERI,SK,SL,TK,NI,BRI,IS,IOPS,LIM,DELT,
         * SIGY,CF,MAX)
0022          DO 20 L=1,LIM
0023          DO 20 K=1,NK
0024       20 Y(K,L)=0.0
0025          READ(5,507) (X(K),K=1,NK)
0026          WRITE(6,511)
0027          CALL XTRM(X,NK)
0028          CALL SMPLT(X,NK,DELT,ALPHA)
0029          CALL NONLI(X,Y,IS,IOPS,LIM,ERI,SK,SL,TK,NI,BRI,SIGY,
         * CF,MAX,NK,DELT)
0030          IF(F1.EQ.0.0.OR.F2.EQ.0.0) GO TO 30
0031          CALL FILTER(X,F1,F2,20,DELT,NK)
0032          DO 31 L=1,LIM
0033       31 CALL FILTER(Y(1,L),F1,F2,20,DELT,NK)
0034          NK=NK-20
0035       30 WRITE(6,512)
0036          CALL XTRM(X,NK)
0037          CALL SMPLT(X,NK,DELT,ALPHA)
0038          AT1=X(1)/(DELT*G)
0039          DO 10 K=2,NK
0040          AT2=(X(K)-X(K-1))/(DELT*G)
0041          X(K-1)=AT1
0042       10 AT1=AT2
0043          X(NK)=AT1
0044          WRITE(6,513)
0045          CALL XTRM(X,NK)
0046          CALL PUNCH(X,NK)
0047          CALL SMPLT(X,NK,DELT,ALPHA)
0048          DO 40 L=1,LIM
```

```
      WRITE(6,514) IS(L),IOPS(L)
      CALL XTRM(Y(1,L),NK)
   40 CALL SMPLT(Y(1,L),NK,DELT,ALPHA)
      STOP
      END
```

```
      SUBROUTINE NONLI(X,Y,IS,IOPS,LIM,ERI,SK,SL,TK,NI,BRI,SIGY,
     * CF,MAX,NK,DELT)
C     NONLI3C
      REAL*8 VOK
      REAL X(5000),Y(5000,3)
      REAL V(201)
      REAL SIG(200),SIGS(50,200)
      REAL SIGY(50),CF(50,200)
      REAL SMAX(200),STRN(200)
      REAL ERI(200),SK(200),SL(200)
      REAL TK(201)
      INTEGER IS(1),IOPS(1)
      INTEGER MH(200)
      LOGICAL LH(200),L
  501 FORMAT('1MAXIMUM STRAIN PROFILE'//(3X,I3,E14.3))
      DO 20 I=1,NI
      LH(I)=.TRUE.
      MH(I)=1
      V(I)=0.0
      SIG(I)=0.0
      SMAX(I)=0.0
      STRN(I)=0.0
      DO 20 M=1,MAX
   20 SIGS(M,I)=0.0
      V(NI+1)=0.0
      G=980.0
      VOK=0.0
      DO 10 K=1,NK
      DO 30 I=1,NI
      STRN(I)=STRN(I)+(V(I+1)-V(I))*SL(I)
      TEST=ABS(STRN(I))
      IF(TEST.GT.SMAX(I)) SMAX(I)=TEST
   30 CONTINUE
      L=LH(NI)
      M=MH(NI)
      VOK=VOK+G*DELT*X(K)
      DELE=(V(NI+1)-V(NI))*ERI(NI)
      IF(DELE.EQ.0.0) GO TO 11
      IF((L.AND.DELE.GT.0.0).OR.((.NOT.L).AND.DELE.LT.0.0)) GO TO 12
      L=.NOT.L
      LH(NI)=L
      M=1
      MH(NI)=1
   12 SIGP=SIG(NI)+DELE*CF(M,NI)
      IF(M.EQ.MAX) GO TO 13
      IF(ABS(SIGP-SIGS(M+1,NI)).LT.SIGY(M+1)) GO TO 13
      IF(SIGP.GT.SIGS(M+1,NI)) SIGP=SIGS(M+1,NI)+SIGY(M+1)
      IF(SIGP.LT.SIGS(M+1,NI)) SIGP=SIGS(M+1,NI)-SIGY(M+1)
      DELE=DELE-(SIGP-SIG(NI))/CF(M,NI)
      SIG(NI)=SIGP
      M=M+1
      MH(NI)=M
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```
           GO TO 12
        13 SIGS(1,NI)=SIGP
           IF(M.EQ.1) GO TO 19
           DO 14 J=2,M
           IF(L) SIGS(J,NI)=SIGP-SIGY(J)
           IF(.NOT.L) SIGS(J,NI)=SIGP+SIGY(J)
        14 CONTINUE
        19 SIG(NI)=SIGP
        11 V(NI+1)=(1.0-1.0/(TK(NI+1)*BRI+1.0))*
          * (VOK-(SK(NI)*SIG(NI)-V(NI+1)/TK(NI+1))/BRI)
           DO 5 JI=2,NI
           I=NI-JI+1
           L=LH(I)
           M=MH(I)
           DELE=(V(I+1)-V(I))*ERI(I)
           IF(DELE.EQ.0.0) GO TO 5
           IF((L.AND.DELE.GT.0.0).OR.((.NOT.L).AND.DELE.LT.0.0)) GO TO 2
           L=.NOT.L
           LH(I)=L
           M=1
           MH(I)=1
         2 SIGP=SIG(I)+DELE*CF(M,I)
           IF(M.EQ.MAX) GO TO 3
           IF(ABS(SIGP-SIGS(M+1,I)).LT.SIGY(M+1)) GO TO 3
           IF(SIGP.GT.SIGS(M+1,I)) SIGP=SIGS(M+1,I)+SIGY(M+1)
           IF(SIGP.LT.SIGS(M+1,I)) SIGP=SIGS(M+1,I)-SIGY(M+1)
           DELE=DELE-(SIGP-SIG(I))/CF(M,I)
           SIG(I)=SIGP
           M=M+1
           MH(I)=M
           GO TO 2
         3 SIGS(1,I)=SIGP
           IF(M.EQ.1) GO TO 9
           DO 4 J=2,M
           IF(L) SIGS(J,I)=SIGP-SIGY(J)
           IF(.NOT.L) SIGS(J,I)=SIGP+SIGY(J)
         4 CONTINUE
         9 SIG(I)=SIGP
         5 V(I+1)=V(I+1)+TK(I+1)*(SK(I+1)*SIG(I+1)-SK(I)*SIG(I))
           V(1)=V(1)+TK(1)*SK(1)*SIG(1)
           IF(LIM.EQ.0) GO TO 10
           DO 40 LL=1,LIM
           ISL=IS(LL)
           IF(IOPS(LL).EQ.1) Y(K,LL)=STRN(ISL)
           IF(IOPS(LL).EQ.2) Y(K,LL)=SIG(ISL)*SK(ISL)
           IF(IOPS(LL).EQ.3) Y(K,LL)=V(ISL)
        40 CONTINUE
        10 X(K)=V(1)
           WRITE(6,501) (I,SMAX(I),I=1,NI)
           RETURN
           END
```

