```
FORTRAN VIID: LICENSED RESTRICTED RIGHTS AS STATED IN LICENSE  **********, SEE DOCUMENTATION PACKAGE, 04-101M99.
  1  000000I          PROGRAM  CNS3D                                                                    1
  2                C      BY: Y. S. CHEN        ON: 8/13/1985                                          2
  3                C                                                                                   3
  4                C*****[ CURVILINEAR N-S CODE FOR 3-D INCOMPRESSIBLE FLOWS ]**********              4
  5                C                                                                                   5
  6  000006I           COMMON                                                                         6
  7                   1/VAR/U(21,18,10),V(21,18,10),P(21,18,10),DK(21,18,10),                        7
  8                   2  DE(21,18,10),ERRU,ERRV,ERRM,ERRK,ERRE,ERRW,                                 8
  9                   3  PP(21,18,10),W(21,18,10),TM(21,18,10)                                       9
 10                   1/PROP/ VISE(21,18,10),DEN(21,18,10),VISC,DENIN,FLOWIN                         10
 11                   1/PCOR/ DU(21,18,10),DV(21,18,10),DW(21,18,10)                                 11
 12                   1/TUR/ SIGK,SIGE,CMU,C1,C2,CMU1,CMU2,E,CK,HINUM,SMNUM,ANV1(800),               12
 13                   2 YN(800),YN1(800),SINX(800),SINY(800),SINZ(800),ANW1(800),                    13
 14                   3 YPLN(800),TAUN(800),IBC(800),JBC(800),KBC(800),IITY(800),                    14
 15                   4 TALW(800),GEN(21,18,10),MC(21,18,10),IJLO(21,18,10),IITO                     15
 16                   1/COEF/ AP(21,18,10),SU(21,18,10),SP(21,18,10),SUK(21,18,10),                  16
 17                   2   SPK(21,18,10),AE(21,18,10),AW(21,18,10),AN(21,18,10),                      17
 18                   3   AS(21,18,10),AT(21,18,10),AB(21,18,10),APO(21,18,10)                       18
 19  000006I           COMMON                                                                         19
 20                   1/TRAN/ X(21,18,10),Y(21,18,10),Z(21,18,10),TJO(21,18,10),                     20
 21                   2   CX(21,18,10),CY(21,18,10),CZ(21,18,10),                                    21
 22                   3   EX(21,18,10),EY(21,18,10),EZ(21,18,10),                                    22
 23                   3   SX(21,18,10),SY(21,18,10),SZ(21,18,10)                                     23
 24                   1/LIMT/ L,M,LT,MT,L1,L2,M1,M2,LO,MO,ISWU,ISWV,ISWP,ISWK,ISWE,                   24
 25                   2   ALU,ALV,ALP,ALK,ALE,ALVIS,ALW,N,N1,N2,NO,ISWW,IG,NT,ALC,DTT                25
 26  000006I           COMMON                                                                         26
 27                   1/TTRAN/TXXE(21,18,10),TXXW(21,18,10),TYYN(21,18,10),                          27
 28                   2   TYYS(21,18,10),TZZT(21,18,10),TZZB(21,18,10),                              28
 29                   3   TYXE(21,18,10),TYXW(21,18,10),TYZT(21,18,10),                              29
 30                   4   TYZS(21,18,10),TXYN(21,18,10),TXYS(21,18,10),                              30
 31                   5   TXZT(21,18,10),TXZB(21,18,10),TZXE(21,18,10),                              31
 32                   6   TZXW(21,18,10),TZYN(21,18,10),TZYS(21,18,10)                               32
 33                   1/UNSTDY/UO(21,18,10),VO(21,18,10),WO(21,18,10),DKO(21,18,10),                 33
 34                   2   DEO(21,18,10),DENO(21,18,10),TMO(21,18,10)                                 34
 35  000006I           LOGICAL INSOU,INSOV,INSOP,INSOK,INSOE,INPRO,INSOW,INSOT                        35
 36                C*****[ INPUT DATA GUIDE ]*************************************************      36
 37                C                                                                                  37
 38                C  NLIMT : MAXIMUM NO. OF ITERATIONS LIMIT                                         38
 39                C                                                                                  39
 40                C  IG    = 1 : LAMINAR                                                             40
 41                C           2 : TURBULENT (K-E MODEL)                                              41
 42                C                                                                                  42
 43                C  ISWP  : NO. OF SWEEPS FOR SOLVING THE P' EQUATION (PP).                         43
 44                C                                                                                  44
 45                C  ITT   : TOTAL NO. OF TIME STEPS.                                                45
 46                C                                                                                  46
 47                C  ALU,ALV,ALW,ALP,ALK,ALE,ALVIS,ALC : UNDER-RELAXATION FACTORS                     47
 48                C                                                                                  48
 49                C  RENL  : REFERENCE REYNOLDS NUMBER.                                              49
 50                C                                                                                  50
 51                C  DTT   : TIME STEP FOR UNSTEADY PROBLEMS.                                        51
 52                C                                                                                  52
 53                C*********************************************************************         53
 54                C-----INPUT DATA (PROBLEM CONTROL SETTING)                                         54
 55  000006I           READ(5,100) NLIMT,IG,ISWP,ITT                                                  55        1
 56  000030I           READ(5,200) ALU,ALV,ALW,ALP,ALK,ALE,ALVIS,ALC                                  56        2
 57  00006CI           READ(5,200) RENL,DTT                                                           57        3
```

```
                C-----CONSTANTS
000090I               EREXT=1.E-3                                               4
00009CI               ISWL=7                                                    5
0000A4I               ISWV=7                                                    6
0000ACI               ISWW=7                                                    7
0000B4I               ISWK=5                                                    8
0000BCI               ISWE=5                                                    9
0000C4I               DENIN=1.0                                                10
0000D0I               VISC=1./RENL                                             11
0000E2I               SIGL=1.0                                                 12
0000EEI               SIGK=1.0                                                 13
0000FAI               SIGE=1.3                                                 14
000106I               CMU=0.09                                                 15
000112I               C1=1.43                                                  16
00011EI               C2=1.92                                                  17
00012AI               E=9.01069                                                18
000136I               CK=0.4                                                   19
000142I               PI=3.141592654                                           20
00014EI               HINUM=1.E30                                              21
00015AI               SMNUM=1.E-30                                             22
000166I               CMU1=CMU**0.25                                           23
00017EI               CMU2=CMU**0.75                                           24
000196I               INSCU=.TRUE.                                             25
00019EI               INSCV=.TRUE.                                             26
0001A6I               INSCP=.TRUE.                                             27
0001AEI               INSCK=.TRUE.                                             28
0001B6I               INSCE=.TRUE.                                             29
0001BEI               INPRO=.TRUE.                                             30
0001C6I               INSCW=.TRUE.                                             31
0001CEI               INSCT=.FALSE.                                            32
0001D6I               IF(IG .EQ. 2) GO TO 10                                   33
0001ECI               INSCK=.FALSE.                                            35
0001F4I               INSCE=.FALSE.                                            36
0001FCI               INPRO=.FALSE.                                            37
000204I          10   CONTINUE                                                 38
                C*****[READ IN INITIAL FLOW FIELDS FROM RESTART FILE (LU = 8)]********
000204I               READ(8,100) L,M,N,L1,L2,M1,M2,N1,N2                      39
000244I               LO=L+1                                                   40
000252I               MO=M+1                                                   41
000260I               NO=N+1                                                   42
00026EI               LT=L-1                                                   43
00027CI               MT=M-1                                                   44
00028AI               NT=N-1                                                   45
                C-----INITIALIZE VARIABLES
000298I               CALL INIT                                                46
                C-----RESTART FILE
0002A0I               DO 50 K=1,N                                              47
0002B4I               DO 50 I=1,L                                              48
0002C8I               READ(8,400)                                              49
0002E4I               DO 50 J=1,M                                              50
0002F8I               READ(8,500) X(I,J,K),Y(I,J,K),Z(I,J,K),U(I,J,K),V(I,J,K),   51
                     1 W(I,J,K),P(I,J,K),TM(I,J,K),DK(I,J,K),DE(I,J,K),
                     2 VISETM,DENTM
000538I               UO(I,J,K)=U(I,J,K)                                       52
000604I               VO(I,J,K)=V(I,J,K)                                       53
000650I               WO(I,J,K)=W(I,J,K)                                       54
00069CI               TMO(I,J,K)=TM(I,J,K)                                     55
```

```
      0006E8I          DKO(I,J,K)=DK(I,J,K)                                                  115      56
      000734I          DEO(I,J,K)=DE(I,J,K)                                                  116      57
      000780I          DENO(I,J,K)=DEN(I,J,K)                                                117      58
      0007CCI       50 CONTINUE                                                              118      59
                    C*************************************************************************  119
                    C-----GET BOUNDARY CONTROL PARAMETERS                                     120
      000814I          CALL DIRCOS                                                           121      60
                    C-----SET BOUNDARY TURBULENCE QUANTITIES TO ZERO                          122
      00081CI          DO 121 I=1,L                                                          123      61
      000830I          DO 121 J=1,M                                                          124      62
      000844I          DO 121 K=1,N                                                          125      63
      000858I          IF(MC(I,J,K) .NE. 0) GO TO 122                                        126      64
      00088EI          GO TO 121                                                             127      66
      0008A4I       122 DK(I,J,K)=0.0                                                        128      67
      0008C0I          DE(I,J,K)=0.0                                                         129      68
      0008ECI          U(I,J,K)=0.0                                                          130      69
      000918I          V(I,J,K)=0.0                                                          131      70
      000944I          W(I,J,K)=0.0                                                          132      71
      000970I       121 CONTINUE                                                             133      72
                    C-----CALCULATE GRID TRANSFORMATION COEFFICIENTS                          134
      000988I          CALL TRANF                                                            135      73
                    C-----TURBULENT VISCOSITY                                                 136
      0009C0I          IF(INPRC) CALL NEWVIS                                                 137      74
                    C-----CALCULATE INLET MASS FLOW RATE                                      138
