PROGRAM STACONE

C STATIC CONE PENETRATION TEST

C SHEAR-BAND = COULOMB FAILURE SURFACE

C UNIQUE SOLUTION OF INITIAL STRESS METHOD

C MONOTONOUSLY LOADING

C AXI-SYMMETRIC CONDITION

C COMPRESSIVE STRESSES ARE POSITIVE

C

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB11/PI1(1250),PI2(1250),PI3(1250),PI4(1250),PI5(1250)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB16/DEP(1250,4,4),GG1(1250,4,2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

COMMON/LB21/PS1(1250),PS3(1250),QS1(1250),QS3(1250)

COMMON/LB22/TTS(1250)

C

CALL INPUTS

CALL PREPAR(IND)

IF(IND.NE.1) GO TO 10

CALL INISTR

10 CLOSE(5)

CLOSE(6)

CLOSE(7)

CLOSE(8)

CLOSE(11)

CLOSE(12)

CLOSE(13)

STOP

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE INPUTS

C \*\*\* DATA INPUT

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

DIMENSION PNA(20),TY(1690),EE1(30),PP1(30),HH1(30),

\* RO1(30),CC1(30),FA1(30),DL1(30),FAI(1690),DLT(1690),

\* STII(50,4)

DIMENSION IDATA(12),IDATAQ(12),IBA(1690),NET(6),NM(1690),

\* MAT(1690),JSTP(30),IFL(30),IST(1250)

C

OPEN(5,FILE='DASTACONE',STATUS='UNKNOWN')

OPEN(6,FILE='PRSTACONE',STATUS='UNKNOWN')

OPEN(7,FILE='DSTRESS',STATUS='UNKNOWN')

OPEN(8,FILE='PRDISPL',STATUS='UNKNOWN')

OPEN(11,FILE='M-AVS1.INP',STATUS='UNKNOWN')

OPEN(12,FILE='M-AVS2.INP',STATUS='UNKNOWN')

OPEN(13,FILE='M-AVS3.INP',STATUS='UNKNOWN')

C

C NN: MAXIMUM NUMBER OF DISPLACEMENT VARIABLES

C NVM: MAXIMUM NUMBER OF INITIAL-STRESS VARIABLES

NN=2600

NVM=2150

DO 2 I=1,5

2 IDATAQ(I)=0.D0

DO 4 I=1,6

4 NET(I)=0

C PNA(I): PROJECT NAME

READ(5,100) (PNA(I),I=1,15)

WRITE(6,100) (PNA(I),I=1,15)

C NNP: NUMBER OF NODES, NNE:NUMBER OF ELEMENTS

C NMAT: NUMBER OF MATERIALS

C NFL: NUMBER OF LOAD POINTS

C NIS: NUMBER OF SETS OF ACTUAL INITIAL-STRESSES

C ITER=0: NO ITERATION, 1:ITERATION

C NTRY: NUMBER OF ITERATIONS FOR NO-TENSION ELEMENT

C ICR=0: NOT CONSIDER CRITICAL STATE

C 1: CONSIDER AFTER FIRST YIELDING (PERFECTLY PLASTIC)

C ONLY FOR MOHR-COULOMB MATERIAL

C 2: CONSIDER AFTER FIRST YIELDING (PERFECTLY PLASTIC)

C BOTH FOR MOHR-COULOMB & COULOMB MATERIALS

C IPR=0: NOT PRINT NODAL & ELEMENT DATA, 1:PRINT

C NSTP: NUMBER OF LOADING-STEPS

C MSTP: ACTUAL CALCULATION NUMBER OF LOADING-STEPS

C KSTP: NUMBER OF LOADING-STEPS FOR MICRO-AVS OUTPUT

C JSTP: STEP NO. OUTPUT FOR MICRO-AVS

C

READ(5,101) NNP,NNE,NMAT,NFL,NIS,ITER,NTRY

READ(5,101) ICR,IPR

READ(5,101) NSTP,MSTP,KSTP

READ(5,101) (JSTP(N),N=1,KSTP)

DO 6 N=1,NSTP

6 LSTP(N)=0

DO 8 L=1,KSTP

N=JSTP(L)

LSTP(N)=1

8 CONTINUE

IF(NSTP.LE.0) NSTP=1

IF(MSTP.LE.0) MSTP=NSTP

IF(NTRY.LE.0) NTRY=1

WRITE(6,200) NNP,NNE,NMAT,NFL,NIS,ITER,NTRY,

\* ICR,IPR,

\* NSTP,MSTP,KSTP,(JSTP(N),N=1,KSTP)

IDY=0

NDY=3

MDY=1

IF(IDY.GE.1) NDY=1

IF(IDY.GE.1) MDY=3

C

C \*\*\* NODAL DATA

C K: NODE NO., XX(I):X-COORDINATE, YY(I):Y-COORDINATE

C IX(I)=0: X-DIRECTION FREE, 1=FIXED

C IY(I)=0: Y-DIRECTION FREE, 1=FIXED

C IQ(I)=0: ROTATION FREE, 1=FIXED

C

WRITE(6,201)

DO 10 I=1,NNP

READ(5,102) K,XX(I),YY(I),IX(I),IY(I),IQ(I)

IF(IPR.EQ.0) GO TO 10

WRITE(6,102) K,XX(I),YY(I),IX(I),IY(I),IQ(I)

10 CONTINUE

C \*\*\* ELEMENT DATA

C K: ELEMENT NO., IJK(L,I): NODE NO.

C K2(L)= ELEMENT TYPE: TRUSS=1, BEAM=2, TEXTILE=3,

C PLANE-STRAIN (ELASTIC=4, ELASTIC-PLASTIC=5),

C INTERFACE=6 (I-J:SHEAR DIRECTION, ANTI-CLOCKWISE)

C MAT(L): MATERAL NO.

C IBA(L)=1: CONSIDER OWN WEIGHT, 0:NOT CONSIDER

C IST(L): NO. OF SET OF ACTUAL INITIAL STRESSES

C LRE(L): TYPE OF SHEAR BAND DIRECTION (1 OR 2)

C \*\*\* IF DATA(I)=0, PRECEDING VALUE IS EMPLOYED

C

DO 12 L=1,NNE

READ(5,103) K,(IJK(L,I),I=1,4),(IDATA(I),I=1,5)

DO 14 I=1,12

IF(IDATA(I).EQ.0) IDATA(I)=IDATAQ(I)

IF(IDATA(I).LT.0) IDATA(I)=0

14 IDATAQ(I)=IDATA(I)

K2(L)= IDATA(1)

MAT(L)=IDATA(2)

IBA(L)=IDATA(3)

IST(L)=IDATA(4)

LRE(L)=IDATA(5)

12 CONTINUE

C \*\*\* MATERIAL PARAMETERS

C EE1(M): YOUNG'S MODULUS FOR K2=1-5, SHEAR RIGIDITY FOR K2=6

C PP1(M): POISSON'S RATIO FOR K2=4 & 5,

C CROSS AREA FOR K2=1-3, YOUNG'S MODULUS FOR K2=6

C HH1(M): 1.0 FOR K2=4 & 5, MOMENT OF INERTIA FOR K2=3

C POISSON'S RATIO FOR K2=6

C RO1(M): DENSITY

C CC1(M): COHESION, FA1(M):ANGLE OF SHEAR RESISTANCE

C DL1(M): ANGLE OF DILATANCY

C

WRITE(6,213)

DO 16 M=1,NMAT

READ(5,107) M1,EE1(M),PP1(M),HH1(M),RO1(M),CC1(M),

\* FA1(M),DL1(M)

WRITE(6,107) M1,EE1(M),PP1(M),HH1(M),RO1(M),CC1(M),

\* FA1(M),DL1(M)

FA1(M)=FA1(M)\*3.14159D0/180.D0

DL1(M)=DL1(M)\*3.14159D0/180.D0

16 CONTINUE

C

DO 18 L=1,NNE

M=MAT(L)

EE(L)=EE1(M)

PP(L)=PP1(M)

HH(L)=HH1(M)

ROU(L)=RO1(M)

CC(L)=CC1(M)

FI=FA1(M)

FAI(L)=FI\*180.D0/3.14159D0

SFI(L)=DSIN(FI)

CFI(L)=DCOS(FI)

DL=DL1(M)

DLT(L)=DL\*180.D0/3.14159D0

SDL(L)=DSIN(DL)

CDL(L)=DCOS(DL)

N=K2(L)

NET(N)=NET(N)+1

IF(N.LE.3.OR.N.EQ.6) ROU(L)=0.D0

18 CONTINUE

C \*\*\* ELEMENT TYPE

WRITE(6,202) (NET(I),I=1,6)

C \*\*\* EMBANKMENT ELEMENTS

NBA=0

DO 20 L=1,NNE

IB=IBA(L)

IF(IB.EQ.0) GO TO 20

NBA=NBA+1

LBA(NBA)=L

20 CONTINUE

IF(NBA.LE.0) GO TO 22

WRITE(6,203) NBA

WRITE(6,101) (LBA(I),I=1,NBA)

22 CONTINUE

C

WRITE(6,205)

DO 26 L=1,NNE

IF(IPR.EQ.0) GO TO 26

WRITE(6,206) L,(IJK(L,I),I=1,4),K2(L),EE(L),PP(L),HH(L),

\* ROU(L),CC(L),FAI(L),DLT(L),IBA(L),IST(L),LRE(L)