```
0001              SUBROUTINE SECT(ERI,SK,SL,TK,NI,BRI,IS,IOPS,LIM,
                 * DELT,SIGY,CF,MAX)
            C     SECT3C3
0002              REAL ERI(200),SK(200),SL(200)
0003              REAL TK(201)
0004              REAL SIGY(50),CF(50,200)
0005              REAL DS(8)
0006              INTEGER IS(1),IOPS(1)
0007          501 FORMAT(F10.0,E10.0,F10.0)
0008          510 FORMAT(5X,'DTT=',F9.5/)
0009          502 FORMAT('1SUBROUTINE SECT'//5X,'RHON=',F8.3/
                 * 5X,'VN=',E12.4/)
0010          503 FORMAT(I1,9X,7(I1,E9.0))
0011          504 FORMAT(5X,'LIM=',I2/5X,'IOPS(L)=',7I12)
0012          514 FORMAT(5X,'DS(L)=',2X,7E12.4)
0013          505 FORMAT(/1X,3X,'I',9X,'VOUT',9X,'DELZ',9X,'GMAX',10X,'TAU',
                 * 11X,'ER',5X,'RHOI',12X,'Z',10X,'PV1',9X,'PVTL'/)
0014          506 FORMAT(I1,E8.0,F5.0,2E8.0,F3.0,I1,E8.0,F3.0,E8.0,F3.0,3E8.0)
0015          507 FORMAT(/1X,'MORE',6X,'THICK',3X,'RHOI',8X,'SCV',5X,'PHREAT',
                 * 3X,'SAT',2X,'IFPH',7X,'GCFN',4X,'XQ',8X,'TCF',4X,'XT',
                 * 7X,'TAUC',6X,'GMAXC',8X,'VIC'/
                 * 1X,I4,E11.3,F7.3,2E11.3,F6.2,I6,E11.3,F6.2,E11.3,F6.2,3E11.3/)
0016          508 FORMAT(/1X,'L=',I2,3X,'IS(L)=',I4,3X,'IOPS(L)=',I2,3X,
                 * 'DS(L)=',E12.4,3X,'ZTOP=',E12.4,3X,'ZBASE=',E12.4/)
0017          509 FORMAT(1X,I4,5E13.4,F9.4,3E13.4)
0018          520 FORMAT(1X,'NUMBER OF SUBLAYERS EXCEEDS 200 - JOB TERMINATED')
0019              CALL SIGMA(MAX,SIGY,SIGYP)
0020              READ(5,501) RHON,VN,DTT
0021              WRITE(6,502) RHON,VN
0022              IF(DTT.NE.0.0) WRITE(6,510) DTT
0023              IF(DTT.EQ.0.0) DTT=DELT
0024              BRI=RHON*VN
0025              READ(5,503) LIM,(IOPS(L),DS(L),L=1,LIM)
0026              IF(LIM.EQ.0) DS(1)=1.0E+15
0027              WRITE(6,504) LIM,(IOPS(L),L=1,LIM)
0028              WRITE(6,514) (DS(L),L=1,LIM)
0029              I=0
0030              Z=0.0
0031              PV1=0.0
0032              ZLAST=0.0
0033              TUU=0.0
0034              PVTL=0.0
0035              UMASS=0.0
0036              DTH=DTT/2.0
0037              ISW=0
0038              L=1
0039              MORE=1
0040              WRITE(6,505)
0041          100 IF(MORE.NE.1) GO TO 900
0042              READ(5,506) MORE,THICK,RHOI,SCV,PHREAT,SAT,IFPH,
                 * GCFN,XQ,TCF,XT,TAUC,GMAXC,VIC
0043              WRITE(6,507) MORE,THICK,RHOI,SCV,PHREAT,SAT,IFPH,
```

```
          * GCFN,XQ,TCF,XT,TAUC,GMAXC,VIC
          PTCF=RHOI*980.0
          PCOEF=(RHOI-SAT)*980.0
          IF(IFPH.EQ.0) PCOEF=PTCF
          PV1=PVTL-SAT*980.0*(Z-PHREAT)
          IF(IFPH.EQ.0) PV1=PVTL
          GCFO=GCFN
          IF(SCV.NE.0) GCFO=GCFN*SCV**XQ
          PNC=0.75
          POC=PNC+XQ/2.0
          PCNN=SQRT(GCFN/RHOI)*PCOEF*0.75
          PCNO=SQRT(GCFO/RHOI)*PCOEF*POC
          IF((VIC.EQ.0.0).AND.(GMAXC.NE.0.0)) VIC=SQRT(GMAXC/RHOI)
          SVB=PV1+THICK*PCOEF
          SLIM=SVB
          IF(SLIM.GT.SCV) SLIM=SCV
      110 DTX=DTH-TUU
          IF(SCV.LE.PV1) GO TO 120
          PV2=(PV1**POC+PCNO*DTX)**(1.0/POC)
          IF(VIC.NE.0.0) PV2=PV1+PCOEF*VIC*DTX
          IF(PV2.LE.SLIM) GO TO 130
          IF(VIC.EQ.0.0) TADD=(SLIM**POC-PV1**POC)/PCNO
          IF(VIC.NE.0.0) TADD=(SLIM-PV1)/(VIC*PCOEF)
          TUU=TUU+TADD
          ZADD=(SLIM-PV1)/PCOEF
          Z=Z+ZADD
          PVTL=PVTL+ZADD*PTCF
          PV1=SLIM
          IF(SLIM.EQ.SVB) GO TO 100
          GO TO 110
      120 PV2=(PV1**PNC+PCNN*DTX)**(1.0/PNC)
          IF(VIC.NE.0.0) PV2=PV1+PCOEF*VIC*DTX
          IF(PV2.LE.SVB) GO TO 130
          IF(VIC.EQ.0.0) TADD=(SVB**PNC-PV1**PNC)/PCNN
          IF(VIC.NE.0.0) TADD=(SVB-PV1)/(VIC*PCOEF)
          TUU=TUU+TADD
          ZADD=(SVB-PV1)/PCOEF
          Z=Z+ZADD
          PVTL=PVTL+ZADD*PTCF
          PV1=SVB
          GO TO 100
      130 DZP=(PV2-PV1)/PCOEF
          Z=Z+DZP
          PVTL=PVTL+DZP*PTCF
          PV1=PV2
          TUU=0.0
          IF(ISW.EQ.1) GO TO 140
          TAU=TCF*PV2
          IF(SCV.GT.PV2) TAU=TAU*(SCV/PV2)**XT
          IF(TAUC.NE.0) TAU=TAUC
          ISW=1
          GO TO 110
```