      0009D4I          FLOWIN=0.0                                                            139      76
      0009E0I          I=1                                                                   140      77
      0009E8I          DO 45 J=2,M                                                           141      78
      0009FCI          DO 45 K=2,N                                                           142      79
      000A10I          UC=(U(I,J,K)+U(I,J-1,K)+U(I,J,K-1)+U(I,J-1,K-1))*0.25                 143      80
      000AC0I          DENC=(DEN(I,J,K)+DEN(I,J-1,K)+DEN(I,J,K-1)+DEN(I,J-1,K-1))*0.25       144      81
      000B70I          P1=(X(I,J,K)+X(I,J,K-1)-X(I,J-1,K)-X(I,J-1,K-1))*0.5                  145      82
      000C20I          P2=(Y(I,J,K)+Y(I,J,K-1)-Y(I,J-1,K)-Y(I,J-1,K-1))*0.5                  146      83
      000CD0I          P3=(Z(I,J,K)+Z(I,J,K-1)-Z(I,J-1,K)-Z(I,J-1,K-1))*0.5                  147      84
      000D80I          Q1=(X(I,J,K)+X(I,J-1,K)-X(I,J,K-1)-X(I,J-1,K-1))*0.5                  148      85
      000E30I          Q2=(Y(I,J,K)+Y(I,J-1,K)-Y(I,J,K-1)-Y(I,J-1,K-1))*0.5                  149      86
      000EE0I          Q3=(Z(I,J,K)+Z(I,J-1,K)-Z(I,J,K-1)-Z(I,J-1,K-1))*0.5                  150      87
      000F90I          AREA=SQRT(P1*P1+P2*P2+P3*P3)*SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                   151      88
      00102CI          FLOWIN=FLOWIN+DENC*AREA*UC                                            152      89
      00104AI       45 CONTINUE                                                              153      90
      00107AI          ITO=1                                                                 154      91
                    C-----TRANSIENT PROCESS                                                   155
      001032I        2 CONTINUE                                                             156      92
      001082I          CALL SYMOUT(3,1,2,L,2,M,2,N)                                          157      93
      0010DCI          ITER=1                                                                158      94
                    C-----SOLUTION PROCEDURES START                                           159
      0010E4I        1 CONTINUE                                                             160      95
      0010E4I          CALL SYMOUT(1,1,2,LT,2,MT,2,NT)                                       161      96
      001140I          IF(INSOU) CALL SOLVEQ(1,ISWU,ALU,SIGU,ERRU,U,UC)                      162      97
      001184I          IF(INSOV) CALL SOLVEQ(2,ISWV,ALV,SIGU,ERRV,V,VO)                      163      99
      0011C8I          IF(INSOW) CALL SOLVEQ(3,ISWW,ALW,SIGU,ERRW,W,WO)                      164     101
      00120CI          IF(INSOT) CALL SOLVEQ(4,ISWW,ALW,SIGU,ERRW,TM,TMO)                    165     103
      001250I          IF(INSOK) CALL SOLVEQ(5,ISWK,ALK,SIGK,ERRK,DK,DKO)                    166     105
      001294I          IF(INSOE) CALL SOLVEQ(6,ISWE,ALE,SIGE,ERRE,DE,DEO)                    167     107
      001208I          IF(INSOP) CALL SOLVEQ(0,ISWP,ALP,SIGU,ERRM,PP,PP)                     168     109
      00131CI          IF(INPRC) CALL NEWVIS                                                 169     111
                    C-----CONVERGENCE CHECK                                                   170
      001330I          WRITE(6,300) ITER,ERRU,ERRV,ERRW,ERRM,ERRK,ERRE,U(7,2,6)              171     113
```

```
172  00136CI          ERRMAX=ERRM+ERRU+ERRV+ERRW                                                    172      114
173  00138AI          IF(ITER .GE. 20 .AND. ERRMAX .GT. 1.E03) GO TO 99                             173      115
174  0013B2I          IF(ITER .GE. NLIMT .OR. ERRMAX .LE. EREXT) GO TO 99                           174      117
175  0013DCI          ITER=ITER+1                                                                   175      119
176  0013EAI          GO TO 1                                                                       176      120
177                C-----PRINT OUT SOLUTIONS                                                       177
178  0013EEI       99 CONTINUE                                                                      178      121
179  0013EEI          WRITE(7,100) L,M,N,L1,L2,M1,M2,N1,N2                                          179      122
180  00142CI          DO 901 K=1,N                                                                  180      123
181  001440I          DO 901 I=1,L                                                                  181      124
182  001454I          WRITE(7,400)                                                                  182      125
183  001470I          DO 902 J=1,M                                                                  183      126
184  001484I          XV=X(I,J,K)                                                                   184      127
185  0014B0I          YV=Y(I,J,K)                                                                   185      128
186  0014DCI          ZV=Z(I,J,K)                                                                   186      129
187  001508I          WRITE(7,500) XV,YV,ZV,U(I,J,K),V(I,J,K),W(I,J,K),P(I,J,K),                    187      130
188                1           TM(I,J,K),DK(I,J,K),DE(I,J,K),VISE(I,J,K),DEN(I,J,K)                188
189  0016E8I      902 CONTINUE                                                                     189      131
190  001700I      901 CONTINUE                                                                     190      132
191  001730I          TIMT=DTT*ITC                                                                  191      133
192  001744I          WRITE(7,300) ITC,TIMT                                                         192      134
193  001768I          IF(ITC .GE. ITT .OR. DTT .EQ. C.0) GO TO 999                                  193      135
194  001792I          ITC=ITC+1                                                                     194      137
195  0017A0I          GO TO 2                                                                       195      138
196  0017A4I      999 CONTINUE                                                                     196      139
197  0017A4I      100 FORMAT(9I5)                                                                  197
198  0017B0I      200 FORMAT(11F7.4)                                                               198
199  0017BEI      300 FORMAT(1X,I5,7E10.2)                                                         199
200  0017C0I      400 FORMAT(//)                                                                   200
201  0017DAI      500 FORMAT(3F8.4,3E12.4,2X,6E11.4)                                               201
202  0017F6I          STOP                                                                          202      140
203  0017FEI          END                                                                           203      141

NO  ERRORS:F7D  R05-01.0C  MAINPROG    CNS3C     02/21/86  09:45:56  TABLE SPACE:  11 KB
STATEMENT BUFFER:   20 LINES/1321 BYTES    STACK SPACE: 181 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
 1  000000I         SUBROUTINE DIRCCS                                                  204
 2  000004I         COMMON                                                             205
 3                 1/TUR/ SIGK,SIGE,CMU,C1,C2,CMU1,CMU2,E,CK,HINUM,SMNUM,ANV1(800),   206
 4                 2 YN(800),YN1(800),SINX(800),SINY(800),SINZ(800),ANW1(800),        207
 5                 3 YPLN(800),TAUN(800),IBC(800),JBC(800),KBC(800),IITY(800),        208
 6                 4 TAUW(800),GEN(21,18,10),MC(21,18,10),IJLO(21,18,10),IITO         209
 7                 1/TRAN/ X(21,18,10),Y(21,18,10),Z(21,18,10),TJO(21,18,10),         210
 8                 2   CX(21,18,10),CY(21,18,10),CZ(21,18,10),                        211
 9                 3   EX(21,18,10),EY(21,18,10),EZ(21,18,10),                        212
10                 3   SX(21,18,10),SY(21,18,10),SZ(21,18,10)                         213
11                 1/LIMT/ L,M,LT,MT,L1,L2,M1,M2,LC,MO,ISWU,ISWV,ISWP,ISWK,ISWE,       214
12                 2   ALU,ALV,ALP,ALK,ALE,ALVIS,ALW,N,N1,N2,NO,ISWW,IG,NT,ALC,DTT    215
13           C-----SET DOMAIN BLOCKAGE CONTROL PARAMETER                               216
14           C-----SCALAR BLOCKAGE :   MC(I,J,K)=1                                     217
15           C-----PRESSURE BLOCKAGE : MC(I,J,K)=2                                     218
16  000004I       DO 10 I=1,LO                                                         219      1
17  000018I       DO 10 J=1,MO                                                         220      2
18  00002CI       DO 10 K=1,NO                                                         221      3
19  000040I       MC(I,J,K)=0                                                          222      4
20  000068I       IF(J.EQ.1.OR.J.EQ.M.OR.K.EQ.N) MC(I,J,K)=1                           223      5
21  0000C4I       IF(I.GE.L1.AND.I.LE.L2.AND.J.GE.M1.AND.J.LE.M2.AND.                  224      7
22                1   K.GE.N1.AND.K.LE.N2) MC(I,J,K)=1                                225
23  000158I       IF(I.GT.L1.AND.I.LE.L2.AND.J.GT.M1.AND.J.LE.M2.AND.                  226      9
24                1   K.GT.N1.AND.K.LE.N2) MC(I,J,K)=2                                227
25           C-----ADD BLOCKAGES AS NEEDED HERE                                        228
26  0001ECI     10  CONTINUE                                                         229     11
27           C-----CALCULATE BOUNDARY GRID SIZES AND ORIENTATIONS                      230
28  000234I       III=1                                                              231     12
29  00023CI       DO 30 I=2,LT                                                       232     13
30  000250I       DO 30 J=2,MT                                                       233     14
31  000264I       DO 30 K=2,NT                                                       234     15
32  000278I       IF(MC(I,J,K) .NE. 0) GO TO 30                                      235     16
33  0002AEI       MCT=MC(I+1,J,K)+MC(I-1,J,K)+MC(I,J+1,K)+MC(I,J-1,K)+               236     18
34                1    MC(I,J,K+1)+MC(I,J,K-1)                                       237
35  0003ACI       IF(MCT .EQ. 0) GO TO 30                                            238     19
36  0003C2I       IF(MC(I,J+1,K) .EQ. 0) GO TO 2                                     239     21
37           C-----NORTH                                                             240
38  0003FCI       IBC(III)=I                                                         241     23
39  000410I       JBC(III)=J                                                         242     24
40  000424I       KBC(III)=K                                                         243     25
41  000438I       IITY(III)=1                                                        244     26
42  000448I       I1=I+1                                                             245     27
43  000456I       I2=I-1                                                             246     28
44  000464I       K1=K+1                                                             247     29
45  000472I       K2=K-1                                                             248     30
46  000480I       IF(I .EQ. L1) I2=I                                                 249     31
47  00049EI       IF(I .EQ. L2) I1=I                                                 250     33
48  0004BCI       IF(K .EQ. N1) K2=K                                                 251     35
49  0004DAI       IF(K .EQ. N2) K1=K                                                 252     37
50  0004F8I       J1=J-1                                                             253     39
51  000506I       J2=J-2                                                             254     40
52  000514I       P1=(Y(I1,J,K1)-Y(I1,J,K2))*(Z(I1,J,K2)-Z(I2,J,K))-                255     41
53                1   (Z(I1,J,K1)-Z(I1,J,K2))*(Y(I1,J,K2)-Y(I2,J,K))                 256
54  000650I       P2=(Z(I1,J,K1)-Z(I1,J,K2))*(X(I1,J,K2)-X(I2,J,K))-                 257     42
55                1   (X(I1,J,K1)-X(I1,J,K2))*(Z(I1,J,K2)-Z(I2,J,K))                 258
56  00078CI       P3=(X(I1,J,K1)-X(I1,J,K2))*(Y(I1,J,K2)-Y(I2,J,K))-                 259     43
57                1   (Y(I1,J,K1)-Y(I1,J,K2))*(X(I1,J,K2)-X(I2,J,K))                 260
```

```
 58  0008C8I          PQ=SQRT(P1*P1+P2*P2+P3*P3)                                    261       44
 59  000912I          P1=P1/PQ                                                      262       45
 60  000924I          P2=P2/PQ                                                      263       46
 61  000936I          P3=P3/PQ                                                      264       47
 62  000948I          R1=(1.-P1**2)                                                 265       48
 63  000964I          R2=(1.-P2**2)                                                 266       49