26 CONTINUE

C \*\*\* NODAL LOADS

IF(NFL.EQ.0) GO TO 30

READ(5,101) (IFL(I),I=1,NFL)

READ(5,106) DELP,WID

WRITE(6,207)

IXY=2

DO 32 I=1,NFL

NOD=IFL(I)

PRES=DELP

FL=-PRES\*WID\*0.5

IF(I.GE.2.AND.I.LT.NFL) FL=FL\*2.D0

LOI(I)=3\*NOD-(3-IXY)

FLO(I)=FL\*XX(NOD)

32 CONTINUE

30 CONTINUE

C \*\*\* ACTUALLY INITIAL STRESSES

C K1: SET NO., STII(K,I) I=1,2,3,4: SIGUMA-X,Y,TAU-XY,SIGUMA-Z

DO 40 L=1,NNE

DO 40 I=1,4

STI(L,I)=0.D0

40 PST(L,I)=0.D0

IF(NIS.LE.0) GO TO 42

WRITE(6,208)

DO 44 K=1,NIS

READ(5,105) K1,(STII(K,I),I=1,4)

44 WRITE(6,105) K1,(STII(K,I),I=1,4)

DO 46 L=1,NNE

IF(K2(L).LE.3) GO TO 46

K=IST(L)

DO 48 I=1,4

STI(L,I)=STII(K,I)

48 PST(L,I)=STII(K,I)

46 CONTINUE

GO TO 50

42 READ(5,101) IU

WRITE(6,209) IU

IF(IU.LE.0) GO TO 50

DO 52 I=1,4

READ(7,106) (PST(L,I),L=1,NNE)

52 WRITE(6,106) (PST(L,I),L=1,NNE)

50 CONTINUE

C \*\*\* CONVERGENCE CONSTANTS ETC.

C SCD: SCALING FACTOR FOR DISPLACEMENT OUTPUT

C ERC: CONV. CONST. FOR CONFINING PRESSURE

C FSS: SAFETY FACTOR FS

READ(5,106) THB,GSB,SCC,ERR

IF(SCC.LT.0.01D0) SCC=1.D0

IF(THB.LT.0.001D0) THB=0.001D0

WRITE(6,210) THB,GSB,SCC,ERR

C \*\*\* DISP. OUTPUT NODE

READ(5,101) NDI

WRITE(6,211) NDI

C

100 FORMAT(15A4)

101 FORMAT(15I5)

102 FORMAT(I5,2F10.4,3I5)

103 FORMAT(10I5)

104 FORMAT(3I5,E12.3)

105 FORMAT(I5,7E10.3)

106 FORMAT(10E8.3)

107 FORMAT(I5,7E10.3)

108 FORMAT(10E8.3)

200 FORMAT(/'NODES=',I5,' ELEMENTS=',I5,' MATERIALS=',I3

\*/' LOADS=',I3,' INITIAL-STRESSES=',I3,' ITERATION=',I2

\*/' TRYALS=',I3,' CRITICAL=',I2,' PRINT=',I2

\*/' LOAD-STEPS=',I5,' ACTUAL STEPS=',I5,' M-AVS STEPS='I5

\*/' M-AVS STEP NO.'/5X,10I5)

201 FORMAT(/'NODAL DATA'/'NO.',9X,'X',9X,'Y',' X-F Y-F R-F')

202 FORMAT(/'TRUSS=',I5,' BEAM=',I5,' TEXTILE=',I5,' P-STRA=',I5,

\*/' P-STRA(NL)=',I5,' INTER=',I5)

203 FORMAT(/'EMBANKMENT ELEMENTS=',I5)

205 FORMAT(/'ELEMENT DATA'

\*/'NO. NODES TYPE E P H ROH C FAI DEL EMB STRE SLIP')

206 FORMAT(I4,4I5,I2,3E9.2,F6.2,F7.2,2F6.2,3I2)

207 FORMAT(/'NODAL LOADS')

208 FORMAT(/'ACTUALLY INITIAL STRESSES')

209 FORMAT(/'INITIAL STRESSES 0=NO, 1=INPUT',I5)

210 FORMAT(/' BAND THICKNESS=',F10.4

\*/' MIN. SHEAR RIGIDITY=',F10.4,' DISP.SCALE=',F10.2

\*/' CRITICAL CHECK=',F10.4)

211 FORMAT(/'DISP. OUTPUT NODE=',I5)

213 FORMAT(/'MATERIAL PARAMETERS'

\*/' NO. E NYU H ROH C FAI DEL')

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE PREPAR(IND)

C \*\*\* SET DISPLACEMENT VECTOR AND STIFFNESS MATRIX

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

DIMENSION EML(1300)

C

DO 10 L=1,NNP

10 NDF(L)=2

DO 12 L=1,NNE

IF(K2(L).NE.2) GO TO 12

I=IJK(L,1)

J=IJK(L,2)

NDF(I)=3

NDF(J)=3

12 CONTINUE

DO 14 L=1,NNP

LY(3\*L-2)=IX(L)

LY(3\*L-1)=IY(L)

IF(NDF(L).EQ.2) IQ(L)=1

LY(3\*L)=IQ(L)

14 CONTINUE

NX=3\*NNP

LOC=0

DO 16 L=1,NX

IF(LY(L).EQ.0) GO TO 18

LY(L)=NN

GO TO 16

18 LOC=LOC+1

LX(LOC)=L

LY(L)=LOC

16 CONTINUE

NY=LOC

WRITE(6,200) NY

IF(NY.LT.NN) GO TO 20

WRITE(6,201)

IND=10

RETURN

C

20 DO 22 I=1,NY

DO 22 J=1,NY

22 GKK(I,J)=0.D0

DO 24 L=1,NNE

DO 24 I=1,8

DO 24 J=1,8

24 EKK(L,I,J)=0.D0

C

DO 30 L=1,NNE

KOL2=K2(L)

GO TO (31,32,31,34,34,34),KOL2

31 CALL TRUSS(L)

GO TO 30

32 CALL BEAM(L)

GO TO 30

34 CALL AXISYM(L,KOL2)

30 CONTINUE

CALL GSTIFF

C

CALL DINV(GKK,NN,NY,0,DET,IND)

IF(IND.EQ.1) GO TO 80

WRITE(6,202) IND

80 CONTINUE

C

200 FORMAT(/'NUMBER OF VARIABLES=',I4)

201 FORMAT(/'\* VARIABLE MEMORY=OVER')

202 FORMAT(/'\* INDEX=',I3)

203 FORMAT(/'EMBANK. LOAD'/(10F7.2))

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE GSTIFF

C \*\*\* GLOBAL STIFFNESS MATRIX

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

C

DO 10 L=1,NNE

KOL2=K2(L)

GO TO (11,12,11,14,14,14),KOL2

11 NV=4

GO TO 20

12 NV=6

GO TO 20

14 NV=8

IF(IJK(L,4).EQ.0) NV=6

20 CONTINUE

DO 30 I=1,NV

IT=LLL(L,I)

IF(IT.EQ.NN) GO TO 30

DO 32 J=1,NV

JT=LLL(L,J)

IF(JT.EQ.NN) GO TO 32

GKK(IT,JT)=GKK(IT,JT)+EKK(L,I,J)

32 CONTINUE

30 CONTINUE

10 CONTINUE

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE INISTR

C \*\*\* APPLY MODIFIED INITIAL STRESS METHOD

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB11/PI1(1250),PI2(1250),PI3(1250),PI4(1250),PI5(1250)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB16/DEP(1250,4,4),GG1(1250,4,2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

COMMON/LB21/PS1(1250),PS3(1250),QS1(1250),QS3(1250)

C

NFAT=0

NTS=0

DO 2 L=1,NNE

JFA(L)=0

MFA(L)=0

LFA(L)=0

JTS(L)=0

PS3(L)=0.D0

QS3(L)=0.D0

DO 4 I=1,4

SST(L,I)=0.D0

4 STAX(L,I)=0.D0

2 CONTINUE

C

DO 100 ITP=1,MSTP

ISTP=ITP

WRITE(6,200) ISTP

CALL LOADVE(ISTP)

DO 6 L=1,NNE

DO 6 I=1,4

6 ST0(L,I)=0.D0

C

DO 110 ITT=1,NTRY

WRITE(6,201) ITT

C

CALL DISPLA

CALL STRESS

DO 10 I=1,NY

10 QTU(I)=PTU(I)+TU(I)

DO 12 L=1,NNE

DO 14 I=1,4

14 QST(L,I)=PST(L,I)+STR(L,I)

12 CONTINUE

C IF(ITT.GE.2) CALL CALSTB(1)

IF(ITT.EQ.NTRY) GO TO 302

CALL YIELD(QST)

IF(ITER.EQ.0) GO TO 302

IF(ITT.EQ.1.AND.NFA.LE.0) GO TO 300

IF(ITT.GE.2.AND.NFA.LE.0) GO TO 302

WRITE(6,202) (IFA(I),I=1,NFA)

CALL CALSTA

DO 20 IE=1,NFA

LI=IFA(IE)

DO 22 I=1,4

22 STAX(LI,I)=STA(IE,I)

SX=STAX(LI,1)

SY=STAX(LI,2)

TA=STAX(LI,3)

CALL PRINCE(SX,SY,TA,S1,S3,TH)