```
  140 DELZ=Z-ZLAST
      I=I+1
      IF(I.GT.200) GO TO 920
  142 IF(Z.LT.DS(L)) GO TO 143
      IS(L)=I
      WRITE(6,508) L,IS(L),IOPS(L),DS(L),ZLAST,Z
      L=L+1
      IF(L.GT.LIM) GO TO 144
      GO TO 142
  144 DS(L)=1.0E+15
  143 ZLAST=Z
      VOUT=DELZ/DTT
      BMASS=RHOI*DELZ
      TK(I)=2.0*DELT/(UMASS+BMASS)
      SL(I)=DELT/DELZ
      GMAX=RHOI*(DELZ/DTT)**2
      ER=TAU/GMAX
      ERI(I)=DELT/(DELZ*ER)
      SK(I)=TAU
      UMASS=BMASS
      CALL MODEL(MAX,SIGY,SIGYP,CF,I)
      WRITE(6,509) I,VOUT,DELZ,GMAX,TAU,ER,RHOI,Z,PV1,PVTL
      ISW=0
      GO TO 110
  900 IF(ISW.EQ.0) GO TO 905
      DELZ=Z-ZLAST
      ZADD=DELZ*(DTT/(TUU+DTH)-1.0)
      Z=Z+ZADD
      PVTL=PVTL+ZADD*PTCF
      PV1=PV1+ZADD*PCOEF
      DELZ=DELZ+ZADD
      I=I+1
      IF(I.GT.200) GO TO 920
  942 IF(Z.LT.DS(L)) GO TO 943
      IS(L)=I
      WRITE(6,508) L,IS(L),IOPS(L),DS(L),ZLAST,Z
      L=L+1
      IF(L.GT.LIM) GO TO 944
      GO TO 942
  944 DS(L)=1.0E+15
  943 VOUT=DELZ/DTT
      BMASS=RHOI*DELZ
      TK(I)=2.0*DELT/(UMASS+BMASS)
      SL(I)=DELT/DELZ
      GMAX=RHOI*(DELZ/DTT)**2
      ER=TAU/GMAX
      ERI(I)=DELT/(DELZ*ER)
      SK(I)=TAU
      UMASS=BMASS
      CALL MODEL(MAX,SIGY,SIGYP,CF,I)
      WRITE(6,509) I,VOUT,DELZ,GMAX,TAU,ER,RHOI,Z,PV1,PVTL
  905 NI=I
```

```
                  TK(NI+1)=2.0*DELT/UMASS
                  IF(L.GT.LIM) GO TO 910
                  DO 901 JL=L,LIM
                  IS(JL)=NI
                  IF(IOPS(JL).EQ.3) IS(JL)=NI+1
                  ZTOP=Z-DELZ
                  IF(IOPS(JL).EQ.3) ZTOP=Z
              901 WRITE(6,508) JL,IS(JL),IOPS(JL),DS(JL),ZTOP,Z
              910 RETURN
              920 WRITE(6,520)
                  STOP
                  END
```

```
      SUBROUTINE SIGMA(MAX,SIGY,SIGYP)
C     SSM-8
      REAL SIGY(50)
      MAX=50
      SIGY(1)=0.0
      DO 1 J=2,6
    1 SIGY(J)=0.025*0.5**(6-J)
      DO 2 J=7,44
    2 SIGY(J)=0.025*FLOAT(J-5)
      DO 3 J=45,50
    3 SIGY(J)=1.0-0.025*0.5**(J-44)
      SIGYP=1.0-0.025*0.5**7
      RETURN
      END
```

```
0001              SUBROUTINE MODEL(MAX,SIGY,SIGYP,CF,I)
           C      SSM-8
0002              REAL SIGY(50),CF(50,200)
0003              MM=MAX-1
0004              EML=0.0
0005              DO 1 J=1,MM
0006              EM=SIGY(J+1)/(1.0-SIGY(J+1))
0007              CF(J,I)=(SIGY(J+1)-SIGY(J))/(EM-EML)
0008            1 EML=EM
0009              EM=SIGYP/(1.0-SIGYP)
0010              CF(MAX,I)=(SIGYP-SIGY(MAX))/(EM-EML)
0011              RETURN
0012              END
```

```
FORTRAN IV G LEVEL  21              FILTER            DATE = 76057          03/37/45            PAGE 0001

      SUBROUTINE FILTER(XX,F1,F2,N,DTF,NKF)
      REAL XX(1)
      REAL YY(5000)
      REAL P(1000)
      PI=3.14159
      P0=(F1+F2)*DTF
      W1=2.0*PI*F1
      W2=2.0*PI*F2
      C=DTF/(2.0*PI)
      Q=1.0/(2.0*(F2-F1))
      DO 1 I=1,N
      T=FLOAT(I)*DTF
      TMQ=T-Q
      ADD=PI*(F2-F1)
      IF(TMQ.NE.0) ADD=SIN(PI*TMQ*(F2-F1))/TMQ
      ADD=C*SIN((W1+W2)*T/2.0)*ADD
    1 P(I)=C*(SIN(W1*T)+SIN(W2*T))*(1.0/T-0.5/(T+Q))+ADD
      DO 2 J=1,NKF
      CUM=P0*XX(J)
      DO 3 I=1,N
      IF((I+J).GT.NKF) GO TO 4
      CUM=CUM+P(I)*XX(J+I)
    3 CONTINUE
    4 DO 5 I=1,N
      IF((J-I).LT.1) GO TO 2
      CUM=CUM+P(I)*XX(J-I)
    5 CONTINUE
    2 YY(J)=CUM
      DO 6 J=1,NKF
    6 XX(J)=YY(J)
      RETURN
      END
```

```
      SUBROUTINE SMPLT(Y,NK,DELT,ALPHA)
C      DUMMY PLOT SUBROUTINE
      REAL Y(5000)
  501 FORMAT(//(10E12.3))
      WRITE(6,501) (Y(K),K=1,NK)
      RETURN
      END
```

```
      SUBROUTINE PUNCH(Y,NK)
      REAL Y(5000)
  501 FORMAT(5E14.8,I6)
      J1=1
      J2=5
      NC=NK/5
      DO 10 KC=1,NC
      WRITE(8,501) (Y(J),J=J1,J2),KC
      J1=J1+5
   10 J2=J2+5
      RETURN
      END
```

```
0001            SUBROUTINE XTRM(Y,NK)
0002            REAL Y(5000)
0003        501 FORMAT(5X,'MAX=',E12.4,1X,'AT K=',I6/5X,'MIN=',
               * E12.4,1X,'AT K=',I6)
0004            KMAX=0
0005            KMIN=0
0006            YMAX=0.0
0007            YMIN=0.0
0008            DO 1 K=1,NK
0009            IF(Y(K).GT.YMAX) KMAX=K
0010            IF(Y(K).GT.YMAX) YMAX=Y(K)
0011            IF(Y(K).LT.YMIN) KMIN=K
0012            IF(Y(K).LT.YMIN) YMIN=Y(K)
0013          1 CONTINUE
0014            WRITE(6,501) YMAX,KMAX,YMIN,KMIN
0015            RETURN
0016            END
```

SAMPLE PROBLEM

INPUT DECK

INPUT CARDS