 64  000980I          R3=(1.-P3**2)                                                 267       50
 65  00099CI          SINX(III)=SQRT(R1)                                            268       51
 66  0009C2I          SINY(III)=SQRT(R2)                                            269       52
 67  0009E6I          SINZ(III)=SQRT(R3)                                            270       53
 68  000A0AI          Q1=X(I,J,K)-X(I,J1,K)                                         271       54
 69  000A5CI          Q2=Y(I,J,K)-Y(I,J1,K)                                         272       55
 70  000AAEI          Q3=Z(I,J,K)-Z(I,J1,K)                                         273       56
 71  000B00I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                     274       57
 72  000B7EI          CC=1.0                                                        275       58
 73  000B8AI          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                    276       59
 74  000BD6I          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                            277       60
 75  000C18I          YN(III)=BB*ABS(COTH)                                          278       61
 76  000C44I          Q1=X(I,J,K)-X(I,J2,K)                                         279       62
 77  000C96I          Q2=Y(I,J,K)-Y(I,J2,K)                                         280       63
 78  000CE8I          Q3=Z(I,J,K)-Z(I,J2,K)                                         281       64
 79  000D3AI          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                    282       65
 80  000D86I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                     283       66
 81  000E02I          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                            284       67
 82  000E44I          YN1(III)=(BB*ABS(COTH)+YN(III))*0.5                           285       68
 83  000E84I          IJLC(I,J,K)=III                                               286       69
 84  000E80I          III=III+1                                                     287       70
 85  000E8EI      2   CONTINUE                                                      288       71
 86  000E8EI          IF(MC(I,J-1,K) .EQ. 0) GO TO 3                                289       72
 87               C-----SOUTH                                                      290
 88  000EF8I          IBC(III)=I                                                    291       74
 89  000F0CI          JBC(III)=J                                                    292       75
 90  000F20I          KBC(III)=K                                                    293       76
 91  000F34I          IITY(III)=2                                                   294       77
 92  000F44I          I1=I+1                                                        295       78
 93  000F52I          I2=I-1                                                        296       79
 94  000F60I          K1=K+1                                                        297       80
 95  000F6EI          K2=K-1                                                        298       81
 96  000F7CI          J1=J+1                                                        299       82
 97  000F8AI          J2=J+2                                                        300       83
 98  000F98I          P1=(Y(I1,J,K1)-Y(I1,J,K2))*(Z(I1,J,K2)-Z(I2,J,K))-            301       84
 99                  1   (Z(I1,J,K1)-Z(I1,J,K2))*(Y(I1,J,K2)-Y(I2,J,K))            302
100  0010D4I          P2=(Z(I1,J,K1)-Z(I1,J,K2))*(X(I1,J,K2)-X(I2,J,K))-            303       85
101                 1   (X(I1,J,K1)-X(I1,J,K2))*(Z(I1,J,K2)-Z(I2,J,K))            304
102  001210I          P3=(X(I1,J,K1)-X(I1,J,K2))*(Y(I1,J,K2)-Y(I2,J,K))-            305       86
103                 1   (Y(I1,J,K1)-Y(I1,J,K2))*(X(I1,J,K2)-X(I2,J,K))            306
104  00134CI          PQ=SQRT(P1*P1+P2*P2+P3*P3)                                    307       87
105  001396I          P1=P1/PQ                                                      308       88
106  0013A8I          P2=P2/PQ                                                      309       89
107  0013BAI          P3=P3/PQ                                                      310       90
108  0013CCI          R1=(1.-P1**2)                                                 311       91
109  0013E8I          R2=(1.-P2**2)                                                 312       92
110  001404I          R3=(1.-P3**2)                                                 313       93
111  001420I          SINX(III)=SQRT(R1)                                            314       94
112  001446I          SINY(III)=SQRT(R2)                                            315       95
113  00146AI          SINZ(III)=SQRT(R3)                                            316       96
114  00148EI          Q1=X(I,J,K)-X(I,J1,K)                                         317       97
```

```
115  0014E0I          Q2=Y(I,J,K)-Y(I,J1,K)                                          318    98
116  001532I          Q3=Z(I,J,K)-Z(I,J1,K)                                          319    99
117  001584I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                      320   100
118  001602I          CC=1.0                                                         321   101
119  00160EI          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                     322   102
120  00165AI          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                             323   103
121  00169CI          YN(III)=BB*ABS(COTH)                                           324   104
122  0016C8I          Q1=X(I,J,K)-X(I,J2,K)                                          325   105
123  00171AI          Q2=Y(I,J,K)-Y(I,J2,K)                                          326   106
124  00176CI          Q3=Z(I,J,K)-Z(I,J2,K)                                          327   107
125  00179EI          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                     328   108
126  0017D0I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                      329   109
127  001866I          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                             330   110
128  0018C8I          YN1(III)=(BB*ABS(COTH)+YN(III))*0.5                            331   111
129  001903I          IJLC(I,J,K)=III                                                332   112
130  001934I          III=III+1                                                      333   113
131  001942I        3 CONTINUE                                                       334   114
132  001942I          IF(MC(I+1,J,K) .EQ. 0) GO TO 4                                 335   115
133               C-----EAST                                                        336
134  001970I          IBC(III)=I                                                     337   117
135  001990I          JBC(III)=J                                                     338   118
136  0019A4I          KBC(III)=K                                                     339   119
137  0019B8I          IITY(III)=3                                                    340   120
138  0019C8I          J1=J+1                                                         341   121
139  0019D6I          J2=J-1                                                         342   122
140  0019E4I          K1=K+1                                                         343   123
141  0019F2I          K2=K-1                                                         344   124
142  001A00I          IF(J .EQ. M1) J2=J                                             345   125
143  001A1EI          IF(J .EQ. M2) J1=J                                             346   127
144  001A3CI          IF(K .EQ. N1) K2=K                                             347   129
145  001A5AI          IF(K .EQ. N2) K1=K                                             348   131
146  001A78I          I1=I-1                                                         349   133
147  001A86I          I2=I-2                                                         350   134
148  001A94I          P1=(Y(I,J1,K1)-Y(I,J1,K2))*(Z(I,J1,K2)-Z(I,J2,K))-             351   135
149                  1   (Z(I,J1,K1)-Z(I,J1,K2))*(Y(I,J1,K2)-Y(I,J2,K))             352
150  001B00I          P2=(Z(I,J1,K1)-Z(I,J1,K2))*(X(I,J1,K2)-X(I,J2,K))-             353   136
151                  1   (X(I,J1,K1)-X(I,J1,K2))*(Z(I,J1,K2)-Z(I,J2,K))             354
152  001B0CI          P3=(X(I,J1,K1)-X(I,J1,K2))*(Y(I,J1,K2)-Y(I,J2,K))-             355   137
153                  1   (Y(I,J1,K1)-Y(I,J1,K2))*(X(I,J1,K2)-X(I,J2,K))             356
154  001E48I          PQ=SQRT(P1*P1+P2*P2+P3*P3)                                     357   138
155  001E92I          P1=P1/PQ                                                       358   139
156  001EA4I          P2=P2/PQ                                                       359   140
157  001EB6I          P3=P3/PQ                                                       360   141
158  001EC8I          R1=(1.-P1**2)                                                  361   142
159  001EE4I          R2=(1.-P2**2)                                                  362   143
160  001F00I          R3=(1.-P3**2)                                                  363   144
161  001F1CI          SINX(III)=SQRT(R1)                                             364   145
162  001F42I          SINY(III)=SQRT(R2)                                             365   146
163  001F66I          SINZ(III)=SQRT(R3)                                             366   147
164  001F8AI          Q1=X(I,J,K)-X(I1,J,K)                                          367   148
165  001FDCI          Q2=Y(I,J,K)-Y(I1,J,K)                                          368   149
166  00202EI          Q3=Z(I,J,K)-Z(I1,J,K)                                          369   150
167  002080I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                      370   151
168  0020FEI          CC=1.0                                                         371   152
169  00210AI          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                     372   153
170  002156I          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                             373   154
171  002198I          YN(III)=BB*ABS(COTH)                                           374   155
```

```
172  0021C4I          Q1=X(I,J,K)-X(I2,J,K)                                          375     156
173  002216I          Q2=Y(I,J,K)-Y(I2,J,K)                                          376     157
174  002268I          Q3=Z(I,J,K)-Z(I2,J,K)                                          377     158
175  0022BAI          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                     378     159
176  002306I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                      379     160
177  002382I          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                             380     161
178  0023C4I          YN1(III)=(BB*ABS(COTH)+YN(III))*0.5                            381     162
179  002404I          IJLC(I,J,K)=III                                                382     163
180  002430I          III=III+1                                                      383     164
181  00243EI      4   CONTINUE                                                       384     165
182  00243EI          IF(MC(I-1,J,K) .EQ. 0) GO TO 5                                 385     166
183              C-----WEST                                                         386
184  002478I          I5C(III)=I                                                     387     168
185  00248CI          J8C(III)=J                                                     388     169
186  0024A0I          K8C(III)=K                                                     389     170
187  0024B4I          IITY(III)=4                                                    390     171
188  0024C4I          J1=J+1                                                         391     172
189  0024D2I          J2=J-1                                                         392     173
190  0024E0I          K1=K+1                                                         393     174
191  0024EEI          K2=K-1                                                         394     175
192  0024FCI          IF(J .EQ. M1) J2=J                                             395     176
193  00251AI          IF(J .EQ. M2) J1=J                                             396     178
194  002538I          IF(K .EQ. N1) K2=K                                             397     180
195  002556I          IF(K .EQ. N2) K1=K                                             398     182
196  002574I          I1=I+1                                                         399     184
197  002582I          I2=I+2                                                         400     185
198  002590I          P1=(Y(I,J1,K1)-Y(I,J1,K2))*(Z(I,J1,K2)-Z(I,J2,K))-             401     186