PI3(LI)=TH

20 CONTINUE

CALL DEPMAT

CALL YGRAD1

300 CONTINUE

IF(NFAT.LE.0) GO TO 302

CALL CALSTC

CALL NOTENS

CALL YGRAD2

110 CONTINUE

C

302 CONTINUE

CALL NOTENS

CALL YGRAD2

CALL DISPLA

CALL STRESS

DO 50 I=1,NY

50 QTU(I)=PTU(I)+TU(I)

DO 52 L=1,NNE

DO 54 I=1,4

54 QST(L,I)=PST(L,I)+STR(L,I)

52 CONTINUE

DO 24 L=1,NNE

DO 24 I=1,4

24 STB(L,I)=QST(L,I)

IF(NFAT.LE.0) GO TO 304

CALL CALSTB(1)

304 CONTINUE

CALL OUTPUT

C

IF(NFAT.LE.0) GO TO 70

IF(ICR.LE.0) GO TO 70

DO 62 IL=1,NFAT

LI=KFA(IL)

IF(LFA(LI).GE.1) GO TO 62

IF(ICR.EQ.2) GO TO 66

SX=STB(LI,1)

SY=STB(LI,2)

TA=STB(LI,3)

CALL PRINCE(SX,SY,TA,S1,S3,TH)

QS1(LI)=S1

QS3(LI)=S3

DI=QS3(LI)-PS3(LI)

IF(DABS(DI).GT.ERR) GO TO 62

66 LFA(LI)=1

CC(LI)=(S1-S3)\*.5D0

SFI(LI)=0.D0

CFI(LI)=1.D0

SDL(LI)=0.D0

CDL(LI)=1.D0

62 CONTINUE

DO 64 L=1,NNE

64 PS3(L)=QS3(L)

70 CONTINUE

C

DO 26 L=1,NNE

26 MFA(L)=JFA(L)

DO 28 L=1,NNE

DO 28 I=1,4

28 SST(L,I)=PST(L,I)

DO 32 L=1,NNE

DO 32 I=1,4

32 PST(L,I)=STB(L,I)

DO 34 I=1,NY

34 PTU(I)=QTU(I)

100 CONTINUE

C

200 FORMAT(/'\* LOADING STEP=',I5)

201 FORMAT('STAGE',I3)

202 FORMAT('NEW YIELD EL',10(/10I5))

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE LOADVE(ISTP)

C \*\*\* CALCULATE LOAD VECTOR

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

DIMENSION EML(1300)

C \*\*\* NODAL LOAD

DO 10 I=1,NY

FF(I)=0.D0

10 TF(I)=0.D0

DO 12 I=1,NFL

IT=LOI(I)

IT=LY(IT)

TF(IT)=FLO(I)

12 CONTINUE

DO 31 I=1,NY

FF(I)=0.D0

DO 31 J=1,NY

FF(I)=FF(I)+GKK(I,J)\*TF(J)

31 CONTINUE

40 RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE DISPLA

C \*\*\* CALCULATE DISPLACEMENTS

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

DIMENSION TR(2600),FE(8),BT(8,4)

C

DO 2 I=1,NY

2 TR(I)=0.D0

IF(NFAT.LE.0) GO TO 4

DO 10 IL=1,NFAT

LI=KFA(IL)

KOL2=K2(LI)

NV=8

IF(IJK(LI,4).EQ.0) NV=6

DO 12 I=1,NV

DO 12 J=1,4

BT(I,J)=0.D0

DO 12 K=1,4

12 BT(I,J)=BT(I,J)+BMX(LI,K,I)\*TMX(LI,K,J)

C

NDY1=NDY

IF(JTS(LI).GE.1.AND.NDY.EQ.3) NDY1=2

C

DO 16 I=1,NV

FE(I)=0.D0

DO 16 J=NDY1,3

16 FE(I)=FE(I)+BT(I,J)\*ST0(LI,J)

A=AES(LI)

DO 18 I=1,NV

IT=LLL(LI,I)

18 TR(IT)=TR(IT)+FE(I)\*A

10 CONTINUE

4 CONTINUE

C

DO 40 I=1,NY

40 TR(I)=TF(I)+TR(I)

DO 42 I=1,NY

TU(I)=0.D0

DO 42 J=1,NY

42 TU(I)=TU(I)+GKK(I,J)\*TR(J)

TU(NN)=0.D0

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE STRESS

C \*\*\* CALCULATE STRESSES

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

DIMENSION EU(8)

C

DO 10 L=1,NNE

DO 20 I=1,6

20 STR(L,I)=0.D0

KOL2=K2(L)

GO TO (11,12,11,14,14,14),KOL2

C \*\*\* TRUSS & TEXTILE

11 DO 22 I=1,4

IT=LLL(L,I)

22 EU(I)=TU(IT)

E=EE(L)

STR(L,1)=0.D0

DO 24 I=1,4

24 STR(L,1)=STR(L,1)+BMX(L,1,I)\*EU(I)\*E

GO TO 10

C \*\*\* BEAM

12 DO 26 I=1,6

IT=LLL(L,I)

26 EU(I)=TU(IT)

DO 28 I=1,6

STR(L,I)=0.D0

DO 28 J=1,6

28 STR(L,I)=STR(L,I)+DBM(L,I,J)\*EU(J)

GO TO 10

C \*\*\* AXI-SYMMETRIC

14 NV=8

IF(IJK(L,4).EQ.0) NV=6

DO 30 I=1,NV

IT=LLL(L,I)

30 EU(I)=TU(IT)

DO 32 I=1,4

EPS(L,I)=0.D0

DO 32 J=1,NV

32 EPS(L,I)=EPS(L,I)+BMX(L,I,J)\*EU(J)

DO 34 I=1,4

STR(L,I)=0.D0

DO 34 J=1,NV

STR(L,I)=STR(L,I)+DBM(L,I,J)\*EU(J)

34 CONTINUE

10 CONTINUE

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE YIELD(RST)

C \*\*\* FIND YIELD ELEMENTS

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LB11/PI1(1250),PI2(1250),PI3(1250),PI4(1250),PI5(1250)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

DIMENSION RST(1250,4),RRS(4),DST(4)

C

IL=0

IM=0

DO 10 L=1,NNE

KOL2=K2(L)

GO TO (10,10,10,14,14,16),KOL2

14 SX=RST(L,1)

SY=RST(L,2)

TA=RST(L,3)

CALL MOHRCO(L,SX,SY,TA,F,S,P2,B0)

GO TO 20

16 SG=RST(L,2)

TA=RST(L,3)

CALL COULOM(L,SG,TA,F,S,0)

20 PI2(L)=S

IF(MFA(L).GE.1) GO TO 30

IF(F) 22,24,24

22 JFA(L)=0

GO TO 10

24 IF(JFA(L).GE.1) GO TO 30

IM=IM+1

IFA(IM)=L

IFS(L)=ISTP

30 IL=IL+1

JFA(L)=IL

KFA(IL)=L

10 CONTINUE

NFA=IM

NFAT=IL

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE CALSTA

C \*\*\* CALCULATE YIELD STRESSES SIGUMA-A

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LB11/PI1(1250),PI2(1250),PI3(1250),PI4(1250),PI5(1250)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

DIMENSION STD(4),RST(4),TST(4),AVECT(4),DST(4)

C

DO 10 IE=1,NFA

LI=IFA(IE)

DO 2 I=1,4

RST(I)=QST(LI,I)

2 TST(I)=PST(LI,I)

DO 4 I=1,4

4 STD(I)=RST(I)-TST(I)

C

KOL2=K2(LI)

GO TO (10,10,10,14,14,16),KOL2

14 SX=RST(1)

SY=RST(2)

TA=RST(3)

CALL MOHRCO(LI,SX,SY,TA,F1,S,P2,B0)

SX=TST(1)

SY=TST(2)

TA=TST(3)

CALL MOHRCO(LI,SX,SY,TA,F0,S,P2,B0)

IF(F0.LE.0.D0) GO TO 20

F1=F0

DO 22 I=1,4

RST(I)=PST(LI,I)

22 TST(I)=SST(LI,I)

DO 24 I=1,4

24 STD(I)=RST(I)-TST(I)

SX=TST(1)

SY=TST(2)

TA=TST(3)

CALL MOHRCO(LI,SX,SY,TA,F0,S,P2,B0)

20 C1=-F0/(F1-F0)

SX=TST(1)+STD(1)\*C1

SY=TST(2)+STD(2)\*C1

TA=TST(3)+STD(3)\*C1

CALL MOHRCO(LI,SX,SY,TA,F2,S,P2,B0)

B2=B0\*\*(-.5D0)

SF=SFI(LI)

A1=B2\*P2-SF

A2=B2\*P2\*(-1.D0)-SF

A3=B2\*4.D0\*TA

R=A1\*STD(1)+A2\*STD(2)+A3\*STD(3)

IF(R.EQ.0.D0) R=0.0001D0

C=C1-F2/R

C IF(C.GT.1.) C=C1

GO TO 18

16 SG=RST(2)

TA=RST(3)

CALL COULOM(LI,SG,TA,F1,S,1)

SG=TST(2)

TA=TST(3)

CALL COULOM(LI,SG,TA,F0,S,1)

IF(F0.LE.0.D0) GO TO 30

F1=F0

DO 32 I=1,4

RST(I)=PST(LI,I)

