```
      PROGRAM PDROP
      IMPLICIT REAL*8 (A-Z)
      INTEGER*4 IADD,SIGN,IERR, ISX
      CHARACTER*1 FILE
      PARAMETER (PI=3.141592654)
      DIMENSION LINC(5)
      COMMON /PARA/N,EI,L1,K,QN,QK,LM,LM2,EM,OD,QEI,Q,SIGMA
      COMMON /CONST/WO,PO,C1,C2,C3,C4,C5,C6,C7
      DATA LINC/50.,-10.,1.,-0.1,0.01/
C
C
      WRITE(6,1)
      WRITE(6,2)
      WRITE(6.3)
      READ(5,*)OD
      WRITE(6,4)
      READ(5,*)T
      WRITE(6,5)
      READ(5,*)EM
      WRITE(6,6)
      READ(5,*)GAMMA
      WRITE(6,7)
      READ(5,*)SG
      WRITE(6,8)
      READ(5,*)SIGINT
      WRITE(6,9)
      READ(5,*)K
      WRITE(6,10)
      READ(5,*)H
C
      WRITE(6,11)
      WRITE(6,12)
      READ(5,13)FILE
      IERR= STR$UPCASE(FILE,FILE)
      ID= OD - 2.*T
C
      I= PI*(OD**4-ID**4)/64.
      EI= EM*I
      AREA= PI*(OD*OD-ID*ID)/4.
      AREAI= PI*ID*ID*9.013310185D-03
      Q= GAMMA*AREA + SG*AREAI
      QEI=Q/EI
      QK=Q/K
C
      IF( FILE. EQ. 'Y' )THEN
        WRITE(1,1)
        WRITE(1,3)OD
        WRITE(1,4)T
        WRITE(1,5)EM
        WRITE(1,6)GAMMA
```

```
0051          WRITE(1,7)SG
0052          WRITE(1,8)SIGINT
0053          WRITE(1,9)K
0054          WRITE(1,10)H
0055        ENDIF
0056  C
0057        STL=0.0
0058        STOLD=0.0
0059        L= 150.0
0060        ITN= 0
0061        ISX=0
0062    100 STLX= 0.75*STL + 0.25*STOLD
0063        ITN= ITN+1
0064        STOLD= STL
0065        IF(ITN.EQ.5)THEN
0066          ITN=0
0067          STOLD= STLX
0068        ENDIF
0069        IF(STLX.GT.60E3)THEN
0070          STLX=60E3
0071          ISX= ISX + 1
0072          STOLD= 0.5*(STLX+STL)
0073          IF(ISX.GT.10)STOP ' OSCILLATING SOLUTION'
0074        ENDIF
0075        SIGMA=SIGINT+STLX
0076        N= ABS(SIGMA*AREA)
0077        IF( N.NE.0.0)QN= Q/N
0078        IADD= 1
0079        SIGN= 1
0080        LOLD= L
0081    200 L1= L*6.
0082        CALL DEPTH
0083        IF(SIGN.EQ.1)THEN
0084          IF(WO.LT.H)GOTO 300
0085          IADD= IADD + 1
0086          SIGN = -1
0087        ELSE
0088          IF(WO.GT.H)GOTO 300
0089          IADD= IADD + 1
0090          SIGN =  1

0092    300 IF(IADD.LT.6)THEN
0093          L= L +
0094          GOTO 200
0095        ENDIF
0096        CALL STRESS(SMAX,STL)
0097        DSTL=ABS(STL-STOLD)
0098        DLL=ABS(L-LOLD)
0099        IF(STLX.EQ.60E3)GOTO 100
0100        IF((DSTL.GT.0.5).OR.(DLL.GT.0.01))GOTO 100
```

```
0101          IF(FILE.EQ.'Y')WRITE(1,14)L,SMAX,STL
0102            WRITE(6,3)OD
0103            WRITE(6,4)T
0104            WRITE(6,5)EM
0105            WRITE(6,6)GAMMA
0106            WRITE(6,7)SG
0107            WRITE(6,8)SIGINT
0108            WRITE(6,9)K
0109            WRITE(6,10)H
0110          WRITE(6,14)L,SMAX,STL
0111          STOP
0112        1 FORMAT(//'0This program calculates the trench length and maximum'
0113         &,' stress induced by'/' the free deflection of a pipeline'
0114         &,' to a specified depth at the center.')