199                  1   (Z(I,J1,K1)-Z(I,J1,K2))*(Y(I,J1,K2)-Y(I,J2,K))             402
200  0026CCI          P2=(Z(I,J1,K1)-Z(I,J1,K2))*(X(I,J1,K2)-X(I,J2,K))-             403     187
201                  1   (X(I,J1,K1)-X(I,J1,K2))*(Z(I,J1,K2)-Z(I,J2,K))             404
202  0028D8I          P3=(X(I,J1,K1)-X(I,J1,K2))*(Y(I,J1,K2)-Y(I,J2,K))-             405     188
203                  1   (Y(I,J1,K1)-Y(I,J1,K2))*(X(I,J1,K2)-X(I,J2,K))             406
204  002944I          PQ=SQRT(P1*P1+P2*P2+P3*P3)                                     407     189
205  00298EI          P1=P1/PQ                                                       408     190
206  0029A0I          P2=P2/PQ                                                       409     191
207  0029B2I          P3=P3/PQ                                                       410     192
208  0029C4I          R1=1.-P1**2                                                    411     193
209  0029E0I          R2=1.-P2**2                                                    412     194
210  0029FCI          R3=1.-P3**2                                                    413     195
211  002A18I          SINX(III)=SQRT(R1)                                             414     196
212  002A3EI          SINY(III)=SQRT(R2)                                             415     197
213  002A62I          SINZ(III)=SQRT(R3)                                             416     198
214  002A86I          Q1=X(I,J,K)-X(I1,J,K)                                          417     199
215  002AD8I          Q2=Y(I,J,K)-Y(I1,J,K)                                          418     200
216  002B2AI          Q3=Z(I,J,K)-Z(I1,J,K)                                          419     201
217  002B7CI          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                      420     202
218  002BFAI          CC=1.0                                                         421     203
219  002C06I          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                     422     204
220  002C52I          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                             423     205
221  002C94I          YN(III)=BB*ABS(COTH)                                           424     206
222  002CC0I          Q1=X(I,J,K)-X(I2,J,K)                                          425     207
223  002D12I          Q2=Y(I,J,K)-Y(I2,J,K)                                          426     208
224  002D64I          Q3=Z(I,J,K)-Z(I2,J,K)                                          427     209
225  002D86I          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                     428     210
226  002E02I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                      429     211
227  002E7EI          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                             430     212
228  002EC0I          YN1(III)=(BB*ABS(COTH)+YN(III))*0.5                            431     213
```

```
229  002F00I          IJLO(I,J,K)=III                                                  432  214
230  002F2CI          III=III+1                                                        433  215
231  002F3AI        5 CONTINUE                                                         434  216
232  002F3AI          IF(MC(I,J,K+1) .EQ. 0) GO TO 6                                   435  217
233                 C-----TOP                                                        436
234  002F72I          ISC(III)=I                                                       437  219
235  002F86I          JBC(III)=J                                                       438  220
236  002F9AI          KBC(III)=K                                                       439  221
237  002FAEI          IITY(III)=5                                                      440  222
238  002FBEI          I1=I+1                                                           441  223
239  002FCCI          I2=I-1                                                           442  224
240  002FDAI          J1=J+1                                                           443  225
241  002FE8I          J2=J-1                                                           444  226
242  002FF6I          IF(I .EQ. L1) I2=I                                               445  227
243  003014I          IF(I .EQ. L2) I1=I                                               446  229
244  003032I          IF(J .EQ. M1) J2=J                                               447  231
245  003050I          IF(J .EQ. M2) J1=J                                               448  233
246  00306EI          K1=K-1                                                           449  235
247  00307CI          K2=K-2                                                           450  236
248  00308AI          P1=(Y(I1,J1,K)-Y(I1,J2,K))*(Z(I1,J2,K)-Z(I2,J,K))-               451  237
249                  1   (Z(I1,J1,K)-Z(I1,J2,K))*(Y(I1,J2,K)-Y(I2,J,K))               452
250  0031C6I          P2=(Z(I1,J1,K)-Z(I1,J2,K))*(X(I1,J2,K)-X(I2,J,K))-               453  238
251                  1   (X(I1,J1,K)-X(I1,J2,K))*(Z(I1,J2,K)-Z(I2,J,K))               454
252  003302I          P3=(X(I1,J1,K)-X(I1,J2,K))*(Y(I1,J2,K)-Y(I2,J,K))-               455  239
253                  1   (Y(I1,J1,K)-Y(I1,J2,K))*(X(I1,J2,K)-X(I2,J,K))               456
254  00343EI          PQ=SQRT(P1*P1+P2*P2+P3*P3)                                       457  240
255  00348AI          P1=P1/PQ                                                         458  241
256  00349CI          P2=P2/PQ                                                         459  242
257  0034AEI          P3=P3/PQ                                                         460  243
258  0034C0I          R1=1.-P1**2                                                      461  244
259  0034DCI          R2=1.-P2**2                                                      462  245
260  0034F8I          R3=1.-P3**2                                                      463  246
261  003514I          SINX(III)=SQRT(R1)                                               464  247
262  00353AI          SINY(III)=SQRT(R2)                                               465  248
263  00355EI          SINZ(III)=SQRT(R3)                                               466  249
264  003582I          Q1=X(I,J,K)-X(I,J,K1)                                            467  250
265  0035D4I          Q2=Y(I,J,K)-Y(I,J,K1)                                            468  251
266  003626I          Q3=Z(I,J,K)-Z(I,J,K1)                                            469  252
267  003678I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                        470  253
268  0036F6I          CC=1.0                                                           471  254
269  003702I          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                       472  255
270  00374EI          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                               473  256
271  003790I          YN(III)=BB*ABS(COTH)                                             474  257
272  0037BCI          Q1=X(I,J,K)-X(I,J,K2)                                            475  258
273  0037E0I          Q2=Y(I,J,K)-Y(I,J,K2)                                            476  259
274  003860I          Q3=Z(I,J,K)-Z(I,J,K2)                                            477  260
275  0038B2I          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                       478  261
276  0038FEI          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                        479  262
277  00397AI          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                               480  263
278  0039BCI          YN1(III)=(BB*ABS(COTH)+YN(III))*0.5                              481  264
279  0039FCI          IJLO(I,J,K)=III                                                  482  265
280  003A28I          III=III+1                                                        483  266
281  003A36I        6 CONTINUE                                                         484  267
282  003A36I          IF(MC(I,J,K-1) .EQ. 0) GO TO 30                                  485  268
283                 C-----BOTTOM                                                     486
284  003A6EI          IBC(III)=I                                                       487  270
285  003A82I          JBC(III)=J                                                       488  271
```

```
286  003A96I          KBC(III)=K                                                    489     272
287  003AAAI          IITY(III)=6                                                   490     273
288  003A8AI          I1=I+1                                                        491     274
289  003AC8I          I2=I-1                                                        492     275
290  003AD6I          J1=J+1                                                        493     276
291  003AE4I          J2=J-1                                                        494     277
292  003AF2I          IF(I .EQ. L1) I2=I                                            495     278
293  003B10I          IF(I .EQ. L2) I1=I                                            496     280
294  003B2EI          IF(J .EQ. M1) J2=J                                            497     282
295  003B4CI          IF(J .EQ. M2) J1=J                                            498     284
296  003B6AI          K1=K+1                                                        499     286
297  003B78I          K2=K+2                                                        500     287
298  003B86I          P1=(Y(I1,J1,K)-Y(I1,J2,K))*(Z(I1,J2,K)-Z(I2,J,K))-            501     288
299                  1    (Z(I1,J1,K)-Z(I1,J2,K))*(Y(I1,J2,K)-Y(I2,J,K))           502
300  003CC2I          P2=(Z(I1,J1,K)-Z(I1,J2,K))*(X(I1,J2,K)-X(I2,J,K))-            503     289
301                  1    (X(I1,J1,K)-X(I1,J2,K))*(Z(I1,J2,K)-Z(I2,J,K))           504
302  003DFEI          P3=(X(I1,J1,K)-X(I1,J2,K))*(Y(I1,J2,K)-Y(I2,J,K))-            505     290
303                  1    (Y(I1,J1,K)-Y(I1,J2,K))*(X(I1,J2,K)-X(I2,J,K))           506
304  003F3AI          PQ=SQRT(P1*P1+P2*P2+P3*P3)                                    507     291
305  003F86I          P1=P1/PQ                                                      508     292
306  003F98I          P2=P2/PQ                                                      509     293
307  003FAAI          P3=P3/PQ                                                      510     294
308  003FBCI          R1=1.-P1**2                                                   511     295
309  003FD8I          R2=1.-P2**2                                                   512     296
310  003FF4I          R3=1.-P3**2                                                   513     297
311  004010I          SINX(III)=SQRT(R1)                                            514     298
312  004036I          SINY(III)=SQRT(R2)                                            515     299
313  00405AI          SINZ(III)=SQRT(R3)                                            516     300
314  00407EI          Q1=X(I,J,K)-X(I,J,K1)                                         517     301
315  004000I          Q2=Y(I,J,K)-Y(I,J,K1)                                         518     302
316  004122I          Q3=Z(I,J,K)-Z(I,J,K1)                                         519     303
317  004174I          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                     520     304
318  0041F2I          CC=1.0                                                        521     305
319  0041FEI          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                    522     306
320  00424AI          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                            523     307
321  00428CI          YN(III)=BB*ABS(COTH)                                          524     308
322  004288I          Q1=X(I,J,K)-X(I,J,K2)                                         525     309
323  00430AI          Q2=Y(I,J,K)-Y(I,J,K2)                                         526     310
324  00435CI          Q3=Z(I,J,K)-Z(I,J,K2)                                         527     311
325  0043AEI          BB=SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                                    528     312
326  0043FAI          AA=SQRT((Q1-P1)**2+(Q2-P2)**2+(Q3-P3)**2)                     529     313
327  004476I          COTH=(BB*BB+CC*CC-AA*AA)/(2*BB*CC)                            530     314
328  004498I          YN1(III)=(BB*ABS(COTH)+YN(III))*0.5                           531     315
329  0044F8I          IJLC(I,J,K)=III                                               532     316
330  004524I          III=III+1                                                     533     317
331  004532I     30   CONTINUE                                                      534     318
332  004580I          IITC=III-1                                                    535     319
333  00458EI          WRITE(6,100) LO,MO,NO,IITO                                    536     320