32 TST(I)=SST(LI,I)

DO 34 I=1,4

34 STD(I)=RST(I)-TST(I)

SG=TST(2)

TA=TST(3)

CALL COULOM(LI,SG,TA,F0,S,1)

30 C=-F0/(F1-F0)

18 CONTINUE

DO 50 I=1,4

50 STA(IE,I)=TST(I)+STD(I)\*C

C

GO TO (10,10,10,54,54,56),KOL2

54 SX=STA(IE,1)

SY=STA(IE,2)

TA=STA(IE,3)

CALL MOHRCO(LI,SX,SY,TA,F,S,P2,B0)

GO TO 58

56 SG=STA(IE,2)

TA=STA(IE,3)

CALL COULOM(LI,SG,TA,F,S,0)

58 PI1(LI)=S

10 CONTINUE

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE CALSTB(IC)

C \*\*\* CALCULATE CURRENT STRESSES SIGUMA-B

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB16/DEP(1250,4,4),GG1(1250,4,2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

DIMENSION SBD(1250,4),QSD(1250,4),SAD(1250,4),S0D(1250,4)

DIMENSION DP(4),STD(4)

C

DO 10 IL=1,NFAT

LI=KFA(IL)

DO 14 I=1,4

DP(I)=0.D0

DO 14 J=1,4

14 DP(I)=DP(I)+TMX(LI,I,J)\*ST0(LI,J)

DO 16 I=1,4

16 STB(LI,I)=QST(LI,I)-DP(I)

10 CONTINUE

C

IF(IC.LE.0) GO TO 80

80 RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE CALSTC

C \*\*\* CALCULATE PRECEDING STRESSES SIGUMA-C

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

C

DO 10 IL=1,NFAT

LI=KFA(IL)

DO 12 I=1,4

12 EPE(LI,I)=0.D0

C

IS=IFS(LI)-ISTP

IF(IS) 20,22,22

20 DO 14 I=1,4

14 STC(LI,I)=PST(LI,I)

GO TO 10

22 DO 16 I=1,4

EPE(LI,I)=0.D0

DO 16 J=1,4

16 EPE(LI,I)=EPE(LI,I)+DIX(LI,I,J)\*(STAX(LI,J)-PST(LI,J))

DO 18 I=1,4

18 STC(LI,I)=STAX(LI,I)

10 CONTINUE

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE DEPMAT

C \*\*\* CALCULATE DEP-MATRIX

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB11/PI1(1250),PI2(1250),PI3(1250),PI4(1250),PI5(1250)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB16/DEP(1250,4,4),GG1(1250,4,2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

DIMENSION T(4,4),D(4,4),TD(4,4),DPF(4,4)

C

DO 10 IE=1,NFA

LI=IFA(IE)

KOL2=K2(LI)

C

GO TO (10,10,10,10,15,16),KOL2

15 SI=1.D0

IF(LRE(LI).GE.2) SI=-1.D0

E=EE(LI)

P=PP(LI)

G=E/(2.D0\*(1.+P))

GO TO 18

16 SI=-1.D0

IF(STR(LI,3).LT.0.D0) SI=1.D0

E=PP(LI)

P=HH(LI)

G=EE(LI)

18 IF(ICR.LE.1) GO TO 12

C

SIT=PI3(LI)

TFI=SFI(LI)/CFI(LI)

TDL=SDL(LI)/CDL(LI)

ALF=3.14159\*0.25+ATAN(TFI)\*0.5

BET=(ALF+SIT)\*(-1.)

IF(LRE(LI).GE.2) BET=ALF-SIT

PI4(LI)=BET

IF(KOL2.EQ.6) PI4(LI)=TIN(LI)

C

IF(ICR.LE.1) GO TO 12

TFI=0.

TDL=0.

12 CONTINUE

IF(KOL2.EQ.6) GO TO 20

CB=DCOS(BET)

SB=DSIN(BET)

T(1,1)=CB\*CB

T(1,2)=SB\*SB

T(1,3)=-2.D0\*SB\*CB

T(1,4)=0.D0

T(2,1)=SB\*SB

T(2,2)=CB\*CB

T(2,3)=2.D0\*SB\*CB

T(2,4)=0.D0

T(3,1)=SB\*CB

T(3,2)=-SB\*CB

T(3,3)=CB\*CB-SB\*SB

T(3,4)=0.D0

T(4,1)=0.D0

T(4,2)=0.D0

T(4,3)=0.D0

T(4,4)=1.D0

DO 22 I=1,4

DO 22 J=1,4

22 TMX(LI,I,J)=T(I,J)

CALL DINV(T,4,4,0,DET,IND)

DO 24 I=1,4

DO 24 J=1,4

24 TMI(LI,I,J)=T(I,J)

DO 26 I=1,4

DO 26 J=1,4

26 T(I,J)=TMX(LI,I,J)

C

20 C1=E\*(1.D0-P)/((1.D0+P)\*(1.D0-2.D0\*P))

C2=E\*P/((1.D0+P)\*(1.D0-2.D0\*P))

B1=1.D0/(C1\*TFI\*TDL+G)

DPF(1,1)=C1

DPF(1,2)=C2

DPF(1,3)=0.D0

DPF(1,4)=C2

DPF(2,1)=C2

DPF(2,2)=C1

DPF(2,3)=0.D0

DPF(2,4)=C2

DPF(3,1)=-SI\*C2\*TFI

DPF(3,2)=-SI\*C1\*TFI

DPF(3,3)=0.D0

DPF(3,4)=-SI\*C2\*TFI

DPF(4,1)=C2

DPF(4,2)=C2

DPF(4,3)=0.D0

DPF(4,4)=C1

C

IF(KOL2.EQ.6) GO TO 40

50 CALL MULT(T,DPF,TD,4,4,4)

CALL XULT(TD,T,DPF,4,4,4)

40 DO 44 I=1,4

DO 44 J=1,4

44 DEP(LI,I,J)=DPF(I,J)

10 CONTINUE

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE NOTENS

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

DIMENSION STD(4),TQS(4),TST(4)

C

IT=0

DO 10 IL=1,NFAT

LI=KFA(IL)

JTS(LI)=0

KOL2=K2(LI)

GO TO (10,10,13,10,15,15),KOL2

13 SG=STR(LI,1)

IF(SG.LE.0.D0) GO TO 10

GO TO 18

15 DO 20 I=1,4

STD(I)=0.D0

DO 20 J=1,4

20 STD(I)=STD(I)+TMI(LI,I,J)\*(QST(LI,J)-STC(LI,J))

IF(STD(2).GE.0.D0) GO TO 10

18 IT=IT+1

ITS(IT)=LI

JTS(LI)=IT

10 CONTINUE

NTS=IT

C IF(NTS.LE.0) GO TO 80

C WRITE(6,200) (ITS(I),I=1,NTS)

C 200 FORMAT(10I5)

80 RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE YGRAD1

C \*\*\* CALCULATE 'INITIAL STRESSES' (STEP-1)

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB16/DEP(1250,4,4),GG1(1250,4,2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

DIMENSION TR(2600),FE(8),GU(2600),BT(8,4)

C

DO 10 IE=1,NFA

LI=IFA(IE)

KOL2=K2(LI)

NV=8

IF(IJK(LI,4).EQ.0) NV=6

IF(KOL2.EQ.6) GO TO 40

DO 12 I=1,NV

DO 12 J=1,4

BT(I,J)=0.D0

DO 12 K=1,4

12 BT(I,J)=BT(I,J)+BMX(LI,K,I)\*TMX(LI,K,J)

GO TO 50

40 DO 41 I=1,NV

DO 41 J=1,4

41 BT(I,J)=0.D0

DO 42 I=1,NV

DO 42 J=1,4

42 BT(I,J)=BMX(LI,J,I)

50 A=AES(LI)

C

NDY1=NDY

IF(NDY.EQ.3) NDY1=2

DO 20 II=NDY1,3

DO 22 I=1,NY

22 TR(I)=0.D0

DO 24 I=1,NV

24 FE(I)=BT(I,II)

DO 26 I=1,NV

IT=LLL(LI,I)

26 TR(IT)=TR(IT)+FE(I)\*A

DO 28 I=1,NY

GU(I)=0.D0

DO 28 J=1,NY

28 GU(I)=GU(I)+GKK(I,J)\*TR(J)

C

DO 30 I=1,NY

30 GG1(LI,II,I)=GU(I)

GG1(LI,II,NN)=0.D0

20 CONTINUE

10 CONTINUE

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE YGRAD2

C \*\*\* CALCULATE 'INITIAL STRESSES' (STEP-2)

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB16/DEP(1250,4,4),GG1(1250,4,2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

DIMENSION EU(8),EP(4),FP(4),DM(4,4),RF(2600),

\* AA(2150,2150),SL0(2600)

C

NVS=NFAT+NTS

IF(NVS.LE.NVM) GO TO 5

WRITE(6,200) NVS

STOP

5 CONTINUE

C

DO 10 IL=1,NVS

LI=KFA(IL)

II=3

IF(IL.GT.NFAT) LI=ITS(IL-NFAT)

IF(IL.GT.NFAT) II=2

NVI=8

IF(IJK(LI,4).EQ.0) NVI=6

C

DO 20 JL=1,NVS

LJ=KFA(JL)

IJ=3

IF(JL.GT.NFAT) LJ=ITS(JL-NFAT)