```
         10        20        30        40        50        60        70        80
....+....*....+....*....+....*....+....*....+....*....+....*....+....*....+....*
SAMPLE PROBLEM  2
  300 0.01       10.0 20.0
 2.6          2.0E+05
3          1 12.5E+022 12.5E+023 12.5E+02
 25.0E+02 2.0  0.0E+00 0.0E+001.01 0.9E+06.280.33E+00.75
 .0        E+00 .05        E+00 .10        E+00 .15        E+00 .20        E+00
 .25       E+00 .30        E+00 .35        E+00 .40        E+00 .45        E+00
 .50       E+00 .45        E+00 .40        E+00 .35        E+00 .30        E+00
 .25       E+00 .20        E+00 .15        E+00 .10        E+00 .05        E+00
 .0        E+00-.05        E+00-.10        E+00-.15        E+00-.20        E+00
....+....*....+....*....+....*....+....*....+....*....+....*....+....*....+....*
-.25       E+00-.30        E+00-.35        E+00-.40        E+00-.45        E+00
-.50       E+00-.45        E+00-.40        E+00-.35        E+00-.30        E+00
-.25       E+00-.20        E+00-.15        E+00-.10        E+00-.05        E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
....+....*....+....*....+....*....+....*....+....*....+....*....+....*....+....*
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0        E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
....+....*....+....*....+....*....+....*....+....*....+....*....+....*....+....*
```

```
         10        20        30        40        50        60        70        80
....+....*....+....*....+....*....+....*....+....*....+....*....+....*....+....*
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
....+....*....+....*....+....*....+....*....+....*....+....*....+....*....+....*
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
....+....*....+....*....+....*....+....*....+....*....+....*....+....*....+....*
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
....+....*....+....*....+....*....+....*....+....*....+....*....+....*....+....*
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
 .0       E+00 .0         E+00 .0         E+00 .0         E+00 .0         E+00
```

SAMPLE PROBLEM

PRINTER OUTPUT

SAMPLE PROBLEM 2

NK= 300
DELT= 0.01000
F1= 10.00
F2= 20.00

```
SUBROUTINE SECT

    RHON=   2.600
    VN=  0.2000E 06

    LIM= 3
    IOPS(L)=              1            2            3
    DS(L)=     0.1250E 04  0.1250E 04  0.1250E 04

   I          VOUT           DELZ          GMAX           TAU           ER     RHOI          Z          PV1          PVTL

MORE       THICK    RHOI          SCV       PHREAT    SAT  IFPH        GCFN     XQ          TCF    XT         TAUC        GMAXC          VIC
   0  0.250E 04  2.000  0.0            0.0          1.00     1  0.900E 06  0.28  0.330E 00  0.75  0.0          0.0          0.0

   1    0.8563E 04    0.8563E 02    0.1467E 09    0.1099E 05    0.7494E-04    2.0000    0.8563F 02    0.8392E 05    0.1678E 06
   2    0.1301E 05    0.1301E 03    0.3388E 09    0.4755E 05    0.1404E-03    2.0000    0.2158E 03    0.2115E 06    0.4229E 06
   3    0.1547E 05    0.1547E 03    0.4788E 09    0.9396E 05    0.1962E-03    2.0000    0.3705E 03    0.3631E 06    0.7262E 06
   4    0.1732E 05    0.1732E 03    0.6001E 09    0.1472E 06    0.2452E-03    2.0000    0.5437E 03    0.5328E 06    0.1066E 07
   5    0.18A4E 05    0.1884E 03    0.7100E 09    0.2057E 06    0.2898E-03    2.0000    0.7321E 03    0.7175E 06    0.1435E 07
   6    0.2015E 05    0.2015E 03    0.8118E 09    0.2689E 06    0.3312E-03    2.0000    0.9336F 03    0.9149E 06    0.1830E 07
   7    0.2130E 05    0.2130E 03    0.9076E 09    0.3359E 06    0.3701E-03    2.0000    0.1147E 04    0.1124E 07    0.2247E 07

L= 1    IS(L)=    8    IOPS(L)= 1    DS(L)=  0.1250E 04    ZTOP=  0.1147E 04    ZBASE=  0.1370E 04

L= 2    IS(L)=    8    IOPS(L)= 2    DS(L)=  0.1250E 04    ZTOP=  0.1147E 04    ZBASE=  0.1370E 04

L= 3    IS(L)=    8    IOPS(L)= 3    DS(L)=  0.1250E 04    ZTOP=  0.1147E 04    ZBASE=  0.1370E 04

   8    0.2234E 05    0.2234E 03    0.9985E 09    0.4065E 06    0.4071E-03    2.0000    0.1370F 04    0.1343E 07    0.2685E 07
   9    0.2330E 05    0.2330E 03    0.1086E 10    0.4804E 06    0.4425E-03    2.0000    0.1603E 04    0.1571E 07    0.3142E 07
  10    0.2418E 05    0.2418E 03    0.1169E 10    0.5572E 06    0.4766E-03    2.0000    0.1845E 04    0.1808E 07    0.3616E 07
  11    0.2500E 05    0.2500E 03    0.1250E 10    0.6367E 06    0.5095E-03    2.0000    0.2095E 04    0.2053E 07    0.4106E 07
  12    0.2577E 05    0.2577E 03    0.1328E 10    0.7188E 06    0.5413E-03    2.0000    0.2352E 04    0.2305E 07    0.4611E 07
  13    0.2634E 05    0.2634E 03    0.1388E 10    0.8033E 06    0.5790E-03    2.0000    0.2616E 04    0.2564E 07    0.5127E 07

INPUT ACCELERATION

    MAX=  0.5000E 00 AT K=     11
    MIN= -0.5000E 00 AT K=     31

   0.0          0.500E-01    0.100E 00    0.150E 00    0.200E 00    0.250E 00    0.300E 00    0.350E 00    0.400E 00    0.450E 00
   0.500E 00    0.450E 00    0.400E 00    0.350E 00    0.300E 00    0.250E 00    0.200E 00    0.150E 00    0.100E 00    0.500E-01
   0.0         -0.500E-01   -0.100E 00   -0.150E 00   -0.200E 00   -0.250E 00   -0.300E 00   -0.350E 00   -0.400E 00   -0.450E 00
  -0.500E 00   -0.450E 00   -0.400E 00   -0.350E 00   -0.300E 00   -0.250E 00   -0.200E 00   -0.150E 00   -0.100E 00   -0.500E-01
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0