0115        2 FORMAT(///'0ENTER THE FOLLOWING DATA::'
0116        3 FORMAT(/'$  Outside diameter of pipe                    (inches): '
0117         &,:,F13.3)
0118        4 FORMAT('$ Wall thickness of pipe                       (inches): '
0119         &,:,F13.3)
0120        5 FORMAT('$ Elastic modulus of pipe material                (psi): '
0121         &,:,F13.3)
0122        6 FORMAT('$ Specific weight of pipe material          (lb/in**3): '
0123         &,:,F13.3)
0124        7 FORMAT('$ Specify gravity of fluid in pipeline                : '
0125         &,:,F13.3)
0126        8 FORMAT('$ Existing axial stress in pipeline               (psi): '
0127         &,:,F13.3)
0128        9 FORMAT('$ Soil stiffness parameter                        (psi): '
0129         &,:,F13.3)
0130       10 FORMAT('$ Lowering depth at center of pipeline         (inches): '
0131         &,:,F13.3)
0132       11 FORMAT('0 Output will be displayed on the terminal screen.')
0133       12 FORMAT('$  Do you want an additional copy on file FOR001? (Y/N): ')
0134       13 FORMAT(A1)
0135       14 FORMAT('0 Length of trench for lowering pipeline        (feet): '
0136         &,F13.3/
0137         &'  Maximum stress in pipeline                    (psi): ',F13.3/
0138         &'  Added axial stress due to lengthing of pipeline(psi):',F14.3//)
0139          END
```

```
0001          SUBROUTINE DEPTH
0002          IMPLICIT REAL*8 (A-Z)
0003    C
0004          PARAMETER (PI=3.141592654)
0005          COMMON /PARA/N,EI,L,K,QN,QK,LM,LM2,EM,OD,QEI,Q,SIGMA
0006          COMMON /CONST/WO,PO,C1,C2,C3,C4,C5,C6,C7
0007          COMMON /GREEK/AG,AG2,BG,BG2
0008    C
0009          IF (SIGMA)1000,2000,3000
0010    C
0011     1000 CONTINUE
0012    C
0013          LM2= N/EI
0014          LM= SQRT(LM2)
0015          LM3= LM*LM2
0016          CLL= COS(LM*L)
0017          SLL= SIN(LM*L)
0018    C
0019          LC=SQRT(K/4./EI)
0020          DC= N/4./EI
0021          AG=SQRT(LC+DC)
0022          BG=SQRT(LC-DC)
0023    C
0024          AG2=AG*AG
0025          BG2=BG*BG
0026          AO= SLL*(AG2-BG2)-CLL*LM*BG
0027          BO= 2.*AG*BG*SLL+AG*LM*CLL
0028          EO= BG*(LM2-3.*AG2+BG2)
0029          FO= AG*(AG2-3.*BG2-LM2)
0030          L2= L*L
0031    C
  32             C5  QN/2
0033             C4= 0.0
0034             C2= 0.0
0035             C7= 2.*C5*(-AO*L*LM2-EO*(L*LM*CLL-SLL))/(AO*FO-BO*EO)
0036             C6= (-2.*L*LM2*C5-FO*C7)/EO
0037             C3= (AG*C7-BG*C6-2.*L*C5)/(-LM*SLL)
0038             C1= C6-L2*C5-CLL*C3
0039          WO= ABS(C1 + C3)
0040          RETURN
0041                E
0042          LC=SQRT(K/4./EI)
0043          AG=SQRT(LC)
  44    C
0045          AL= AG*L
0046          AL2= AL*AL
0047          AL3= AL*AL2
0048          AL4= AL2*AL2
0049          AG2= AG*AG
0050          AG3= AG*AG2
```

```
      L2= L*L
      L3= L2*L
      L4=L3*L
C
         C1= QEI*L4/24.*(1.+4./AL+6./AL2+6./AL3)
         C2=0.0
         C3= -QEI*L2/12.*(3.+3./AL+AL)/(AL+1.)
         C4= 0.0
         C5= QEI/24.
         C6= QEI*L4/12.*(2./AL+6./AL2+3./AL3)/(AL+1.)
         C7= QEI*L4/12.*(3./AL3-2./AL)/(AL+1.)
      WO= ABS(C1)
      RETURN
 3000 CONTINUE
      LM2= N/EI
      LM= SQRT(LM2)
      LM3= LM*LM2
      CLL= COSH(LM*L)
      SLL= SINH(LM*L)
C
      LC=SQRT(K/4./EI)
      DC= N/4./EI
      AG=SQRT(LC+DC)
      BG=SQRT(LC-DC)
C
      AG2=AG*AG
      BG2=BG*BG
      AO= SLL*(BG2-AG2)-CLL*LM*AG
      BO= 2.*AG*BG*SLL+BG*LM*CLL
      EO= -AG*(LM2+3.*BG2-AG2)
      FO= BG*(BG2-3.*AG2+LM2)
      L2= L*L
C
         C5=  -QN/2.
         C4= 0.0
         C2= 0.0
         C7= 2.*C5*(AO*L*LM2-EO*(L*LM*CLL-SLL))/(AO*FO-BO*EO)
         C6= (2.*L*LM2*C5-FO*C7)/EO
         C3= (BG*C7-AG*C6-2.*L*C5)/(LM*SLL)
         C1= C6-L2*C5-CLL*C3
      WO= ABS(C1 + C3)
      RETURN
      END
```