IF(JL.GT.NFAT) IJ=2

DO 22 I=1,NVI

IT=LLL(LI,I)

22 EU(I)=GG1(LJ,IJ,IT)

DO 24 I=1,4

EP(I)=0.D0

DO 24 J=1,NVI

24 EP(I)=EP(I)+BMX(LI,I,J)\*EU(J)

IF(IL-NFAT) 25,25,27

25 IF(JTS(LI).GE.1) GO TO 27

DO 26 I=1,4

DO 26 J=1,4

26 DM(I,J)=DMX(LI,I,J)-DEP(LI,I,J)

GO TO 29

27 DO 28 I=1,4

DO 28 J=1,4

28 DM(I,J)=DMX(LI,I,J)

29 DO 30 I=1,4

FP(I)=0.D0

DO 30 J=1,4

30 FP(I)=FP(I)+DM(I,J)\*EP(J)

DO 32 I=1,4

EP(I)=0.D0

DO 32 J=1,4

32 EP(I)=EP(I)+TMI(LI,I,J)\*FP(J)

C

C1=0.D0

IF(LJ.EQ.LI.AND.IJ.EQ.II) C1=1.D0

AA(IL,JL)=C1-EP(II)

20 CONTINUE

10 CONTINUE

C

DO 50 JL=1,NVS

LJ=KFA(JL)

IF(JL.GT.NFAT) LJ=ITS(JL-NFAT)

NV=8

IF(IJK(LJ,4).EQ.0) NV=6

DO 52 I=1,NV

IT=LLL(LJ,I)

52 EU(I)=FF(IT)

DO 54 I=1,4

EP(I)=0.D0

DO 54 J=1,NV

54 EP(I)=EP(I)+BMX(LJ,I,J)\*EU(J)

IF(JL-NFAT) 55,55,57

55 IF(JTS(LJ).GE.1) GO TO 57

DO 56 I=1,4

DO 56 J=1,4

56 DM(I,J)=DMX(LJ,I,J)-DEP(LJ,I,J)

GO TO 59

57 DO 58 I=1,4

DO 58 J=1,4

58 DM(I,J)=DMX(LJ,I,J)

59 DO 60 I=1,4

FP(I)=0.D0

DO 60 J=1,4

60 FP(I)=FP(I)+DM(I,J)\*EP(J)

DO 62 I=1,4

EP(I)=0.D0

DO 62 J=1,4

62 EP(I)=EP(I)+TMI(LJ,I,J)\*FP(J)

C

IJ=3

IF(JL.GT.NFAT) IJ=2

RF(JL)=EP(IJ)

50 CONTINUE

C

DO 70 JL=1,NVS

LJ=KFA(JL)

IF(JL.GT.NFAT) LJ=ITS(JL-NFAT)

IF(JL-NFAT) 71,71,73

71 IF(JTS(LJ).GE.1) GO TO 73

DO 72 I=1,4

DO 72 J=1,4

72 DM(I,J)=DMX(LJ,I,J)-DEP(LJ,I,J)

GO TO 75

73 DO 74 I=1,4

DO 74 J=1,4

74 DM(I,J)=DMX(LJ,I,J)

75 DO 76 I=1,4

FP(I)=0.D0

DO 76 J=1,4

76 FP(I)=FP(I)+DM(I,J)\*EPE(LJ,J)

DO 78 I=1,4

EP(I)=0.D0

DO 78 J=1,4

78 EP(I)=EP(I)+TMI(LJ,I,J)\*FP(J)

C

IJ=3

IF(JL.GT.NFAT) IJ=2

RF(JL)=RF(JL)-EP(IJ)

70 CONTINUE

C

CALL GAUSSZ(AA,RF,NVM,NVS)

C

DO 82 JL=1,NFAT

LJ=KFA(JL)

ST0(LJ,2)=0.D0

82 CONTINUE

DO 84 JL=1,NVS

LJ=KFA(JL)

IJ=3

IF(JL.GT.NFAT) LJ=ITS(JL-NFAT)

IF(JL.GT.NFAT) IJ=2

ST0(LJ,IJ)=RF(JL)

84 CONTINUE

200 FORMAT(/'\* NUMBER OF INITIAL STRESSES IS OVER',I5)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE MOHRCO(L,SX,SY,TA,F,S,P2,B0)

C \*\*\* MOHR-COULOMB YIELD CONDITION

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

P1=.5D0\*(SX+SY)

P2=SX-SY

B0=P2\*P2+4.D0\*TA\*TA

S1=P1+.5D0\*DSQRT(B0)

S3=P1-.5D0\*DSQRT(B0)

A1=(S1+S3)\*SFI(L)+2.D0\*CC(L)\*CFI(L)

B1=S1-S3

F=B1-A1

S=A1/B1

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE COULOM(L,SG,TA,F,S,IC)

C \*\*\* COULOMB YIELD CONDITION

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

ST=CC(L)+SG\*SFI(L)/CFI(L)

IF(IC.LE.0) ST=VFUNC(ST)

TA=DABS(TA)

F=TA-ST

S=0.D0

IF(TA.GT.0.001D0) S=ST/TA

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE TRUSS(L)

C \*\*\* TRUSS ELEMENT

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

DIMENSION LL(4),BM(4),EK(4,4),T(4,4),TEK(4,4),TET(4,4)

C

II=IJK(L,1)

JJ=IJK(L,2)

C

E=EE(L)

A=PP(L)

XI=XX(II)

YI=YY(II)

XJ=XX(JJ)

YJ=YY(JJ)

DX=XJ-XI

DY=YJ-YI

EL=DSQRT(DX\*DX+DY\*DY)

C=DX/EL

S=DY/EL

BM(1)=1.D0/EL

BM(2)=0.D0

BM(3)=-1.D0/EL

BM(4)=0.D0

DO 2 I=1,4

DO 2 J=1,4

2 EK(I,J)=BM(I)\*BM(J)\*E\*EL\*A

C

DO 4 I=1,4

DO 4 J=1,4

4 T(I,J)=0.D0

T(1,1)=C

T(1,2)=S

T(2,1)=-S

T(2,2)=C

T(3,3)=C

T(3,4)=S

T(4,3)=-S

T(4,4)=C

CALL WULT(T,EK,TEK,4,4,4)

CALL MULT(TEK,T,TET,4,4,4)

DO 10 I=1,4

DO 10 J=1,4

EKK(L,I,J)=TET(I,J)

10 CONTINUE

C

AES(L)=A\*EL

DO 6 J=1,4

BMX(L,1,J)=0.D0

DO 6 K=1,4

6 BMX(L,1,J)=BMX(L,1,J)+BM(K)\*T(K,J)

DBM(L,1,1)=E\*EL

LL(4)=3\*JJ-1

LL(3)=LL(4)-1

LL(2)=3\*II-1

LL(1)=LL(2)-1

DO 8 I=1,4

IT=LL(I)

8 LLL(L,I)=LY(IT)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE BEAM(L)

C \*\*\* BEAM (RAHMEN) ELEMENT

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

DIMENSION LL(10),EK(6,6),T(6,6),TEK(6,6),TET(6,6),EKT(6,6)

C

II=IJK(L,1)

JJ=IJK(L,2)

C

E=EE(L)

A=PP(L)

AI=HH(L)

XI=XX(II)

YI=YY(II)

XJ=XX(JJ)

YJ=YY(JJ)

DX=XJ-XI

DY=YJ-YI

EL=DSQRT(DX\*DX+DY\*DY)

C=DX/EL

S=DY/EL

G=E\*A/EL

G5=2.D0\*E\*AI/EL

G4=2.D0\*G5

G3=3.D0\*G5/EL

G2=2.D0\*G3/EL

C

DO 2 I=1,6

DO 2 J=1,6

T(I,J)=0.D0

EK(I,J)=0.D0

2 CONTINUE

EK(1,1)=G

EK(2,2)=G2

EK(3,3)=G4

EK(4,4)=G

EK(5,5)=G2

EK(6,6)=G4

EK(1,4)=-G

EK(2,3)=G3

EK(2,5)=-G2

EK(2,6)=G3

EK(3,5)=-G3

EK(3,6)=G5

EK(5,6)=-G3

DO 4 I=1,5

IP1=I+1

DO 6 J=IP1,6

6 EK(J,I)=EK(I,J)

4 CONTINUE

DO 8 K=1,4,3

T(K,K)=C

T(K,K+1)=S

T(K+1,K)=-S

T(K+1,K+1)=C

T(K+2,K+2)=1.D0

8 CONTINUE

CALL WULT(T,EK,TEK,6,6,6)

CALL MULT(TEK,T,TET,6,6,6)

CALL MULT(EK,T,EKT,6,6,6)

DO 10 I=1,6

DO 10 J=1,6

DBM(L,I,J)=EKT(I,J)

EKK(L,I,J)=TET(I,J)

10 CONTINUE

C

LL(6)=3\*JJ

LL(5)=LL(6)-1

LL(4)=LL(5)-1

LL(3)=3\*II

LL(2)=LL(3)-1

LL(1)=LL(2)-1

DO 12 I=1,6

IT=LL(I)

12 LLL(L,I)=LY(IT)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE AXISYM(L,KOL2)

C \*\*\* AXI-SYMMETRIC ELEMENT

IMPLICIT REAL\*8(A-H,O-Z)