   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
```

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MAXIMUM STRAIN PROFILE

1	0.125E-01
2	0.290E-02
3	0.328E-02
4	0.323E-02
5	0.338E-02
6	0.310E-02
7	0.282E-02
8	0.305E-02
9	0.333E-02
10	0.371E-02
11	0.431E-02
12	0.520E-02
13	0.620E-02

SURFACE VELOCITY

MAX= 0.3703E 02 AT K= 48
MIN= -0.8119E 01 AT K= 88

0.927E-02	0.114E-01	0.115E-01	0.802E-02	0.271E-02	0.199E-02	0.124E-01	0.321E-01	0.467E-01	0.361E-01
-0.488E-02	-0.472E-01	-0.243E-01	0.147E 00	0.529E 00	0.114E 01	0.193E 01	0.284E 01	0.381E 01	0.481E 01
0.582E 01	0.687E 01	0.795E 01	0.907E 01	0.102E 02	0.114E 02	0.125E 02	0.137E 02	0.149E 02	0.161E 02
0.173E 02	0.185E 02	0.198E 02	0.210E 02	0.222E 02	0.235E 02	0.247E 02	0.260E 02	0.272E 02	0.285E 02
0.297E 02	0.309E 02	0.322E 02	0.336E 02	0.350E 02	0.362E 02	0.369E 02	0.370E 02	0.366E 02	0.357E 02
0.347E 02	0.336E 02	0.325E 02	0.315E 02	0.304E 02	0.293E 02	0.282E 02	0.270E 02	0.258E 02	0.247E 02
0.235E 02	0.223E 02	0.211E 02	0.199E 02	0.187E 02	0.175E 02	0.163E 02	0.150E 02	0.138E 02	0.126E 02
0.113E 02	0.101E 02	0.881E 01	0.756E 01	0.629E 01	0.502E 01	0.374E 01	0.246E 01	0.121E 01	-0.293E-01
-0.127E 01	-0.256E 01	-0.392E 01	-0.530E 01	-0.655E 01	-0.751E 01	-0.804E 01	-0.812E 01	-0.784E 01	-0.739E 01
-0.690E 01	-0.648E 01	-0.612E 01	-0.577E 01	-0.540E 01	-0.498E 01	-0.453E 01	-0.408E 01	-0.363E 01	-0.319E 01
-0.275E 01	-0.229E 01	-0.181E 01	-0.129E 01	-0.745E 00	-0.194E 00	0.338E 00	0.837E 00	0.131E 01	0.178E 01
0.228E 01	0.278E 01	0.326E 01	0.364E 01	0.387E 01	0.391E 01	0.379E 01	0.355E 01	0.327E 01	0.299E 01
0.274E 01	0.252E 01	0.229E 01	0.207E 01	0.184E 01	0.159E 01	0.133E 01	0.105E 01	0.740E 00	0.399E 00
0.383E-01	-0.328E 00	-0.688E 00	-0.103E 01	-0.136E 01	-0.166E 01	-0.192E 01	-0.214E 01	-0.232E 01	-0.246E 01
-0.256E 01	-0.263E 01	-0.265E 01	-0.260E 01	-0.246E 01	-0.224E 01	-0.196E 01	-0.165E 01	-0.135E 01	-0.107E 01
-0.815E 00	-0.582E 00	-0.356E 00	-0.129E 00	0.103E 00	0.339E 00	0.579E 00	0.818E 00	0.105E 01	0.126E 01
0.144E 01	0.160E 01	0.172E 01	0.181E 01	0.187E 01	0.189E 01	0.187E 01	0.182E 01	0.175E 01	0.165E 01
0.153E 01	0.137E 01	0.116E 01	0.907E 00	0.623E 00	0.341E 00	0.854E-01	-0.134E 00	-0.322E 00	-0.489E 00
-0.644E 00	-0.793E 00	-0.933E 00	-0.106E 01	-0.118E 01	-0.128E 01	-0.135E 01	-0.141E 01	-0.143E 01	-0.142E 01
-0.139E 01	-0.134E 01	-0.126E 01	-0.116E 01	-0.104E 01	-0.907E 00	-0.758E 00	-0.597E 00	-0.419E 00	-0.219E 00
-0.134E-02	0.221E 00	0.428E 00	0.601E 00	0.733E 00	0.831E 00	0.904E 00	0.965E 00	0.102E 01	0.106E 01
0.108E 01	0.109E 01	0.108E 01	0.106E 01	0.102E 01	0.960E 00	0.881E 00	0.785E 00	0.677E 00	0.558E 00
0.430E 00	0.293E 00	0.152E 00	0.875E-02	-0.135E 00	-0.281E 00	-0.431E 00	-0.580E 00	-0.713E 00	-0.815E 00
-0.876E 00	-0.900E 00	-0.898E 00	-0.886E 00	-0.870E 00	-0.849E 00	-0.817E 00	-0.770E 00	-0.710E 00	-0.642E 00
-0.568E 00	-0.487E 00	-0.396E 00	-0.292E 00	-0.180E 00	-0.646E-01	0.489E-01	0.158E 00	0.260E 00	0.359E 00
0.453E 00	0.545E 00	0.633E 00	0.712E 00	0.770E 00	0.798E 00	0.792E 00	0.756E 00	0.702E 00	0.643E 00
0.586E 00	0.531E 00	0.472E 00	0.403E 00	0.327E 00	0.246E 00	0.164E 00	0.824E-01	-0.175E-02	-0.889E-01
-0.177E 00	-0.263E 00	-0.340E 00	-0.407E 00	-0.464E 00	-0.513E 00	-0.556E 00	-0.593E 00	-0.622E 00	-0.639E 00

SURFACE ACCELERATION

MAX= 0.1423E 00 AT K= 44
MIN= -0.1401E 00 AT K= 84

0.946E-03	0.216E-03	0.127E-04	-0.357E-03	-0.541E-03	-0.741E-04	0.106E-02	0.202E-02	0.148E-02	-0.108E-02
-0.418E-02	-0.432E-02	0.234E-02	0.175E-01	0.390E-01	0.619E-01	0.809E-01	0.931E-01	0.991E-01	0.102E 00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.123E 00

0.104E 00	0.107E 00	0.110E 00	0.114E 00	0.116E 00	0.118E 00	0.120E 00	0.121E 00	0.122E 00	0.123E 00
0.123E 00	0.124E 00	0.125E 00	0.125E 00	0.126E 00	0.127E 00	0.129E 00	0.129E 00	0.128E 00	0.125E 00
0.123E 00	0.125E 00	0.133E 00	0.142E 00	0.141E 00	0.120E 00	0.747E-01	0.149E-01	-0.440E-01	-0.874E-01