334  0045B8I    100   FORMAT(4I5)                                                   537
335  0045C4I          RETURN                                                        538     321
336  0045CCI          END                                                           539     322

NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  CIRCCS    02/21/86  09:47:58  TABLE SPACE:   6 KB
STATEMENT BUFFER:   20 LINES/1321 BYTES    STACK SPACE: 203 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
      SUBROUTINE TRANF                                                                  540
      COMMON                                                                            541
     1/VAR/U(21,18,10),V(21,18,10),P(21,18,10),DK(21,18,10),                            542
     2  DE(21,18,10),ERRU,ERRV,ERRM,ERRK,ERRE,ERRW,                                     543
     3  PP(21,18,10),W(21,18,10),TM(21,18,10)                                           544
     1/PROP/ VISE(21,18,10),DEN(21,18,10),VISC,DENIN,FLOWIN                          545
     1/PCOR/ DU(21,18,10),DV(21,18,10),DW(21,18,10)                                  546
     1/TUR/ SIGK,SIGE,CMU,C1,C2,CMU1,CMU2,E,CK,HINUM,SMNUM,ANV1(800),                 547
     2 YN(800),YN1(800),SINX(800),SINY(300),SINZ(300),ANW1(800),                     548
     3 YPLN(800),TAUN(800),IBC(800),JBC(800),KBC(800),IITY(800),                     549
     4 TALW(800),GEN(21,18,10),MC(21,18,10),IJLO(21,18,10),IITO                      550
     1/COEF/ AP(21,18,10),SU(21,18,10),SP(21,18,10),SUK(21,18,10),                   551
     2   SPK(21,18,10),AE(21,18,10),AW(21,18,10),AN(21,18,10),                       552
     3   AS(21,18,10),AT(21,18,10),AB(21,18,10),APO(21,18,10)                        553
      COMMON                                                                          554
     1/TRAN/ X(21,18,10),Y(21,18,10),Z(21,18,10),TJO(21,18,10),                      555
     2   CX(21,18,10),CY(21,18,10),CZ(21,18,10),                                     556
     3   EX(21,18,10),EY(21,18,10),EZ(21,18,10),                                     557
     3   SX(21,18,10),SY(21,18,10),SZ(21,18,10)                                      558
     1/LIMT/ L,M,LT,MT,L1,L2,M1,M2,LO,MO,ISWU,ISWV,ISWP,ISWK,ISWE,                    559
     2   ALU,ALV,ALP,ALK,ALE,ALVIS,ALW,N,N1,N2,NO,ISWW,IG,NT,ALC,DTT                 560
      COMMON                                                                          561
     1/TTRAN/TXXE(21,18,10),TXXW(21,18,10),TYYN(21,18,10),                           562
     2   TYYS(21,18,10),TZZT(21,18,10),TZZB(21,18,10),                               563
     3   TYXE(21,18,10),TYXW(21,18,10),TYZT(21,18,10),                               564
     4   TYZB(21,18,10),TXYN(21,18,10),TXYS(21,18,10),                               565
     5   TXZT(21,18,10),TXZB(21,18,10),TZXE(21,18,10),                               566
     6   TZXW(21,18,10),TZYN(21,18,10),TZYS(21,18,10)                                567
C-----CALCULATE GRID TRANSFORMATION COEFFICIENTS                                     568
      DO 40 I=2,L                                                                     569
      DO 40 J=2,M                                                                     570
      DO 40 K=2,N                                                                     571
      P1=(X(I,J,K)+X(I,J-1,K)+X(I,J,K-1)+X(I,J-1,K-1)-X(I-1,J,K)-                     572
     1  X(I-1,J-1,K)-X(I-1,J,K-1)-X(I-1,J-1,K-1))*0.25                               573
      P2=(X(I,J,K)+X(I-1,J,K)+X(I,J,K-1)+X(I-1,J,K-1)-X(I,J-1,K)-                     574
     1  X(I-1,J-1,K)-X(I,J-1,K-1)-X(I-1,J-1,K-1))*0.25                               575
      P3=(X(I,J,K)+X(I-1,J,K)+X(I,J-1,K)+X(I-1,J-1,K)-X(I,J,K-1)-                     576
     1  X(I-1,J,K-1)-X(I,J-1,K-1)-X(I-1,J-1,K-1))*0.25                               577
      Q1=(Y(I,J,K)+Y(I,J-1,K)+Y(I,J,K-1)+Y(I,J-1,K-1)-Y(I-1,J,K)-                     578
     1  Y(I-1,J-1,K)-Y(I-1,J,K-1)-Y(I-1,J-1,K-1))*0.25                               579
      Q2=(Y(I,J,K)+Y(I-1,J,K)+Y(I,J,K-1)+Y(I-1,J,K-1)-Y(I,J-1,K)-                     580
     1  Y(I-1,J-1,K)-Y(I,J-1,K-1)-Y(I-1,J-1,K-1))*0.25                               581
      Q3=(Y(I,J,K)+Y(I-1,J,K)+Y(I,J-1,K)+Y(I-1,J-1,K)-Y(I,J,K-1)-                     582
     1  Y(I-1,J,K-1)-Y(I,J-1,K-1)-Y(I-1,J-1,K-1))*0.25                               583
      R1=(Z(I,J,K)+Z(I,J-1,K)+Z(I,J,K-1)+Z(I,J-1,K-1)-Z(I-1,J,K)-                     584
     1  Z(I-1,J-1,K)-Z(I-1,J,K-1)-Z(I-1,J-1,K-1))*0.25                               585
      R2=(Z(I,J,K)+Z(I-1,J,K)+Z(I,J,K-1)+Z(I-1,J,K-1)-Z(I,J-1,K)-                     586
     1  Z(I-1,J-1,K)-Z(I,J-1,K-1)-Z(I-1,J-1,K-1))*0.25                               587
      R3=(Z(I,J,K)+Z(I-1,J,K)+Z(I,J-1,K)+Z(I-1,J-1,K)-Z(I,J,K-1)-                     588
     1  Z(I-1,J,K-1)-Z(I,J-1,K-1)-Z(I-1,J-1,K-1))*0.25                               589
      PTR=1.0/(P1*(Q2*R3-Q3*R2)-P2*(Q1*R3-Q3*R1)+P3*(Q1*R2-Q2*R1))                     590
      SU(I,J,K)=ABS(1.0/PTR)                                                          591
      AE(I,J,K)=PTR*(Q2*R3-Q3*R2)                                                     592
      AW(I,J,K)=-PTR*(P2*R3-P3*R2)                                                    593
      AN(I,J,K)=PTR*(P2*Q3-P3*Q2)                                                     594
      AS(I,J,K)=-PTR*(Q1*R3-Q3*R1)                                                    595
      AT(I,J,K)=PTR*(P1*R3-P3*R1)                                                     596
```

```
000EF4I        AB(I,J,K)=-PTR*(P1*Q3-P3*Q1)                                            20
000F42I        DU(I,J,K)=PTR*(Q1*R2-Q2*R1)                                             21
000F88I        DV(I,J,K)=-PTR*(P1*R2-P2*R1)                                            22
000FD6I        DW(I,J,K)=PTR*(P1*Q2-P2*Q1)                                             23
00101CI     40 CONTINUE                                                                24
001064I        CALL WALVAL(1.0,2,L,2,M,2,N,AE)                                         25
0010BCI        CALL WALVAL(1.0,2,L,2,M,2,N,AW)                                         26
001114I        CALL WALVAL(1.0,2,L,2,M,2,N,AN)                                         27
00116CI        CALL WALVAL(1.0,2,L,2,M,2,N,AS)                                         28
0011C4I        CALL WALVAL(1.0,2,L,2,M,2,N,AT)                                         29
00121CI        CALL WALVAL(1.0,2,L,2,M,2,N,AB)                                         30
001274I        CALL WALVAL(1.0,2,L,2,M,2,N,DU)                                         31
0012CCI        CALL WALVAL(1.0,2,L,2,M,2,N,DV)                                         32
001324I        CALL WALVAL(1.0,2,L,2,M,2,N,DW)                                         33
00137CI        CALL WALVAL(1.0,2,L,2,M,2,N,SU)                                         34
0013D4I        DO 80 I=1,L                                                             35
0013E8I        DO 80 J=1,M                                                             36
0013FCI        DO 80 K=1,N                                                             37
001410I        CX(I,J,K)=(AE(I,J,K)+AE(I,J+1,K)+AE(I,J,K+1)+AE(I,J+1,K+1)+             38
              1 AE(I+1,J,K)+AE(I+1,J+1,K)+AE(I+1,J,K+1)+AE(I+1,J+1,K+1))*0.125
001594I        CY(I,J,K)=(AW(I,J,K)+AW(I,J+1,K)+AW(I,J,K+1)+AW(I,J+1,K+1)+             39
              1 AW(I+1,J,K)+AW(I+1,J+1,K)+AW(I+1,J,K+1)+AW(I+1,J+1,K+1))*0.125
001718I        CZ(I,J,K)=(AN(I,J,K)+AN(I,J+1,K)+AN(I,J,K+1)+AN(I,J+1,K+1)+             40
              1 AN(I+1,J,K)+AN(I+1,J+1,K)+AN(I+1,J,K+1)+AN(I+1,J+1,K+1))*0.125
00189CI        EX(I,J,K)=(AS(I,J,K)+AS(I,J+1,K)+AS(I,J,K+1)+AS(I,J+1,K+1)+             41
              1 AS(I+1,J,K)+AS(I+1,J+1,K)+AS(I+1,J,K+1)+AS(I+1,J+1,K+1))*0.125
001A20I        EY(I,J,K)=(AT(I,J,K)+AT(I,J+1,K)+AT(I,J,K+1)+AT(I,J+1,K+1)+             42
              1 AT(I+1,J,K)+AT(I+1,J+1,K)+AT(I+1,J,K+1)+AT(I+1,J+1,K+1))*0.125
001BA4I        EZ(I,J,K)=(AB(I,J,K)+AB(I,J+1,K)+AB(I,J,K+1)+AB(I,J+1,K+1)+             43
              1 AB(I+1,J,K)+AB(I+1,J+1,K)+AB(I+1,J,K+1)+AB(I+1,J+1,K+1))*0.125
001D28I        SX(I,J,K)=(DU(I,J,K)+DU(I,J+1,K)+DU(I,J,K+1)+DU(I,J+1,K+1)+             44
              1 DU(I+1,J,K)+DU(I+1,J+1,K)+DU(I+1,J,K+1)+DU(I+1,J+1,K+1))*0.125
001EACI        SY(I,J,K)=(DV(I,J,K)+DV(I,J+1,K)+DV(I,J,K+1)+DV(I,J+1,K+1)+             45
              1 DV(I+1,J,K)+DV(I+1,J+1,K)+DV(I+1,J,K+1)+DV(I+1,J+1,K+1))*0.125
002030I        SZ(I,J,K)=(DW(I,J,K)+DW(I,J+1,K)+DW(I,J,K+1)+DW(I,J+1,K+1)+             46
              1 DW(I+1,J,K)+DW(I+1,J+1,K)+DW(I+1,J,K+1)+DW(I+1,J+1,K+1))*0.125
002194I        TJO(I,J,K)=(SU(I,J,K)+SU(I,J+1,K)+SU(I,J,K+1)+SU(I,J+1,K+1)+            47
              1 SU(I+1,J,K)+SU(I+1,J+1,K)+SU(I+1,J,K+1)+SU(I+1,J+1,K+1))*0.125
002338I     80 CONTINUE                                                                48
00238CI        DO 200 I=1,LO                                                           49
002394I        DO 200 J=1,MO                                                           50
0023A8I        DO 200 K=1,NO                                                           51
0023BCI        DU(I,J,K)=0.0                                                           52
0023E8I    200 CONTINUE                                                                53
002430I        DO 160 I=2,LT                                                           54
002444I        DO 160 J=2,MT                                                           55
002458I        DO 160 K=2,NT                                                           56
00246CI        CXE=(CX(I+1,J,K)+CX(I,J,K))*0.5                                         57
0024C8I        CXW=(CX(I-1,J,K)+CX(I,J,K))*0.5                                         58
002524I        CXN=(CX(I,J+1,K)+CX(I,J,K))*0.5                                         59
002580I        CXS=(CX(I,J,K)+CX(I,J-1,K))*0.5                                         60
0025DCI        CXT=(CX(I,J,K+1)+CX(I,J,K))*0.5                                         61
002636I        CXB=(CX(I,J,K)+CX(I,J,K-1))*0.5                                         62
002690I        CYE=(CY(I+1,J,K)+CY(I,J,K))*0.5                                         63
0026ECI        CYW=(CY(I,J,K)+CY(I-1,J,K))*0.5                                         64
002748I        CYN=(CY(I,J+1,K)+CY(I,J,K))*0.5                                         65
0027A4I        CYS=(CY(I,J,K)+CY(I,J-1,K))*0.5                                         66
```

```
115  002800I          CYT=(CY(I,J,K+1)+CY(I,J,K))*0.5                                                                  654  67
116  00285AI          CYB=(CY(I,J,K)+CY(I,J,K-1))*0.5                                                                  655  68
117  0028B4I          CZE=(CZ(I+1,J,K)+CZ(I,J,K))*0.5                                                                  656  69
118  002910I          CZW=(CZ(I,J,K)+CZ(I-1,J,K))*0.5                                                                  657  70
119  00296CI          CZN=(CZ(I,J+1,K)+CZ(I,J,K))*0.5                                                                  658  71
120  0029C8I          CZS=(CZ(I,J,K)+CZ(I,J-1,K))*0.5                                                                  659  72
121  002A24I          CZT=(CZ(I,J,K+1)+CZ(I,J,K))*0.5                                                                  660  73
122  002A7EI          CZB=(CZ(I,J,K)+CZ(I,J,K-1))*0.5                                                                  661  74
123  002AD8I          EXE=(EX(I+1,J,K)+EX(I,J,K))*0.5                                                                  662  75
124  002B34I          EXW=(EX(I,J,K)+EX(I-1,J,K))*0.5                                                                  663  76
125  002B90I          EXN=(EX(I,J+1,K)+EX(I,J,K))*0.5                                                                  664  77
126  002BECI          EXS=(EX(I,J,K)+EX(I,J-1,K))*0.5                                                                  665  78
127  002C48I          EXT=(EX(I,J,K+1)+EX(I,J,K))*0.5                                                                  666  79
128  002CA2I          EXB=(EX(I,J,K)+EX(I,J,K-1))*0.5                                                                  667  80
129  002CFCI          EYE=(EY(I+1,J,K)+EY(I,J,K))*0.5                                                                  668  81
130  002D58I          EYW=(EY(I,J,K)+EY(I-1,J,K))*0.5                                                                  669  82
131  002DB4I          EYN=(EY(I,J+1,K)+EY(I,J,K))*0.5                                                                  670  83
132  002E10I          EYS=(EY(I,J,K)+EY(I,J-1,K))*0.5                                                                  671  84
133  002E6CI          EYT=(EY(I,J,K+1)+EY(I,J,K))*0.5                                                                  672  85
134  002EC6I          EYB=(EY(I,J,K)+EY(I,J,K-1))*0.5                                                                  673  86