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB3/STR(1250,6),EPS(1250,4),FLO(60),EKK(1250,8,8)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB18/TMX(1250,4,4),TMI(1250,4,4),TIN(1250)

DIMENSION LL(10),D(4,4),ES(8,8),IOE(6),B(4,6),DB(4,6),

\* EK(6,6),BM(4,8),BMT(4,8),T(8,8),TEK(8,8),XXL(4),YYL(4),

\* COR(8),COD(8),TM(4,4)

C

II=IJK(L,1)

JJ=IJK(L,2)

KK=IJK(L,3)

MM=IJK(L,4)

C

DO 2 I=1,4

DO 2 J=1,4

2 D(I,J)=0.D0

C

E=EE(L)

P=PP(L)

H=HH(L)

GO TO (80,80,80,14,14,16),KOL2

14 CONTINUE

GP=1.D0+P

GM=1.D0-P

GN=1.D0-2.D0\*P

G=E\*GM/(GP\*GN)

G1=G\*P/GM

G2=G\*GN\*0.5D0/GM

D(1,1)=G

D(2,2)=G

D(3,3)=G2

D(4,4)=G

D(1,2)=G1

D(1,4)=G1

D(2,4)=G1

D(2,1)=D(1,2)

D(4,1)=D(1,4)

D(4,2)=D(2,4)

GO TO 18

16 CONTINUE

GP=1.D0+H

GM=1.D0-H

GN=1.D0-2.D0\*H

G=P/(GP\*GN)

G1=GM\*G

G2=H\*G

D(1,1)=G1

D(2,2)=G1

D(3,3)=E

D(4,4)=G1

D(1,2)=G2

D(1,4)=G2

D(2,4)=G2

D(2,1)=D(1,2)

D(4,1)=D(1,4)

D(4,2)=D(2,4)

C

DO 4 I=1,4

DO 4 J=1,4

4 TM(I,J)=0.D0

DO 6 I=1,4

6 TM(I,I)=1.D0

DO 8 I=1,4

DO 8 J=1,4

8 TMX(L,I,J)=TM(I,J)

DO 10 I=1,4

DO 10 J=1,4

10 TMI(L,I,J)=TM(I,J)

C

DX=XX(JJ)-XX(II)

DY=YY(JJ)-YY(II)

EL=DSQRT(DX\*DX+DY\*DY)

C=DX/EL

S=DY/EL

DO 20 I=1,8

DO 20 J=1,8

20 T(I,J)=0.D0

DO 22 I=1,7,2

T(I,I)=C

T(I,I+1)=S

T(I+1,I)=-S

T(I+1,I+1)=C

22 CONTINUE

TA=S/C

TIN(L)=DATAN(TA)

COR(1)=XX(II)

COR(2)=YY(II)

COR(3)=XX(JJ)

COR(4)=YY(JJ)

COR(5)=XX(KK)

COR(6)=YY(KK)

COR(7)=XX(MM)

COR(8)=YY(MM)

DO 24 I=1,8

COD(I)=0.D0

DO 24 J=1,8

24 COD(I)=COD(I)+T(I,J)\*COR(J)

DO 26 I=1,4

IE=2\*I

IO=IE-1

XXL(I)=COD(IO)

YYL(I)=COD(IE)

26 CONTINUE

C

18 CONTINUE

DO 30 I=1,4

DO 30 J=1,6

30 B(I,J)=0.D0

DO 32 I=1,8

DO 32 J=1,8

32 ES(I,J)=0.D0

DO 34 I=1,4

DO 34 J=1,8

34 BMT(I,J)=0.D0

AE=0.D0

I1=0

I2=1

I3=2

N4=4

NV=8

IF(MM.EQ.0) N4=1

IF(MM.EQ.0) NV=6

DO 40 LI=1,N4

I1=I1+1

I2=I2+1

IF(I2.EQ.5) I2=1

I3=I3+1

IF(I3.EQ.5) I3=1

I1E=2\*I1

I1O=I1E-1

I2E=2\*I2

I2O=I2E-1

I3E=2\*I3

I3O=I3E-1

IOE(1)=I1O

IOE(2)=I1E

IOE(3)=I2O

IOE(4)=I2E

IOE(5)=I3O

IOE(6)=I3E

GO TO (80,80,80,44,44,46),KOL2

44 CONTINUE

IIT=IJK(L,I1)

JJT=IJK(L,I2)

KKT=IJK(L,I3)

XI=XX(IIT)

YI=YY(IIT)

XJ=XX(JJT)

YJ=YY(JJT)

XK=XX(KKT)

YK=YY(KKT)

GO TO 48

46 CONTINUE

XI=XXL(I1)

YI=YYL(I1)

XJ=XXL(I2)

YJ=YYL(I2)

XK=XXL(I3)

YK=YYL(I3)

48 CONTINUE

RR=(XI+XJ+XK)/3.D0

ZZ=(YI+YJ+YK)/3.D0

AI=XJ\*YK-XK\*YJ

AJ=XK\*YI-XI\*YK

AK=XI\*YJ-XJ\*YI

BI=YJ-YK

BJ=YK-YI

BK=YI-YJ

CI=XK-XJ

CJ=XI-XK

CK=XJ-XI

DA=(AI+AJ+AK)\*0.5D0

AE4=DABS(DA)\*RR

AE=AE+AE4\*0.5D0

D2=0.125D0/DA

IF(MM.EQ.0) D2=0.5D0/DA

BMT(3,I1E)=BMT(3,I1E)-BI\*D2

BMT(3,I1O)=BMT(3,I1O)-CI\*D2

BMT(3,I2E)=BMT(3,I2E)-BJ\*D2

BMT(3,I2O)=BMT(3,I2O)-CJ\*D2

BMT(3,I3E)=BMT(3,I3E)-BK\*D2

BMT(3,I3O)=BMT(3,I3O)-CK\*D2

BMT(4,I1O)=BMT(4,I1O)-(AI/RR+BI+CI\*ZZ/RR)\*D2

BMT(4,I2O)=BMT(4,I2O)-(AJ/RR+BJ+CJ\*ZZ/RR)\*D2

BMT(4,I3O)=BMT(4,I3O)-(AK/RR+BK+CK\*ZZ/RR)\*D2

C

DEL2=1.D0/(AI+AJ+AK)

B(3,1)=-CI\*DEL2

B(3,2)=-BI\*DEL2

B(3,3)=-CJ\*DEL2

B(3,4)=-BJ\*DEL2

B(3,5)=-CK\*DEL2

B(3,6)=-BK\*DEL2

B(4,1)=-(AI/RR+BI+CI\*ZZ/RR)\*DEL2

B(4,3)=-(AJ/RR+BJ+CJ\*ZZ/RR)\*DEL2

B(4,5)=-(AK/RR+BK+CK\*ZZ/RR)\*DEL2

DO 50 I=1,3

IE=2\*I

IO=IE-1

B(1,IO)=B(3,IE)

B(2,IE)=B(3,IO)

50 CONTINUE

CALL MULT(D,B,DB,4,4,6)

CALL WULT(B,DB,EK,6,4,6)

DO 52 I=1,6

IE=IOE(I)

DO 54 J=1,6

JE=IOE(J)

ES(IE,JE)=ES(IE,JE)+EK(I,J)

54 CONTINUE

52 CONTINUE

40 CONTINUE

C

IF(MM.EQ.0) AE=DABS(DA)

AES(L)=AE

GO TO (80,80,80,64,64,66),KOL2

64 CONTINUE

C1=0.25D0

IF(MM.EQ.0) C1=1.D0

DO 70 I=1,NV

DO 70 J=1,NV

70 EKK(L,I,J)=ES(I,J)\*AE\*C1

DO 72 I=1,2

DO 72 J=1,NV

72 BMX(L,I,J)=0.D0

DO 74 J=1,NV

BMX(L,3,J)=BMT(3,J)

74 BMX(L,4,J)=BMT(4,J)

N1=NV/2

DO 76 J=1,N1

JE=2\*J

JO=JE-1

BMX(L,1,JO)=BMX(L,3,JE)

76 BMX(L,2,JE)=BMX(L,3,JO)

GO TO 68

66 CONTINUE

CALL WULT(T,ES,TEK,8,8,8)

CALL MULT(TEK,T,ES,8,8,8)

DO 78 I=1,8

DO 78 J=1,8

78 EKK(L,I,J)=ES(I,J)\*AES(L)\*0.25D0

DO 90 I=1,4

DO 90 J=1,8

90 BM(I,J)=0.D0

DO 92 J=1,8

BM(3,J)=BMT(3,J)

92 BM(4,J)=BMT(4,J)

DO 94 J=1,4

JE=2\*J

JO=JE-1

BM(1,JO)=BM(3,JE)

BM(2,JE)=BM(3,JO)

94 CONTINUE

DO 96 I=1,4

DO 96 J=1,8

BMX(L,I,J)=0.D0

DO 96 K=1,8

96 BMX(L,I,J)=BMX(L,I,J)+BM(I,K)\*T(K,J)

68 CONTINUE

LL(8)=3\*MM-1

LL(7)=LL(8)-1

LL(6)=3\*KK-1

LL(5)=LL(6)-1

LL(4)=3\*JJ-1

LL(3)=LL(4)-1

LL(2)=3\*II-1

LL(1)=LL(2)-1

DO 98 I=1,NV

IT=LL(I)