-0.109E 00	-0.113E 00	-0.109E 00	-0.106E 00	-0.108E 00	-0.112E 00	-0.116E 00	-0.118E 00	-0.119E 00	-0.119E 00
-0.120E 00	-0.121E 00	-0.121E 00	-0.122E 00	-0.123E 00	-0.124E 00	-0.125E 00	-0.126E 00	-0.126E 00	-0.127E 00
-0.127E 00	-0.127E 00	-0.128E 00	-0.128E 00	-0.129E 00	-0.130E 00	-0.131E 00	-0.130E 00	-0.128E 00	-0.126E 00
-0.127E 00	-0.132E 00	-0.139E 00	-0.140E 00	-0.128E 00	-0.979E-01	-0.542E-01	-0.799E-02	0.281E-01	0.467E-01
0.492E-01	0.430E-01	0.369E-01	0.354E-01	0.384E-01	0.426E-01	0.456E-01	0.464E-01	0.458E-01	0.450E-01
0.451E-01	0.465E-01	0.493E-01	0.528E-01	0.556E-01	0.562E-01	0.543E-01	0.509E-01	0.483E-01	0.482E-01
0.502E-01	0.517E-01	0.488E-01	0.391E-01	0.231E-01	0.425E-02	-0.127E-01	-0.241E-01	-0.287E-01	-0.282E-01
-0.256E-01	-0.234E-01	-0.226E-01	-0.230E-01	-0.238E-01	-0.248E-01	-0.264E-01	-0.288E-01	-0.318E-01	-0.348E-01
-0.368E-01	-0.374E-01	-0.368E-01	-0.353E-01	-0.332E-01	-0.304E-01	-0.267E-01	-0.224E-01	-0.181E-01	-0.143E-01
-0.109E-01	-0.716E-02	-0.189E-02	0.544E-02	0.142E-01	0.226E-01	0.287E-01	0.314E-01	0.309E-01	0.284E-01
0.257E-01	0.238E-01	0.231E-01	0.232E-01	0.236E-01	0.241E-01	0.245E-01	0.244E-01	0.234E-01	0.215E-01
0.188E-01	0.157E-01	0.126E-01	0.942E-02	0.595E-02	0.208E-02	-0.182E-02	-0.511E-02	-0.754E-02	-0.960E-02
-0.123E-01	-0.163E-01	-0.214E-01	-0.262E-01	-0.289E-01	-0.288E-01	-0.261E-01	-0.224E-01	-0.191E-01	-0.170E-01
-0.159E-01	-0.151E-01	-0.143E-01	-0.132E-01	-0.118E-01	-0.101E-01	-0.790E-02	-0.516E-02	-0.217E-02	0.681E-03
0.318E-02	0.544E-02	0.769E-02	0.100E-01	0.122E-01	0.139E-01	0.152E-01	0.165E-01	0.182E-01	0.204E-01
0.222E-01	0.227E-01	0.211E-01	0.177E-01	0.135E-01	0.991E-02	0.753E-02	0.620E-02	0.521E-02	0.402E-02
0.252E-02	0.896E-03	-0.671E-03	-0.227E-02	-0.409E-02	-0.613E-02	-0.811E-02	-0.977E-02	-0.110E-01	-0.121E-01
-0.131E-01	-0.139E-01	-0.144E-01	-0.146E-01	-0.146E-01	-0.149E-01	-0.153E-01	-0.152E-01	-0.136E-01	-0.104E-01
-0.624E-02	-0.237E-02	0.165E-03	0.124E-02	0.158E-02	0.214E-02	0.329E-02	0.480E-02	0.610E-02	0.693E-02
0.754E-02	0.828E-02	0.936E-02	0.106E-01	0.114E-01	0.118E-01	0.116E-01	0.111E-01	0.105E-01	0.100E-01
0.966E-02	0.940E-02	0.899E-02	0.798E-02	0.596E-02	0.289E-02	-0.637E-03	-0.369E-02	-0.551E-02	-0.601E-02
-0.578E-02	-0.564E-02	-0.607E-02	-0.695E-02	-0.779E-02	-0.825E-02	-0.834E-02	-0.838E-02	-0.858E-02	-0.890E-02
-0.902E-02	-0.870E-02	-0.790E-02	-0.685E-02	-0.583E-02	-0.500E-02	-0.435E-02	-0.375E-02	-0.296E-02	-0.173E-02

OUTPUT - I= 8 IOPS= 1

MAX= 0.2992E-02 AT K= 35
MIN= -0.1669E-02 AT K= 63

0.174E-05	0.249E-05	0.237E-05	0.101E-05	-0.647E-06	-0.461E-07	0.648E-05	0.224E-04	0.499E-04	0.892E-04
0.139E-03	0.198E-03	0.265E-03	0.339E-03	0.421E-03	0.510E-03	0.605E-03	0.708E-03	0.817E-03	0.932E-03
0.105E-02	0.118E-02	0.131E-02	0.145E-02	0.159E-02	0.173E-02	0.188E-02	0.202E-02	0.217E-02	0.234E-02
0.251E-02	0.269E-02	0.284E-02	0.295E-02	0.299E-02	0.297E-02	0.289E-02	0.276E-02	0.260E-02	0.242E-02
0.224E-02	0.208E-02	0.193E-02	0.179E-02	0.164E-02	0.147E-02	0.127E-02	0.106E-02	0.837E-03	0.619E-03
0.407E-03	0.197E-03	-0.129E-04	-0.225E-03	-0.441E-03	-0.664E-03	-0.893E-03	-0.112E-02	-0.133E-02	-0.149E-02
-0.161E-02	-0.166E-02	-0.167E-02	-0.165E-02	-0.163E-02	-0.161E-02	-0.161E-02	-0.160E-02	-0.159E-02	-0.158E-02
-0.156E-02	-0.154E-02	-0.152E-02	-0.149E-02	-0.147E-02	-0.144E-02	-0.142E-02	-0.140E-02	-0.138E-02	-0.135E-02
-0.132E-02	-0.129E-02	-0.125E-02	-0.122E-02	-0.119E-02	-0.115E-02	-0.111E-02	-0.106E-02	-0.101E-02	-0.963E-03
-0.928E-03	-0.906E-03	-0.888E-03	-0.867E-03	-0.839E-03	-0.810E-03	-0.788E-03	-0.775E-03	-0.770E-03	-0.765E-03
-0.754E-03	-0.738E-03	-0.719E-03	-0.703E-03	-0.694E-03	-0.690E-03	-0.691E-03	-0.695E-03	-0.701E-03	-0.710E-03
-0.721E-03	-0.735E-03	-0.750E-03	-0.764E-03	-0.779E-03	-0.793E-03	-0.807E-03	-0.821E-03	-0.835E-03	-0.850E-03
-0.866E-03	-0.881E-03	-0.896E-03	-0.908E-03	-0.917E-03	-0.923E-03	-0.926E-03	-0.928E-03	-0.929E-03	-0.930E-03