135  002F20I          EZE=(EZ(I+1,J,K)+EZ(I,J,K))*0.5                                                                  674  87
136  002F7CI          EZW=(EZ(I,J,K)+EZ(I-1,J,K))*0.5                                                                  675  88
137  002FD8I          EZN=(EZ(I,J+1,K)+EZ(I,J,K))*0.5                                                                  676  89
138  003034I          EZS=(EZ(I,J,K)+EZ(I,J-1,K))*0.5                                                                  677  90
139  003090I          EZT=(EZ(I,J,K+1)+EZ(I,J,K))*0.5                                                                  678  91
140  0030EAI          EZB=(EZ(I,J,K)+EZ(I,J,K-1))*0.5                                                                  679  92
141  003144I          SXE=(SX(I+1,J,K)+SX(I,J,K))*0.5                                                                  680  93
142  0031A0I          SXW=(SX(I,J,K)+SX(I-1,J,K))*0.5                                                                  681  94
143  0031FCI          SXN=(SX(I,J+1,K)+SX(I,J,K))*0.5                                                                  682  95
144  003258I          SXS=(SX(I,J,K)+SX(I,J-1,K))*0.5                                                                  683  96
145  0032B4I          SXT=(SX(I,J,K+1)+SX(I,J,K))*0.5                                                                  684  97
146  00330EI          SXB=(SX(I,J,K)+SX(I,J,K-1))*0.5                                                                  685  98
147  003368I          SYE=(SY(I+1,J,K)+SY(I,J,K))*0.5                                                                  686  99
148  0033C4I          SYW=(SY(I,J,K)+SY(I-1,J,K))*0.5                                                                  687  100
149  003420I          SYN=(SY(I,J+1,K)+SY(I,J,K))*0.5                                                                  688  101
150  00347CI          SYS=(SY(I,J,K)+SY(I,J-1,K))*0.5                                                                  689  102
151  0034D8I          SYT=(SY(I,J,K+1)+SY(I,J,K))*0.5                                                                  690  103
152  003532I          SYB=(SY(I,J,K)+SY(I,J,K-1))*0.5                                                                  691  104
153  00358CI          SZE=(SZ(I+1,J,K)+SZ(I,J,K))*0.5                                                                  692  105
154  0035E8I          SZW=(SZ(I,J,K)+SZ(I-1,J,K))*0.5                                                                  693  106
155  003644I          SZN=(SZ(I,J+1,K)+SZ(I,J,K))*0.5                                                                  694  107
156  0036A0I          SZS=(SZ(I,J,K)+SZ(I,J-1,K))*0.5                                                                  695  108
157  0036FCI          SZT=(SZ(I,J,K+1)+SZ(I,J,K))*0.5                                                                  696  109
158  003756I          SZB=(SZ(I,J,K)+SZ(I,J,K-1))*0.5                                                                  697  110
159  0037B0I          TXXE(I,J,K)=CXE*CX(I,J,K)+CYE*CY(I,J,K)+CZE*CZ(I,J,K)                                            698  111
160  00385EI          TXXW(I,J,K)=CXW*CX(I,J,K)+CYW*CY(I,J,K)+CZW*CZ(I,J,K)                                            699  112
161  00390CI          TYYN(I,J,K)=EXN*EX(I,J,K)+EYN*EY(I,J,K)+EZN*EZ(I,J,K)                                            700  113
162  0039BAI          TYYS(I,J,K)=EXS*EX(I,J,K)+EYS*EY(I,J,K)+EZS*EZ(I,J,K)                                            701  114
163  003A68I          TZZT(I,J,K)=SXT*SX(I,J,K)+SYT*SY(I,J,K)+SZT*SZ(I,J,K)                                            702  115
164  003B16I          TZZB(I,J,K)=SXB*SX(I,J,K)+SYB*SY(I,J,K)+SZB*SZ(I,J,K)                                            703  116
165  003BC4I          TYXE(I,J,K)=(EXE*CX(I,J,K)+EYE*CY(I,J,K)+EZE*CZ(I,J,K))*0.25                                     704  117
166  003C78I          TYXW(I,J,K)=(EXW*CX(I,J,K)+EYW*CY(I,J,K)+EZW*CZ(I,J,K))*0.25                                     705  118
167  003D2CI          TYZT(I,J,K)=(EXT*SX(I,J,K)+EYT*SY(I,J,K)+EZT*SZ(I,J,K))*0.25                                     706  119
168  003DE0I          TYZB(I,J,K)=(EXB*SX(I,J,K)+EYB*SY(I,J,K)+EZB*SZ(I,J,K))*0.25                                     707  120
169  003E94I          TXYN(I,J,K)=(CXN*EX(I,J,K)+CYN*EY(I,J,K)+CZN*EZ(I,J,K))*0.25                                     708  121
170  003F48I          TXYS(I,J,K)=(CXS*EX(I,J,K)+CYS*EY(I,J,K)+CZS*EZ(I,J,K))*0.25                                     709  122
171  003FFCI          TXZT(I,J,K)=(CXT*SX(I,J,K)+CYT*SY(I,J,K)+CZT*SZ(I,J,K))*0.25                                     710  123
```

```
172  0040801          TXZB(I,J,K)=(CXB*SX(I,J,K)+CYB*SY(I,J,K)+CZB*SZ(I,J,K))*0.25                711     124
173  0041641          TZXE(I,J,K)=(SXE*CX(I,J,K)+SYE*CY(I,J,K)+SZE*CZ(I,J,K))*0.25                712     125
174  0042181          TZXW(I,J,K)=(SXW*CX(I,J,K)+SYW*CY(I,J,K)+SZW*CZ(I,J,K))*0.25                713     126
175  0042CC1          TZYN(I,J,K)=(SXN*EX(I,J,K)+SYN*EY(I,J,K)+SZN*EZ(I,J,K))*0.25                714     127
176  0043801          TZYS(I,J,K)=(SXS*EX(I,J,K)+SYS*EY(I,J,K)+SZS*EZ(I,J,K))*0.25                715     128
177  0044341    160   CONTINUE                                                                    716     129
178  00447C1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TXXE)                                        717     130
179  0044D41          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TXXW)                                        718     131
180  00452C1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TYYN)                                        719     132
181  0045841          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TYYS)                                        720     133
182  00450C1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TZZT)                                        721     134
183  0046341          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TZZB)                                        722     135
184  00468C1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TYXE)                                        723     136
185  0046E41          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TYXW)                                        724     137
186  00473C1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TYZT)                                        725     138
187  0047941          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TYZB)                                        726     139
188  0047EC1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TXYN)                                        727     140
189  0048441          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TXYS)                                        728     141
190  00489C1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TXZT)                                        729     142
191  0048F41          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TXZB)                                        730     143
192  00494C1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TZXE)                                        731     144
193  0049A41          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TZXW)                                        732     145
194  0049FC1          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TZYN)                                        733     146
195  004A541          CALL WALVAL(1.0,2,LT,2,MT,2,NT,TZYS)                                        734     147
196  004AAC1          RETURN                                                                      735     148
197  004A941          END                                                                         736     149

NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  TRANF     02/21/86  09:50:44  TABLE SPACE:  10 KB
STATEMENT BUFFER:   20 LINES/1321 BYTES    STACK SPACE: 199 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
  1  000000I          SUBROUTINE INIT                                                    737
  2  000004I          COMMON                                                             738
  3                  1/VAR/U(21,18,10),V(21,18,10),P(21,18,10),DK(21,18,10),            739
  4                  2  DE(21,18,10),ERRU,ERRV,ERRM,ERRK,ERRE,ERRW,                    740
  5                  3  PP(21,18,10),W(21,18,10),TM(21,18,10)                           741
  6                  1/PROP/ VISE(21,18,10),DEN(21,18,10),VISC,DENIN,FLOWIN           742
  7                  1/PCOR/ DU(21,18,10),DV(21,18,10),DW(21,18,10)                   743
  8  000004I          COMMON                                                             744
  9                  1/LIMT/ L,M,LT,MT,L1,L2,M1,M2,LC,MC,ISWU,ISWV,ISWP,ISWK,ISWE,     745
 10                  2   ALU,ALV,ALP,ALK,ALE,ALVIS,ALW,N,N1,N2,NC,ISWW,IG,NT,ALC,DTT  746
 11              C-----INITIALIZE VARIABLES                                             747
 12  000004I          DO 10 I=1,LC                                                       748        1
 13  000018I          DO 10 J=1,MC                                                       749        2
 14  00002CI          DO 10 K=1,NC                                                       750        3
 15  000040I          U(I,J,K)=0.0                                                       751        4
 16  000054I          V(I,J,K)=0.0                                                       752        5
 17  000068I          W(I,J,K)=0.0                                                       753        6
 18  00007CI          P(I,J,K)=0.0                                                       754        7
 19  000090I          PP(I,J,K)=0.0                                                      755        8
 20  0000A4I          DK(I,J,K)=0.0                                                      756        9
 21  0000B8I          DE(I,J,K)=0.0                                                      757       10
 22  0000CCI          DEN(I,J,K)=DENIN                                                   758       11
 23  0000E0I          VISE(I,J,K)=VISC                                                   759       12
 24  0000F4I       10 CONTINUE                                                           760       13
 25  000108I          RETURN                                                             761       14
 26  00011AI          END                                                                762       15

NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  INIT      02/21/86  09:51:07  TABLE SPACE:    3 KB
STATEMENT BUFFER:    20 LINES/1321 BYTES     STACK SPACE: 126 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
  1  000000I          SUBROUTINE NEWVIS                                                  763
  2  000004I          COMMON                                                             764
  3                  1/VAR/U(21,18,10),V(21,18,10),P(21,18,10),DK(21,18,10),            765
  4                  2  DE(21,18,10),ERRU,ERRV,ERRM,ERRK,ERRE,ERRW,                    766
  5                  3  PP(21,18,10),W(21,18,10),TM(21,18,10)                          767
  6                  1/PROP/ VISE(21,18,10),DEN(21,18,10),VISC,DENIN,FLOWIN          768
  7                  1/PCOR/ DU(21,18,10),DV(21,18,10),DW(21,18,10)                  769
  8                  1/TUR/ SIGK,SIGE,CMU,C1,C2,CMU1,CMU2,E,CK,HINUM,SMNUM,ANV1(800),  770
  9                  2 YN(800),YN1(800),SINX(800),SINY(800),SINZ(800),ANW1(800),     771
 10                  3 YPLN(800),TAUN(800),IBC(800),JBC(800),KBC(800),IITY(800),      772
 11                  4 TALW(800),GEN(21,18,10),MC(21,18,10),IJLO(21,18,10),IITO      773
 12  000004I          COMMON                                                             774
 13                  1/LIMT/ L,M,LT,MT,L1,L2,M1,M2,LO,MO,ISWU,ISWV,ISWP,ISWK,ISWE,     775
 14                  2   ALU,ALV,ALP,ALK,ALE,ALVIS,ALW,N,N1,N2,NO,ISWW,IG,NT,ALC,DTT   776
 15                C-----EVALUATE TURBULENT VISCOSITY                                   777
 16  000004I          DO 10 I=1,L                                                        778        1
 17  000018I          DO 10 J=1,M                                                        779        2
 18  00002CI          DO 10 K=1,N                                                        780        3
 19  000040I          IF(DK(I,J,K) .LE. SMNUM) DK(I,J,K)=SMNUM                           781        4
 20  00009EI          IF(DE(I,J,K) .LE. SMNUM) DE(I,J,K)=SMNUM                           782        6
 21  0000FCI          IF(DE(I,J,K) .LE. SMNUM) GO TO 12      -                           783        8
 22  000134I          TURVIS=DEN(I,J,K)*CMU*DK(I,J,K)**2/DE(I,J,K)+VISC                  784       10
 23  0001C2I          GO TO 14                                                           785       11