98 LLL(L,I)=LY(IT)

DO 100 I=1,4

DO 100 J=1,NV

DBM(L,I,J)=0.D0

DO 100 K=1,4

100 DBM(L,I,J)=DBM(L,I,J)+D(I,K)\*BMX(L,K,J)

DO 102 I=1,4

DO 102 J=1,4

102 DMX(L,I,J)=D(I,J)

CALL DINV(D,4,4,0,DET,IND)

DO 104 I=1,4

DO 104 J=1,4

104 DIX(L,I,J)=D(I,J)

80 CONTINUE

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE DINV(AA,N0,N1,N2,DET,IND)

C \*\*\* INVERCE MATRIX

IMPLICIT REAL\*8(A-H,O-Z)

DIMENSION AA(N0,N0),IPERM(2600),X(2600)

N=N1

M=N+N2

NMX=N0+1

IF(0.GE.N.OR.N2.LT.0.OR.N.GE.NMX.OR.M.GE.NMX) GO TO 80

IND=1

DO 1 I=1,N

1 IPERM(I)=I

EPS=0.D0

DO 2 K=1,N

RMAX=0.D0

DO 3 J=K,N

V=DABS(AA(K,J))

IF(RMAX-V) 4,3,3

4 RMAX=V

L=J

3 CONTINUE

IF(EPS-RMAX) 5,6,6

6 IF(EPS\*0.01D0-RMAX) 7,8,8

8 DET=0.D0

IND=3

DO 9 I=1,N

DO 9 J=1,N

9 AA(I,J)=1.0038D0

WRITE(6,200)

GO TO 11

7 IND=2

5 PIVOT=AA(K,L)

PIVI=1.D0/PIVOT

IF(L-K) 12,13,12

12 IW=IPERM(K)

IPERM(K)=IPERM(L)

IPERM(L)=IW

DO 14 I=1,N

W=AA(I,K)

AA(I,K)=AA(I,L)

AA(I,L)=W

14 CONTINUE

13 CONTINUE

DO 15 J=1,M

X(J)=AA(K,J)\*PIVI

AA(K,J)=X(J)

15 CONTINUE

DO 16 I=1,N

IF(I-K) 17,16,17

17 W=AA(I,K)

IF(W) 18,16,18

18 DO 19 J=1,M

IF(J-K) 20,19,20

20 AA(I,J)=-W\*X(J)+AA(I,J)

19 CONTINUE

AA(I,K)=-W\*PIVI

16 CONTINUE

AA(K,K)=PIVI

EPS=DMAX1(RMAX\*1.D-33,EPS)

2 CONTINUE

DO 21 I=1,N

22 K=IPERM(I)

IF(K-I) 23,21,23

23 IW=IPERM(K)

IPERM(K)=IPERM(I)

IPERM(I)=IW

DO 24 J=1,M

W=AA(I,J)

AA(I,J)=AA(K,J)

AA(K,J)=W

24 CONTINUE

GO TO 22

21 CONTINUE

11 RETURN

80 CONTINUE

WRITE(6,201) N,N2

IND=4

GO TO 11

201 FORMAT(/'N1=',I5,' N2=',I5,' MEMORY-OVER')

200 FORMAT(/'THE GIVEN MATRIX IS SINGULAR')

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE GAUSSZ(A,X,N0,N)

C \*\*\* GAUSS-ZAIDEL SWEEP OUT CALCULATION

IMPLICIT REAL\*8(A-H,O-Z)

DIMENSION A(N0,N0),X(N0),JUNJO(N0),SCALEF(N0),WORK(N0)

DO 1 I=1,N

1 JUNJO(I)=I

C

DO 2 I=1,N

P=DABS(A(1,1))

DO 3 J=2,N

3 P=DMAX1(P,DABS(A(I,J)))

IF(P.EQ.0.D0) GO TO 9001

DO 4 J=1,N

4 A(I,J)=A(I,J)/P

2 X(I)=X(I)/P

DO 5 J=1,N

P=DABS(A(1,J))

DO 6 I=2,N

6 P=DMAX1(P,DABS(A(I,J)))

IF(P.EQ.0.D0) GO TO 9002

DO 7 I=1,N

7 A(I,J)=A(I,J)/P

5 SCALEF(J)=P

C

DO 8 K=1,N-1

C

P=DABS(A(K,K))

II=K

JJ=K

DO 9 I=K,N

DO 10 J=K,N

AA=DABS(A(I,J))

IF(AA.LE.P) GO TO 10

P=AA

II=I

JJ=J

10 CONTINUE

9 CONTINUE

IF(P.LT.1.0D-8) GO TO 9003

DO 11 I=1,N

W=A(I,K)

A(I,K)=A(I,JJ)

11 A(I,JJ)=W

DO 12 J=K,N

W=A(K,J)

A(K,J)=A(II,J)

12 A(II,J)=W

W=X(K)

X(K)=X(II)

X(II)=W

J=JUNJO(K)

JUNJO(K)=JUNJO(JJ)

JUNJO(JJ)=J

C

P=A(K,K)

DO 13 J=K,N

13 A(K,J)=A(K,J)/P

X(K)=X(K)/P

DO 14 I=K+1,N

Q=A(I,K)

DO 15 J=K+1,N

15 A(I,J)=A(I,J)-Q\*A(K,J)

14 X(I)=X(I)-Q\*X(K)

8 CONTINUE

X(N)=X(N)/A(N,N)

C

DO 16 L=2,N

K=N-L+2

DO 16 I=1,K-1

16 X(I)=X(I)-X(K)\*A(I,K)

C

DO 17 I=1,N

17 WORK(I)=X(I)

DO 18 I=1,N

J=JUNJO(I)

18 X(J)=WORK(I)/SCALEF(J)

RETURN

C

9001 WRITE(6,200)

200 FORMAT('I-TH ROW=0')

GO TO 80

9002 WRITE(6,201)

201 FORMAT('I-TH COL=0')

GO TO 80

9003 WRITE(6,202)

202 FORMAT('SMALL PIVOT')

80 STOP

END

C \* \* \* \* \* \* \* \* \* \*

FUNCTION VFUNC(C)

C \*\*\* VFUNC(C)=0, WHEN C IS LESS THAN 0

IMPLICIT REAL\*8(A-H,O-Z)

VFUNC=0.D0

IF(C.GT.0.D0) VFUNC=C

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE PRINCE(SX,SY,TA,S1,S3,T)

C \*\*\* CALCULATE PRINCIPAL STRESSES

IMPLICIT REAL\*8(A-H,O-Z)

C=.5D0\*(SX+SY)

A1=(SY-SX)\*.5D0

A2=A1\*A1+TA\*TA

A=0.D0

IF(A2.GT.0.D0) A=DSQRT(A2)

S1=C+A

S3=C-A

IF(SY.EQ.S3) GO TO 1

T1=TA/(SY-S3)

T=DATAN(T1)

GO TO 2

1 T=3.141592653589793D0\*.5D0

2 RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE MULT(A,B,C,L,M,N)

C \*\*\* MULTIPLY MATRIX A \* B

IMPLICIT REAL\*8(A-H,O-Z)

DIMENSION A(L,M),B(M,N),C(L,N)

DO 1 I=1,L

DO 1 J=1,N

C(I,J)=0.D0

DO 1 K=1,M

1 C(I,J)=C(I,J)+A(I,K)\*B(K,J)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE WULT(A,B,C,L,M,N)

C \*\*\* MULTIPLY MATRIX A(TRANSPOSE) \* B

IMPLICIT REAL\*8(A-H,O-Z)

DIMENSION A(M,L),B(M,N),C(L,N)

DO 1 I=1,L

DO 1 J=1,N

C(I,J)=0.D0

DO 1 K=1,M

1 C(I,J)=C(I,J)+A(K,I)\*B(K,J)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE XULT(A,B,C,L,M,N)

C \*\*\* MULTIPLY MATRIX A \* B(TRANSPOSE)

IMPLICIT REAL\*8(A-H,O-Z)

DIMENSION A(L,M),B(N,M),C(L,N)

DO 1 I=1,L

DO 1 J=1,N

C(I,J)=0.D0

DO 1 K=1,M

1 C(I,J)=C(I,J)+A(I,K)\*B(J,K)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE VULT(A,U,V,M,N)

C \*\*\* MULTIPLY MATRIX A \* VECTOR U

IMPLICIT REAL\*8(A-H,O-Z)

DIMENSION A(M,N),U(N),V(M)

DO 1 I=1,M

V(I)=0.D0

DO 1 J=1,N

1 V(I)=V(I)+A(I,J)\*U(J)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE OUTPUT

C \*\*\* RESULT OUTPUT

IMPLICIT REAL\*8(A-H,O-Z)

CHARACTER\*5 AC(1250)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB5/DBM(1250,6,8),BMX(1250,4,8),SDL(1250),CDL(1250)

COMMON/LAB6/GKK(2600,2600),TF(2600),TU(2600),FF(2600)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LAB8/ROU(1250),CC(1250),SFI(1250),CFI(1250)

COMMON/LAB9/NBA,LBA(1250),LOI(60),LRE(1250),LSTP(200)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB11/PI1(1250),PI2(1250),PI3(1250),PI4(1250),PI5(1250)

COMMON/LB12/ST0(1250,4),STA(1250,4),STAX(1250,4),SST(1250,4)