-0.930E-03	-0.929E-03	-0.927E-03	-0.925E-03	-0.922E-03	-0.917E-03	-0.909E-03	-0.900E-03	-0.888E-03	-0.876E-03
-0.864E-03	-0.852E-03	-0.841E-03	-0.831E-03	-0.821E-03	-0.812E-03	-0.803E-03	-0.796E-03	-0.789E-03	-0.783E-03
-0.777E-03	-0.773E-03	-0.770E-03	-0.769E-03	-0.771E-03	-0.773E-03	-0.776E-03	-0.780E-03	-0.785E-03	-0.789E-03
-0.794E-03	-0.800E-03	-0.806E-03	-0.813E-03	-0.822E-03	-0.831E-03	-0.840E-03	-0.849E-03	-0.858E-03	-0.865E-03
-0.872E-03	-0.877E-03	-0.882E-03	-0.886E-03	-0.889E-03	-0.891E-03	-0.892E-03	-0.893E-03	-0.892E-03	-0.891E-03
-0.888E-03	-0.884E-03	-0.880E-03	-0.874E-03	-0.869E-03	-0.864E-03	-0.858E-03	-0.853E-03	-0.847E-03	-0.842E-03
-0.836E-03	-0.830E-03	-0.824E-03	-0.818E-03	-0.812E-03	-0.808E-03	-0.804E-03	-0.802E-03	-0.800E-03	-0.799E-03
-0.799E-03	-0.800E-03	-0.801E-03	-0.803E-03	-0.805E-03	-0.809E-03	-0.812E-03	-0.817E-03	-0.821E-03	-0.827E-03
-0.832E-03	-0.837E-03	-0.842E-03	-0.846E-03	-0.850E-03	-0.854E-03	-0.857E-03	-0.861E-03	-0.864E-03	-0.867E-03
-0.870E-03	-0.872E-03	-0.873E-03	-0.873E-03	-0.873E-03	-0.871E-03	-0.869E-03	-0.867E-03	-0.864E-03	-0.861E-03
-0.858E-03	-0.854E-03	-0.850E-03	-0.846E-03	-0.842E-03	-0.838E-03	-0.833E-03	-0.830E-03	-0.826E-03	-0.824E-03
-0.822E-03	-0.820E-03	-0.818E-03	-0.817E-03	-0.816E-03	-0.815E-03	-0.815E-03	-0.815E-03	-0.816E-03	-0.817E-03
-0.819E-03	-0.822E-03	-0.825E-03	-0.828E-03	-0.831E-03	-0.834E-03	-0.837E-03	-0.840E-03	-0.844E-03	-0.847E-03
-0.850E-03	-0.852E-03	-0.855E-03	-0.857E-03	-0.858E-03	-0.859E-03	-0.860E-03	-0.860E-03	-0.860E-03	-0.859E-03

-0.859E-03	-0.858E-03	-0.857E-03	-0.856E-03	-0.854E-03	-0.852E-03	-0.849E-03	-0.846E-03	-0.843E-03	-0.841E-03

OUTPUT - I= 8 IOPS= 2

MAX= 0.3617E 06 AT K= 33
MIN= -0.3363E 06 AT K= 61

0.984E 03	0.150E 04	0.103E 04	-0.628E 03	-0.232E 04	-0.144E 04	0.515E 04	0.197E 05	0.423E 05	0.708E 05
0.102E 06	0.132E 06	0.160E 06	0.184E 06	0.206E 06	0.225E 06	0.242E 06	0.258E 06	0.271E 06	0.283E 06
0.293E 06	0.301E 06	0.309E 06	0.317E 06	0.324E 06	0.330E 06	0.334E 06	0.336E 06	0.338E 06	0.344E 06
0.352E 06	0.361E 06	0.362E 06	0.349E 06	0.318E 06	0.270E 06	0.209E 06	0.142E 06	0.740E 05	0.106E 05
-0.436E 05	-0.858E 05	-0.116E 06	-0.138E 06	-0.157E 06	-0.176E 06	-0.197E 06	-0.218E 06	-0.237E 06	-0.251E 06
-0.263E 06	-0.274E 06	-0.284E 06	-0.293E 06	-0.300E 06	-0.307E 06	-0.313E 06	-0.321E 06	-0.329E 06	-0.336E 06
-0.336E 06	-0.330E 06	-0.317E 06	-0.301E 06	-0.288E 06	-0.278E 06	-0.270E 06	-0.262E 06	-0.253E 06	-0.240E 06
-0.226E 06	-0.212E 06	-0.197E 06	-0.182E 06	-0.166E 06	-0.150E 06	-0.136E 06	-0.124E 06	-0.113E 06	-0.100E 06
-0.858E 05	-0.695E 05	-0.530E 05	-0.383E 05	-0.256E 05	-0.135E 05	-0.147E 02	0.157E 05	0.320E 05	0.463E 05
0.564E 05	0.626E 05	0.671E 05	0.723E 05	0.788E 05	0.853E 05	0.899E 05	0.919E 05	0.925E 05	0.936E 05
0.965E 05	0.101E 06	0.105E 06	0.109E 06	0.112E 06	0.113E 06	0.112E 06	0.108E 06	0.102E 06	0.923E 05
0.807E 05	0.680E 05	0.554E 05	0.432E 05	0.315E 05	0.203E 05	0.939E 04	-0.125E 04	-0.118E 05	-0.224E 05
-0.330E 05	-0.432E 05	-0.525E 05	-0.600E 05	-0.656E 05	-0.692E 05	-0.714E 05	-0.725E 05	-0.731E 05	-0.733E 05
-0.730E 05	-0.722E 05	-0.708E 05	-0.686E 05	-0.652E 05	-0.602E 05	-0.532E 05	-0.443E 05	-0.341E 05	-0.232E 05
-0.126E 05	-0.265E 04	0.648E 04	0.149E 05	0.226E 05	0.295E 05	0.358E 05	0.413E 05	0.462E 05	0.507E 05
0.547E 05	0.578E 05	0.596E 05	0.600E 05	0.588E 05	0.564E 05	0.532E 05	0.494E 05	0.453E 05	0.409E 05
0.360E 05	0.308E 05	0.250E 05	0.185E 05	0.113E 05	0.345E 04	-0.460E 04	-0.123E 05	-0.193E 05	-0.253E 05
-0.304E 05	-0.347E 05	-0.384E 05	-0.413E 05	-0.436E 05	-0.452E 05	-0.462E 05	-0.466E 05	-0.461E 05	-0.447E 05
-0.420E 05	-0.382E 05	-0.336E 05	-0.286E 05	-0.235E 05	-0.185E 05	-0.135E 05	-0.862E 04	-0.368E 04	0.132E 04
0.639E 04	0.115E 05	0.167E 05	0.218E 05	0.264E 05	0.303E 05	0.333E 05	0.353E 05	0.365E 05	0.370E 05
0.370E 05	0.364E 05	0.351E 05	0.332E 05	0.307E 05	0.276E 05	0.241E 05	0.200E 05	0.154E 05	0.105E 05