 24  0001C8I     12   TURVIS=VISC                                                        786       12
 25  0001D4I     14   CONTINUE                                                           787       13
 26  0001D4I          VISE(I,J,K)=VISE(I,J,K)+ALVIS*(TURVIS-VISE(I,J,K))                 788       14
 27  000252I     10   CONTINUE                                                           789       15
 28  00029AI          RETURN                                                             790       16
 29  0002A0I          END                                                                791       17

NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  NEWVIS    02/21/86  09:51:23  TABLE SPACE:   5 KB
STATEMENT BUFFER:   20 LINES/1321 BYTES    STACK SPACE: 203 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
      SUBROUTINE SOLVEQ(IE,ISWF,ALF,SIGF,ERRF,F,F0)                                  792
      DIMENSION F(21,18,10),F1(21,18,10),F0(21,18,10)                                793
      COMMON                                                                         794
     1/VAR/U(21,18,10),V(21,18,10),P(21,18,10),QK(21,18,10),                         795
     2  QE(21,18,10),ERRU,ERRV,ERRM,ERRK,ERRE,ERRW,                                  796
     3  PP(21,18,10),W(21,18,10),TM(21,18,10)                                        797
     1/PROP/ VISE(21,18,10),DEN(21,18,10),VISC,DENIN,FLOWIN                         798
     1/PCOR/ DU(21,18,10),DV(21,18,10),DW(21,18,10)                                 799
     1/TUR/ SIGK,SIGE,CMU,C1,C2,CMU1,CMU2,E,CK,HINUM,SMNUM,ANV1(800),                800
     2 YN(800),YN1(800),SINX(800),SINY(800),SINZ(800),ANW1(800),                    801
     3 YPLN(800),TAUN(800),IBC(800),JBC(800),KBC(800),IITY(800),                    802
     4 TAUW(800),GEN(21,18,10),MC(21,18,10),IJL0(21,18,10),IITO                     803
     1/COEF/ AP(21,18,10),SU(21,18,10),SP(21,18,10),SUK(21,18,10),                  804
     2   SPK(21,18,10),AE(21,18,10),AW(21,18,10),AN(21,18,10),                      805
     3   AS(21,18,10),AT(21,18,10),AB(21,18,10),APO(21,18,10)                       806
      COMMON                                                                         807
     1/TRAN/ X(21,18,10),Y(21,18,10),Z(21,18,10),TJO(21,18,10),                     808
     2   CX(21,18,10),CY(21,18,10),CZ(21,18,10),                                    809
     3   EX(21,18,10),EY(21,18,10),EZ(21,18,10),                                    810
     3   SX(21,18,10),SY(21,18,10),SZ(21,18,10)                                     811
     1/LIMT/ L,M,LT,MT,L1,L2,M1,M2,LO,MO,ISWU,ISWV,ISWP,ISWK,ISWE,                   812
     2   ALU,ALV,ALP,ALK,ALE,ALVIS,ALW,N,N1,N2,NO,ISWW,IG,NT,ALC,DTT                813
      COMMON                                                                         814
     1/TTRAN/TXXE(21,18,10),TXXW(21,18,10),TYYN(21,18,10),                          815
     2   TYYS(21,18,10),TZZT(21,18,10),TZZB(21,18,10),                              816
     3   TYXE(21,18,10),TYXW(21,18,10),TYZT(21,18,10),                              817
     4   TYZB(21,18,10),TXYN(21,18,10),TXYS(21,18,10),                              818
     5   TXZT(21,18,10),TXZB(21,18,10),TZXE(21,18,10),                              819
     6   TZXW(21,18,10),TZYN(21,18,10),TZYS(21,18,10)                               820
C------TRANSPORT EQUATIONS LINEARIZATION AND SOLVER                                 821
      ERRF=0.0                                                                       822      1
      PI=3.141592654                                                                 823      2
C-----PRESSURE CORRECTION SOLVER STARTS FROM 10                                      824
      IF(IE .EQ. 0) GO TO 10                                                         825      3
C-----U, V, W, TM, K & E EQUATIONS                                                   826
      IS=2                                                                           827      5
      IT=LT                                                                          828      6
      JS=2                                                                           829      7
      JT=MT                                                                          830      8
      KS=2                                                                           831      9
      KT=NT                                                                          832     10
      GO TO (21,29,29,29,29,21,21,21), IE                                            833     11
   21 CONTINUE                                                                       834     12
      DO 22 I=IS,IT                                                                  835     13
      DO 22 J=JS,JT                                                                  836     14
      DO 22 K=KS,KT                                                                  837     15
   22 F1(I,J,K)=VISE(I,J,K)/SIGF                                                     838     16
C-----EVALUATE LINK COEFF. AND SOURCE TERMS                                          839
      DO 20 I=IS,IT                                                                  840     17
      DO 20 J=JS,JT                                                                  841     18
      DO 20 K=KS,KT                                                                  842     19
      GAE=0.5*(F1(I+1,J,K)+F1(I,J,K))                                                843     20
      GAW=0.5*(F1(I-1,J,K)+F1(I,J,K))                                                844     21
      GAN=0.5*(F1(I,J+1,K)+F1(I,J,K))                                                845     22
      GAS=0.5*(F1(I,J-1,K)+F1(I,J,K))                                                846     23
      GAT=0.5*(F1(I,J,K+1)+F1(I,J,K))                                                847     24
      GAB=0.5*(F1(I,J,K-1)+F1(I,J,K))                                                848     25
```

```
 58  003F18I          DENE=0.5*(DEN(I+1,J,K)+DEN(I,J,K))                                  849      26
 59  003F74I          DENW=0.5*(DEN(I-1,J,K)+DEN(I,J,K))                                  850      27
 60  003FD0I          DENN=0.5*(DEN(I,J+1,K)+DEN(I,J,K))                                  851      28
 61  00402CI          DENS=0.5*(DEN(I,J-1,K)+DEN(I,J,K))                                  852      29
 62  004088I          DENT=0.5*(DEN(I,J,K+1)+DEN(I,J,K))                                  853      30
 63  0040E2I          DENB=0.5*(DEN(I,J,K-1)+DEN(I,J,K))                                  854      31
 64  00413CI          UE=C.5*(U(I+1,J,K)+U(I,J,K))                                        855      32
 65  004198I          UW=C.5*(U(I-1,J,K)+U(I,J,K))                                        856      33
 66  0041F4I          UN=C.5*(U(I,J+1,K)+U(I,J,K))                                        857      34
 67  004250I          US=C.5*(U(I,J-1,K)+U(I,J,K))                                        858      35
 68  0042ACI          UT=C.5*(U(I,J,K+1)+U(I,J,K))                                        859      36
 69  004306I          UB=0.5*(U(I,J,K-1)+U(I,J,K))                                        860      37
 70  004360I          VE=0.5*(V(I+1,J,K)+V(I,J,K))                                        861      38
 71  0043BCI          VW=C.5*(V(I-1,J,K)+V(I,J,K))                                        862      39
 72  004418I          VN=C.5*(V(I,J+1,K)+V(I,J,K))                                        863      40
 73  004474I          VS=C.5*(V(I,J-1,K)+V(I,J,K))                                        864      41
 74  0044D0I          VT=C.5*(V(I,J,K+1)+V(I,J,K))                                        865      42
 75  00452AI          VB=C.5*(V(I,J,K-1)+V(I,J,K))                                        866      43
 76  004584I          WE=C.5*(W(I+1,J,K)+W(I,J,K))                                        867      44
 77  0045E0I          WW=C.5*(W(I-1,J,K)+W(I,J,K))                                        868      45
 78  00463CI          WN=C.5*(W(I,J+1,K)+W(I,J,K))                                        869      46
 79  004698I          WS=C.5*(W(I,J-1,K)+W(I,J,K))                                        870      47
 80  0046F4I          WT=C.5*(W(I,J,K+1)+W(I,J,K))                                        871      48
 81  00474EI          WB=C.5*(W(I,J,K-1)+W(I,J,K))                                        872      49
 82  0047A8I          CE=DENE*(UE*CX(I,J,K)+VE*CY(I,J,K)+WE*CZ(I,J,K))                    873      50
 83  00483CI          CW=DENW*(UW*CX(I,J,K)+VW*CY(I,J,K)+WW*CZ(I,J,K))                    874      51
 84  0048D0I          CN=DENN*(UN*EX(I,J,K)+VN*EY(I,J,K)+WN*EZ(I,J,K))                    875      52
 85  004964I          CS=DENS*(US*EX(I,J,K)+VS*EY(I,J,K)+WS*EZ(I,J,K))                    876      53
 86  0049F8I          CT=DENT*(UT*SX(I,J,K)+VT*SY(I,J,K)+WT*SZ(I,J,K))                    877      54
 87  004A8CI          CB=DENB*(UB*SX(I,J,K)+VB*SY(I,J,K)+WB*SZ(I,J,K))                    878      55
 88  004B20I          DDE=GAE*TXXE(I,J,K)+GAN*TXYN(I,J,K)-GAS*TXYS(I,J,K)+                879      56
 89                  1     GAT*TXZT(I,J,K)-GAB*TXZB(I,J,K)                               880
 90  004C0AI          DDW=GAW*TXXW(I,J,K)+GAS*TXYS(I,J,K)-GAN*TXYN(I,J,K)-                881      57
 91                  1     GAT*TXZT(I,J,K)+GAB*TXZB(I,J,K)                               882
 92  004CF4I          DDN=GAN*TYYN(I,J,K)+GAE*TYXE(I,J,K)-GAW*TYXW(I,J,K)+                883      58
 93                  1     GAT*TYZT(I,J,K)-GAB*TYZB(I,J,K)                               884
 94  004DDEI          DDS=GAS*TYYS(I,J,K)+GAW*TYXW(I,J,K)-GAE*TYXE(I,J,K)-                885      59
 95                  1     GAT*TYZT(I,J,K)+GAB*TYZB(I,J,K)                               886
 96  004EC8I          DDT=GAT*TZZT(I,J,K)+GAE*TZXE(I,J,K)-GAW*TZXW(I,J,K)+                887      60
 97                  1     GAN*TZYN(I,J,K)-GAS*TZYS(I,J,K)                               888
 98  004FB2I          DDB=GAB*TZZB(I,J,K)+GAW*TZXW(I,J,K)-GAE*TZXE(I,J,K)-                889      61
 99                  1     GAN*TZYN(I,J,K)+GAS*TZYS(I,J,K)                               890
100  00509CI          CPO=ABS(CE-CW+CN-CS+CT-CB)                                          891      62
101  005062I          AE(I,J,K)=(AMAX1(ABS(0.5*CE),DDE)-0.5*CE)*TJO(I,J,K)                892      63
102  005186I          AW(I,J,K)=(AMAX1(ABS(0.5*CW),DDW)+0.5*CW)*TJO(I,J,K)                893      64
103  00522AI          AN(I,J,K)=(AMAX1(ABS(0.5*CN),DDN)-0.5*CN)*TJO(I,J,K)                894      65
104  0052CEI          AS(I,J,K)=(AMAX1(ABS(0.5*CS),DDS)+0.5*CS)*TJO(I,J,K)                895      66
105  005372I          AT(I,J,K)=(AMAX1(ABS(0.5*CT),DDT)-0.5*CT)*TJO(I,J,K)                896      67
106  005416I          AB(I,J,K)=(AMAX1(ABS(0.5*CB),DDB)+0.5*CB)*TJO(I,J,K)                897      68
107  00548AI          DDNE=GAE*TYXE(I,J,K)+GAN*TXYN(I,J,K)                                898      69
108  00551AI          DDSE=-GAE*TYXE(I,J,K)-GAS*TXYS(I,J,K)                               899      70
109  005582I          DDNW=-GAW*TYXW(I,J,K)-GAN*TXYN(I,J,K)                               900      71
110  0055EAI          DDSW=GAW*TYXW(I,J,K)+GAS*TXYS(I,J,K)                                901      72
111  00564AI          DDET=GAE*TZXE(I,J,K)+GAT*TXZT(I,J,K)                                902      73
112  0056AAI          DDEB=-GAE*TZXE(I,J,K)-GAB*TXZB(I,J,K)                               903      74
113  005712I          DDWT=-GAW*TZXW(I,J,K)-GAT*TXZT(I,J,K)                               904      75
114  00577AI          DDWB=GAW*TZXW(I,J,K)+GAB*TXZB(I,J,K)                                905      76
```

```
      DONT=GAN*TZYN(I,J,K)+GAT*TYZT(I,J,K)                                  906    77
      DONB=-GAN*TZYN(I,J,K)-GAB*TYZB(I,J,K)                                 907    78
      DOST=-GAS*TZYS(I,J,K)-GAT*TYZT(I,J,K)                                 908    79
      DOSB=GAS*TZYS(I,J,K)+GAB*TYZB(I,J,K)                                  909    80
      SU(I,J,K)=CPO*F(I,J,K)+DONE*F(I+1,J+1,K)+DOSE*F(I+1,J-1,K)+           910    81
     1          DONW*F(I-1,J+1,K)+DOSW*F(I-1,J-1,K)+                        911
     2          DOET*F(I+1,J,K+1)+DOEB*F(I+1,J,K-1)+                        912
     3          DOWT*F(I-1,J,K+1)+DOWB*F(I-1,J,K-1)+                        913
     4          DONT*F(I,J+1,K+1)+DONB*F(I,J+1,K-1)+                        914
     5          DOST*F(I,J-1,K+1)+DOSB*F(I,J-1,K-1)                         915
      DV(I,J,K)=CPO*V(I,J,K)+DONE*V(I+1,J+1,K)+DOSE*V(I+1,J-1,K)+           916    82
     1          DONW*V(I-1,J+1,K)+DOSW*V(I-1,J-1,K)+                        917
     2          DOET*V(I+1,J,K+1)+DOEB*V(I+1,J,K-1)+                        918
     3          DOWT*V(I-1,J,K+1)+DOWB*V(I-1,J,K-1)+                        919
     4          DONT*V(I,J+1,K+1)+DONB*V(I,J+1,K-1)+                        920
     5          DOST*V(I,J-1,K+1)+DOSB*V(I,J-1,K-1)                         921