COMMON/LB13/STB(1250,4),STC(1250,4),EPE(1250,4),STI(1250,4)

COMMON/LB14/ISTP,MSTP,NTRY,IDL,NDY,MDY,NDI

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

COMMON/LB21/PS1(1250),PS3(1250),QS1(1250),QS3(1250)

COMMON/LB22/TTS(1250)

DIMENSION UX(1300),UY(1300),UM(1300),WST(1250,7)

C

IST=ISTP

IOUT=LSTP(IST)

WRITE(6,200) ISTP

SCU=SCC

QTU(NN)=0.D0

DO 2 I=1,NNP

JX=LY(3\*I-2)

JY=LY(3\*I-1)

JM=LY(3\*I)

UX(I)=QTU(JX)\*SCU

UY(I)=QTU(JY)\*SCU

UM(I)=QTU(JM)\*SCU

2 CONTINUE

PRES=DELP\*FLOAT(IST)

WRITE(8,220) PRES,UY(NDI)

C

IF(IOUT.LE.0) GO TO 20

CALL MAVS1

CALL MAVS2

WRITE(6,201) (UX(I),I=1,NNP)

WRITE(6,213)

WRITE(6,201) (UY(I),I=1,NNP)

WRITE(6,202)

DO 10 L=1,NNE

TTS(L)=0.0

KOL2=K2(L)

A=1.D0

IF(KOL2.EQ.1.OR.KOL2.EQ.3) A=PP(L)

DO 12 I=1,4

12 WST(L,I)=STB(L,I)\*A

DO 14 I=5,7

14 WST(L,I)=0.D0

IF(KOL2.LE.3.OR.KOL2.GE.6) GO TO 10

SX=WST(L,1)

SY=WST(L,2)

TA=WST(L,3)

CALL PRINCE(SX,SY,TA,S1,S3,TH)

WST(L,5)=S1

WST(L,6)=S3

WST(L,7)=TH\*180.D0/3.141592653589793D0

IF(WST(L,6).LE.0.0) TTS(L)=2.0

10 CONTINUE

C DO 16 I=1,7

C WRITE(6,203) (WST(L,I),L=1,NNE)

C 16 WRITE(6,213)

C WRITE(6,204) (PI2(L),L=1,NNE)

IF(NFAT.EQ.0) GO TO 140

WRITE(6,205) (KFA(K),K=1,NFAT)

WRITE(6,218)

DO 50 K=1,NFAT

LI=KFA(K)

50 UY(K)=PI4(LI)\*180.D0/3.141592653589793D0

WRITE(6,203) (UY(K),K=1,NFAT)

IF(NTS.GE.1) WRITE(6,212) (ITS(K),K=1,NTS)

140 CONTINUE

20 CONTINUE

200 FORMAT(/'LOADING STEP',I5/'DISP. X, Y')

201 FORMAT(10E11.3)

202 FORMAT('STRESS SR,SZ,TA,ST,S1,S3,TH')

203 FORMAT(10E10.2)

204 FORMAT('SAFETY-FACTOR'/(10F7.3))

205 FORMAT('YIELD-ELEMENT'/(10I5))

206 FORMAT('YIELD-FACTOR'/(10F7.3))

207 FORMAT('INITIAL-STRESSES')

208 FORMAT('YIELD-STRESSES SX,SY,TA,S1,S3,TH')

209 FORMAT('PLASTIC STRAINS %')

210 FORMAT('FAILURE STEP'/(10I5))

211 FORMAT('THRUST R,N,S',3F10.3)

212 FORMAT('NO-TENSION EL.'/(10I5))

213 FORMAT(' ')

215 FORMAT(7E12.4)

216 FORMAT('EQUIVALENT NODAL FORCE'/' EL NODES')

217 FORMAT(16I4)

218 FORMAT('ANGLE OF S1, SLIP-SUR. DISP')

219 FORMAT('LEFT-1, RIGHT-2'/(10I5))

220 FORMAT(2E12.3)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE MAVS1

C \*\*\* MICRO-AVS10 OUTPUT (PART 1: DIRECTION OF SHEAR BAND)

IMPLICIT REAL\*8(A-H,O-Z)

CHARACTER\*5 AC(900)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LB11/PI1(1250),PI2(1250),PI3(1250),PI4(1250),PI5(1250)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

DIMENSION SX(1250),SY(1250),XXX(1300),YYY(1300)

DIMENSION J(1250)

C

DO 2 L=1,NNE

J(L)=1

SX(L)=0.D0

SY(L)=0.D0

IF(JFA(L).LE.0.AND.JTS(L).LE.0) GO TO 2

IF(JTS(L).GE.1) SI=3.14159D0\*0.5D0

IF(JFA(L).GE.1) SI=PI4(L)

SX(L)=DCOS(SI)

SY(L)=DSIN(SI)

2 CONTINUE

C

WRITE(11,301) NNP,NNE

DO 8 I=1,NNP

XXX(I)=XX(I)\*100.D0

YYY(I)=YY(I)\*100.D0

WRITE(11,302) I,XXX(I),YYY(I),0

8 CONTINUE

C

DO 10 L=1,NNE

AC(L)='quad'

IF(IJK(L,4).EQ.0) AC(L)='tri'

IF(IJK(L,3).EQ.0) GO TO 10

WRITE(11,303) L,J(L),AC(L),(IJK(L,I),I=1,4)

10 CONTINUE

WRITE(11,304)

WRITE(11,305)

WRITE(11,306)

DO 12 I=1,NNE

12 WRITE(11,307) I,SX(I),SY(I)

C

301 FORMAT(2I5,4X,'0',4X,'2',4X,'0')

302 FORMAT(I5,2F12.3,F9.3)

303 FORMAT(2I5,A8,I4,20I5)

304 FORMAT(3X,'2',3X,'1',4X,'1')

305 FORMAT('strX , (kN/m2)')

306 FORMAT('strY , (kN/m2)')

307 FORMAT(I5,3E13.5)

RETURN

END

C \* \* \* \* \* \* \* \* \* \*

SUBROUTINE MAVS2

C \*\*\* MICRO-AVS10 OUTPUT (PART 2: DISPLACEMENTS & YIELD ELEMENTS)

IMPLICIT REAL\*8(A-H,O-Z)

CHARACTER\*5 AC(900)

COMMON/LAB1/NNP,NNE,NFL,NSTP,NIS,NFA,NFAT,NY,NN,NVM,ITER,ICR

COMMON/LAB2/XX(1300),YY(1300),DMX(1250,4,4),DIX(1250,4,4)

COMMON/LAB4/K2(1250),IJK(1250,4),IX(1300),IY(1300),IQ(1300)

COMMON/LAB7/AES(1250),EE(1250),PP(1250),HH(1250)

COMMON/LB10/LX(6500),LY(6500),NDF(6500),LLL(1250,8)

COMMON/LB15/QST(1250,4),PST(1250,4),QTU(2600),PTU(2600)

COMMON/LB17/IFA(1250),JFA(1250),KFA(1250),MFA(1250),IFS(1250)

COMMON/LB19/DWE(20),RKH,THB,GSB,SCC,ERR,DELP

COMMON/LB20/NTS,ITS(1250),JTS(1250),LFA(1250)

DIMENSION UX(1300),UY(1300),UM(1300),PI9(1250)

C

QTU(NN)=0.D0

DO 2 I=1,NNP

JX=LY(3\*I-2)

JY=LY(3\*I-1)

JM=LY(3\*I)

SCU=SCC

UX(I)=QTU(JX)\*SCU

UY(I)=QTU(JY)\*SCU

2 CONTINUE

WRITE(12,310) 1

WRITE(12,311)

WRITE(12,300) 1

C

WRITE(12,301) NNP,NNE

DO 10 I=1,NNP

10 WRITE(12,302) I,XX(I),YY(I),0

DO 12 L=1,NNE

AC(L)='quad'

IF(IJK(L,4).EQ.0) AC(L)='tri'

IF(IJK(L,3).EQ.0) AC(L)='line'

WRITE(12,303) L,K2(L),AC(L),(IJK(L,I),I=1,4)

12 CONTINUE

WRITE(12,304)

WRITE(12,305)

WRITE(12,306)

WRITE(12,307)

WRITE(12,308)

DO 14 I=1,NNP

14 WRITE(12,309) I,UX(I),UY(I),0

WRITE(12,313)

WRITE(12,314)

DO 20 L=1,NNE

PI9(L)=0.1D0

IF(JTS(L).GE.1) PI9(L)=1.D0

IF(JFA(L).GE.1) PI9(L)=2.D0

20 CONTINUE

DO 24 L=1,NNE

24 WRITE(12,315) L,PI9(L)

C

300 FORMAT('step',I1)

301 FORMAT(2I5)

302 FORMAT(I5,3F10.4)

303 FORMAT(2I5,A6,20I5)

304 FORMAT(4X,'3',4X,'1')

305 FORMAT(4X,'3',4X,'1',4X,'1',4X,'1')

306 FORMAT(1X,'disp\_x, m')

307 FORMAT(1X,'disp\_y, m')

308 FORMAT(1X,'disp\_z, m')

309 FORMAT(I5,3E14.4)

310 FORMAT(I5)

311 FORMAT('data\_geom')

313 FORMAT(4X,'1',4X,'1')

314 FORMAT(1X,'no')

315 FORMAT(I5,E12.3)

RETURN

END