0.558E 04	0.967E 03	-0.321E 04	-0.699E 04	-0.105E 05	-0.139E 05	-0.170E 05	-0.200E 05	-0.228E 05	-0.253E 05
-0.276E 05	-0.293E 05	-0.304E 05	-0.306E 05	-0.299E 05	-0.284E 05	-0.264E 05	-0.241E 05	-0.214E 05	-0.184E 05
-0.152E 05	-0.117E 05	-0.804E 04	-0.430E 04	-0.444E 03	0.347E 04	0.726E 04	0.107E 05	0.135E 05	0.158E 05
0.177E 05	0.192E 05	0.206E 05	0.218E 05	0.228E 05	0.236E 05	0.239E 05	0.237E 05	0.230E 05	0.215E 05
0.194E 05	0.168E 05	0.139E 05	0.110E 05	0.800E 04	0.505E 04	0.209E 04	-0.884E 03	-0.383E 04	-0.672E 04
-0.950E 04	-0.121E 05	-0.144E 05	-0.162E 05	-0.175E 05	-0.183E 05	-0.186E 05	-0.187E 05	-0.186E 05	-0.184E 05
-0.180E 05	-0.173E 05	-0.163E 05	-0.149E 05	-0.131E 05	-0.109E 05	-0.829E 04	-0.549E 04	-0.267E 04	-0.242E 01

OUTPUT - I= 8 IOPS= 3

MAX= 0.3341E 02 AT K= 35
MIN= -0.4331E 01 AT K= 88

0.296E-01	0.435E-01	0.369E-01	0.333E-02	-0.341E-01	-0.181E-01	0.127E 00	0.466E 00	0.102E 01	0.178E 01
0.269E 01	0.369E 01	0.474E 01	0.584E 01	0.699E 01	0.817E 01	0.939E 01	0.106E 02	0.119E 02	0.132E 02
0.146E 02	0.159E 02	0.173E 02	0.187E 02	0.201E 02	0.215E 02	0.229E 02	0.243E 02	0.257E 02	0.271E 02
0.288E 02	0.305E 02	0.320E 02	0.330E 02	0.334E 02	0.331E 02	0.321E 02	0.308E 02	0.291E 02	0.274E 02
0.255E 02	0.239E 02	0.226E 02	0.216E 02	0.207E 02	0.199E 02	0.189E 02	0.177E 02	0.163E 02	0.150E 02
0.136E 02	0.124E 02	0.111E 02	0.984E 01	0.859E 01	0.737E 01	0.616E 01	0.489E 01	0.353E 01	0.213E 01
0.828E 00	-0.181E 00	-0.785E 00	-0.101E 01	-0.101E 01	-0.961E 00	-0.992E 00	-0.111E 01	-0.129E 01	-0.147E 01
-0.167E 01	-0.189E 01	-0.211E 01	-0.229E 01	-0.240E 01	-0.245E 01	-0.250E 01	-0.261E 01	-0.280E 01	-0.304E 01
-0.326E 01	-0.344E 01	-0.358E 01	-0.373E 01	-0.390E 01	-0.410E 01	-0.426E 01	-0.433E 01	-0.428E 01	-0.416E 01
-0.402E 01	-0.393E 01	-0.386E 01	-0.374E 01	-0.351E 01	-0.315E 01	-0.273E 01	-0.235E 01	-0.205E 01	-0.180E 01
-0.154E 01	-0.124E 01	-0.885E 00	-0.508E 00	-0.145E 00	0.185E 00	0.480E 00	0.745E 00	0.979E 00	0.118E 01
0.134E 01	0.147E 01	0.159E 01	0.170E 01	0.182E 01	0.192E 01	0.201E 01	0.208E 01	0.212E 01	0.213E 01
0.209E 01	0.202E 01	0.189E 01	0.171E 01	0.149E 01	0.124E 01	0.963E 00	0.685E 00	0.416E 00	0.163E 00
-0.754E-01	-0.302E 00	-0.521E 00	-0.729E 00	-0.922E 00	-0.109E 01	-0.122E 01	-0.132E 01	-0.138E 01	-0.142E 01
-0.145E 01	-0.146E 01	-0.146E 01	-0.145E 01	-0.141E 01	-0.136E 01	-0.128E 01	-0.119E 01	-0.108E 01	-0.947E 00
-0.796E 00	-0.620E 00	-0.421E 00	-0.205E 00	0.138E-01	0.224E 00	0.415E 00	0.580E 00	0.721E 00	0.841E 00

[illegible]	[illegible]	[illegible]	0.115E 01	0.118E 01	0.117E 01	0.114E 01	0.109E 01	0.103E 01	0.957E 00

0.944E 00	0.103E 01	0.110E 01	0.115E 01	0.118E 01	0.117E 01	0.114E 01	0.109E 01	0.103E 01	0.957E 00
0.882E 00	0.800E 00	0.707E 00	0.601E 00	0.486E 00	0.364E 00	0.235E 00	0.997E-01	-0.432E-01	-0.192E 00
-0.342E 00	-0.486E 00	-0.615E 00	-0.722E 00	-0.804E 00	-0.862E 00	-0.899E 00	-0.919E 00	-0.925E 00	-0.916E 00
-0.892E 00	-0.849E 00	-0.789E 00	-0.712E 00	-0.623E 00	-0.528E 00	-0.432E 00	-0.339E 00	-0.246E 00	-0.152E 00
-0.548E-01	0.452E-01	0.146E 00	0.245E 00	0.340E 00	0.432E 00	0.519E 00	0.599E 00	0.668E 00	0.720E 00
0.751E 00	0.759E 00	0.746E 00	0.717E 00	0.677E 00	0.629E 00	0.572E 00	0.507E 00	0.431E 00	0.347E 00
0.256E 00	0.163E 00	0.729E-01	-0.109E-01	-0.882E-01	-0.161E 00	-0.230E 00	-0.297E 00	-0.360E 00	-0.417E 00
-0.467E 00	-0.510E 00	-0.546E 00	-0.575E 00	-0.595E 00	-0.602E 00	-0.590E 00	-0.560E 00	-0.513E 00	-0.456E 00
-0.393E 00	-0.329E 00	-0.262E 00	-0.193E 00	-0.118E 00	-0.393E-01	0.403E-01	0.116E 00	0.182E 00	0.239E 00
0.286E 00	0.326E 00	0.361E 00	0.393E 00	0.420E 00	0.440E 00	0.452E 00	0.457E 00	0.456E 00	0.448E 00
0.434E 00	0.408E 00	0.369E 00	0.318E 00	0.256E 00	0.190E 00	0.125E 00	0.620E-01	0.205E-02	-0.567E-01
-0.115E 00	-0.172E 00	-0.226E 00	-0.272E 00	-0.308E 00	-0.334E 00	-0.351E 00	-0.361E 00	-0.365E 00	-0.366E 00