      DW(I,J,K)=CPO*W(I,J,K)+DONE*W(I+1,J+1,K)+DOSE*W(I+1,J-1,K)+           922    83
     1          DONW*W(I-1,J+1,K)+DOSW*W(I-1,J-1,K)+                        923
     2          DOET*W(I+1,J,K+1)+DOEB*W(I+1,J,K-1)+                        924
     3          DOWT*W(I-1,J,K+1)+DOWB*W(I-1,J,K-1)+                        925
     4          DONT*W(I,J+1,K+1)+DONB*W(I,J+1,K-1)+                        926
     5          DOST*W(I,J-1,K+1)+DOSB*W(I,J-1,K-1)                         927
      PP(I,J,K)=CPO*DK(I,J,K)+DONE*DK(I+1,J+1,K)+DOSE*DK(I+1,J-1,K)+        928    84
     1          DONW*DK(I-1,J+1,K)+DOSW*DK(I-1,J-1,K)+                      929
     2          DOET*DK(I+1,J,K+1)+DOEB*DK(I+1,J,K-1)+                      930
     3          DOWT*DK(I-1,J,K+1)+DOWB*DK(I-1,J,K-1)+                      931
     4          DONT*DK(I,J+1,K+1)+DONB*DK(I,J+1,K-1)+                      932
     5          DOST*DK(I,J-1,K+1)+DOSB*DK(I,J-1,K-1)                       933
      SUK(I,J,K)=CPO                                                        934    85
      SPK(I,J,K)=-CPO-APC(I,J,K)                                            935    86
      UCXI=UE-UW                                                            936    87
      UEDA=UN-US                                                            937    88
      USCI=UT-UB                                                            938    89
      VCXI=VE-VW                                                            939    90
      VEDA=VN-VS                                                            940    91
      VSCI=VT-VB                                                            941    92
      WCXI=WE-WW                                                            942    93
      WEDA=WN-WS                                                            943    94
      WSCI=WT-WB                                                            944    95
      UX=UCXI*CX(I,J,K)+UEDA*EX(I,J,K)+USCI*SX(I,J,K)                       945    96
      UY=UCXI*CY(I,J,K)+UEDA*EY(I,J,K)+USCI*SY(I,J,K)                       946    97
      UZ=UCXI*CZ(I,J,K)+UEDA*EZ(I,J,K)+USCI*SZ(I,J,K)                       947    98
      VX=VCXI*CX(I,J,K)+VEDA*EX(I,J,K)+VSCI*SX(I,J,K)                       948    99
      VY=VCXI*CY(I,J,K)+VEDA*EY(I,J,K)+VSCI*SY(I,J,K)                       949   100
      VZ=VCXI*CZ(I,J,K)+VEDA*EZ(I,J,K)+VSCI*SZ(I,J,K)                       950   101
      WX=WCXI*CX(I,J,K)+WEDA*EX(I,J,K)+WSCI*SX(I,J,K)                       951   102
      WY=WCXI*CY(I,J,K)+WEDA*EY(I,J,K)+WSCI*SY(I,J,K)                       952   103
      WZ=WCXI*CZ(I,J,K)+WEDA*EZ(I,J,K)+WSCI*SZ(I,J,K)                       953   104
      GEN(I,J,K)=VISE(I,J,K)*((UY+VX)**2+(VZ+WY)**2+(WX+UZ)**2+             954   105
     1          2*(UX*UX+VY*VY+WZ*WZ))                                      955
   20 CONTINUE                                                              956   106
C-------------------------------------------------------------------------  957
   29 CONTINUE                                                              958   107
C-----CALCULATE SOURCE TERMS                                               959
      GO TO (1,2,3,4,5,6,7), IE                                             960   108
C-----U-, V-, W-SOURCES                                                    961
    1 CONTINUE                                                              962   109
```

```
      DO 15 I=IS,IT                                                     963     110
      DO 15 J=JS,JT                                                     964     111
      DO 15 K=KS,KT                                                     965     112
      GAE=0.5*(F1(I+1,J,K)+F1(I,J,K))                                   966     113
      GAW=0.5*(F1(I-1,J,K)+F1(I,J,K))                                   967     114
      GAN=0.5*(F1(I,J+1,K)+F1(I,J,K))                                   968     115
      GAS=0.5*(F1(I,J-1,K)+F1(I,J,K))                                   969     116
      GAT=0.5*(F1(I,J,K+1)+F1(I,J,K))                                   970     117
      GAB=0.5*(F1(I,J,K-1)+F1(I,J,K))                                   971     118
      PCXI=(P(I+1,J,K)+P(I+1,J+1,K)+P(I+1,J,K+1)+P(I+1,J+1,K+1)-        972     119
     1       P(I,J,K)-P(I,J+1,K)-P(I,J,K+1)-P(I,J+1,K+1))*0.25          973
      PEDA=(P(I,J+1,K)+P(I+1,J+1,K)+P(I,J+1,K+1)+P(I+1,J+1,K+1)-        974     120
     1       P(I,J,K)-P(I+1,J,K)-P(I,J,K+1)-P(I+1,J,K+1))*0.25          975
      PSCI=(P(I,J,K+1)+P(I+1,J,K+1)+P(I,J+1,K+1)+P(I+1,J+1,K+1)-        976     121
     1       P(I,J,K)-P(I+1,J,K)-P(I,J+1,K)-P(I+1,J+1,K))*0.25          977
      UCE=U(I+1,J,K)-U(I,J,K)                                           978     122
      UCW=U(I,J,K)-U(I-1,J,K)                                           979     123
      UCN=(U(I+1,J+1,K)+U(I+1,J,K)-U(I-1,J+1,K)-U(I-1,J,K))*0.25        980     124
      UCS=(U(I+1,J,K)+U(I+1,J-1,K)-U(I-1,J,K)-U(I-1,J-1,K))*0.25        981     125
      UCT=(U(I+1,J,K+1)+U(I+1,J,K)-U(I-1,J,K+1)-U(I-1,J,K))*0.25        982     126
      UCB=(U(I+1,J,K)+U(I+1,J,K-1)-U(I-1,J,K)-U(I-1,J,K-1))*0.25        983     127
      UEE=(U(I+1,J+1,K)+U(I,J+1,K)-U(I+1,J-1,K)-U(I,J-1,K))*0.25        984     128
      UEW=(U(I,J+1,K)+U(I-1,J+1,K)-U(I,J-1,K)-U(I-1,J-1,K))*0.25        985     129
      UEN=U(I,J+1,K)-U(I,J,K)                                           986     130
      UES=U(I,J,K)-U(I,J-1,K)                                           987     131
      UET=(U(I,J+1,K+1)+U(I,J+1,K)-U(I,J-1,K+1)-U(I,J-1,K))*0.25        988     132
      UEB=(U(I,J+1,K)+U(I,J+1,K-1)-U(I,J-1,K)-U(I,J-1,K-1))*0.25        989     133
      USE=(U(I+1,J,K+1)+U(I,J,K+1)-U(I+1,J,K-1)-U(I,J,K-1))*0.25        990     134
      USW=(U(I,J,K+1)+U(I-1,J,K+1)-U(I,J,K-1)-U(I-1,J,K-1))*0.25        991     135
      USN=(U(I,J+1,K+1)+U(I,J,K+1)-U(I,J+1,K-1)-U(I,J,K-1))*0.25        992     136
      USS=(U(I,J,K+1)+U(I,J-1,K+1)-U(I,J,K-1)-U(I,J-1,K-1))*0.25        993     137
      UST=U(I,J,K+1)-U(I,J,K)                                           994     138
      USB=U(I,J,K)-U(I,J,K-1)                                           995     139
      VCE=V(I+1,J,K)-V(I,J,K)                                           996     140
      VCW=V(I,J,K)-V(I-1,J,K)                                           997     141
      VCN=(V(I+1,J+1,K)+V(I+1,J,K)-V(I-1,J+1,K)-V(I-1,J,K))*0.25        998     142
      VCS=(V(I+1,J,K)+V(I+1,J-1,K)-V(I-1,J,K)-V(I-1,J-1,K))*0.25        999     143
      VCT=(V(I+1,J,K+1)+V(I+1,J,K)-V(I-1,J,K+1)-V(I-1,J,K))*0.25        1000    144
      VCB=(V(I+1,J,K)+V(I+1,J,K-1)-V(I-1,J,K)-V(I-1,J,K-1))*0.25        1001    145
      VEE=(V(I+1,J+1,K)+V(I,J+1,K)-V(I+1,J-1,K)-V(I,J-1,K))*0.25        1002    146
      VEW=(V(I,J+1,K)+V(I-1,J+1,K)-V(I,J-1,K)-V(I-1,J-1,K))*0.25        1003    147
      VEN=V(I,J+1,K)-V(I,J,K)                                           1004    148
      VES=V(I,J,K)-V(I,J-1,K)                                           1005    149
      VET=(V(I,J+1,K+1)+V(I,J+1,K)-V(I,J-1,K+1)-V(I,J-1,K))*0.25        1006    150
      VEB=(V(I,J+1,K)+V(I,J+1,K-1)-V(I,J-1,K)-V(I,J-1,K-1))*0.25        1007    151
      VSE=(V(I+1,J,K+1)+V(I,J,K+1)-V(I+1,J,K-1)-V(I,J,K-1))*0.25        1008    152
      VSW=(V(I,J,K+1)+V(I-1,J,K+1)-V(I,J,K-1)-V(I-1,J,K-1))*0.25        1009    153
      VSN=(V(I,J+1,K+1)+V(I,J,K+1)-V(I,J+1,K-1)-V(I,J,K-1))*0.25        1010    154
      VSS=(V(I,J,K+1)+V(I,J-1,K+1)-V(I,J,K-1)-V(I,J-1,K-1))*0.25        1011    155
      VST=V(I,J,K+1)-V(I,J,K)                                           1012    156
      VSB=V(I,J,K)-V(I,J,K-1)                                           1013    157
      WCE=W(I+1,J,K)-W(I,J,K)                                           1014    158
      WCW=W(I,J,K)-W(I-1,J,K)                                           1015    159
      WCN=(W(I+1,J+1,K)+W(I+1,J,K)-W(I-1,J+1,K)-W(I-1,J,K))*0.25        1016    160
      WCS=(W(I+1,J,K)+W(I+1,J-1,K)-W(I-1,J,K)-W(I-1,J-1,K))*0.25        1017    161
      WCT=(W(I+1,J,K+1)+W(I+1,J,K)-W(I-1,J,K+1)-W(I-1,J,K))*0.25        1018    162
      WCB=(W(I+1,J,K)+W(I+1,J,K-1)-W(I-1,J,K)-W(I-1,J,K-1))*0.25        1019    163
```

```
229  008BD2I        WEE=(W(I+1,J+1,K)+W(I,J+1,K)-W(I+1,J-1,K)-W(I,J-1,K))*0.25                                    1020     164
230  008C9EI        WEW=(W(I,J+1,K)+W(I-1,J+1,K)-W(I,J-1,K)-W(I-1,J-1,K))*0.25                                   1021     165
231  008D4AI        WEN=W(I,J+1,K)-W(I,J,K)                                                                      1022     166
232  008DA0I        WES=W(I,J,K)-W(I,J-1,K)                                                                      1023     167
233  008DF6I        WET=(W(I,J+1,K+1)+W(I,J+1,K)-W(I,J-1,K+1)-W(I,J-1,K))*0.25                                   1024     168
234  008EAEI        WEB=(W(I,J+1,K)+W(I,J+1,K-1)-W(I,J-1,K)-W(I,J-1,K-1))*0.25                                   1025     169
235  008F66I        WSE=(W(I+1,J,K+1)+W(I,J,K+1)-W(I+1,J,K-1)-W(I,J,K-1))*0.25                                   1026     170
236  00901AI        WSW=(W(I,J,K+1)+W(I-1,J,K+1)-W(I,J,K-1)-W(I-1,J,K-1))*0.25                                   1027     171
237  0090CEI        WSN=(W(I,J+1,K+1)+W(I,J,K+1)-W(I,J+1,K-1)-W(I,J,K-1))*0.25                                   1028     172
238  009182I        WSS=(W(I,J,K+1)+W(I,J-1,K+1)-W(I,J,K-1)-W(I,J-1,K-1))*0.25                                   1029     173
239  009236I        WST=W(I,J,K+1)-W(I,J,K)                                                                      1030     174
240  00928AI        WSB=W(I,J,K)-W(I,J,K-1)                                                                      1031     175
241  0092DEI        SU(I,J,K)=SU(I,J,K)-PCXI*CX(I,J,K)-PEDA*EX(I,J,K)-PSCI*SX(I,J,K)                             1032     176
242  009384I        DV(I,J,K)=DV(I,J,K)-PCXI*CY(I,J,K)-PEDA*EY(I,J,K)-PSCI*SY(I,J,K)                             1033     177
243  00948AI        DW(I,J,K)=DW(I,J,K)-PCXI*CZ(I,J,K)-PEDA*EZ(I,J,K)-PSCI*SZ(I,J,K)                             1034     178
244  009560I        CXE=(CX(I+1,J,K)+CX(I,J,K))*0.5                                                              1035     179
245  00953CI        CXW=(CX(I-1,J,K)+CX(I,J,K))*0.5                                                              1036     180
246  009618I        CXN=(CX(I,J+1,K)+CX(I,J,K))*0.5                                                              1037     181
247  009674I        CXS=(CX(I,J,K)+CX(I,J-1,K))*0.5                                                              1038     182
248  0096D0I        CXT=(CX(I,J,K+1)+CX(I,J,K))*0.5                                                              1039     183
249  00972AI        CXB=(CX(I,J,K)+CX(I,J,K-1))*0.5                                                              1040     184
250  009784I        EXE=(EX(I+1,J,K)+EX(I,J,K))*0.5                                                              1041     185
251  0097E0I        EXW=(EX(I,J,K)+EX(I-1,J,K))*0.5                                                              1042     186
252  00983CI        EXN=(EX(I,J+1,K)+EX(I,J,K))*0.5                                                              1043     187
253  009898I        EXS=(EX(I,J,K)+EX(I,J-1,K))*0.5                                                              1044     188
254  0098F4I        EXT=(EX(I,J,K+1)+EX(I,J,K))*0.5                                                              1045     189
255  00994EI        EXB=(EX(I,J,K)+EX(I,J,K-1))*0.5                                                              1046     190
256  0099A8I        SXE=(SX(I+1,J,K)+SX(I,J,K))*0.5                                                              1047     191
257  009A04I        SXW=(SX(I,J,K)+SX(I-1,J,K))*0.5                                                              1048     192
258  009A60I        SXN=(SX(I,J+1,K)+SX(I,J,K))*0.5                                                              1049     193
259  009ABCI        SXS=(SX(I,J,K)+SX(I,J-1,K))*0.5                                                              1050     194
260  009B18I        SXT=(SX(I,J,K+1)+SX(I,J,K))*0.5                                                              1051     195
261  009B72I        SXB=(SX(I,J,K)+SX(I,J,K-1))*0.5                                                              1052     196
262  009BCCI        QE=GAE*(UCE*CXE+UEE*EXE+USE*SXE)                                                             1053     197
263  009C00I        QW=GAW*(UCW*CXW+UEW*EXW+USW*SXW)                                                             1054     198
264  009C34I        QN=GAN*(UCN*CXN+UEN*EXN+USN*SXN)                                                             1055     199
265  009C68I        QS=GAS*(UCS*CXS+UES*EXS+USS*SXS)                                                             1056     200
266  009C9CI        QT=GAT*(UCT*CXT+UET*EXT+UST*SXT)                                                             1057     201
267  009CD0I        QB=GAB*(UCB*CXB+UEB*EXB+USB*SXB)                                                             1058     202
268  009D04I        SOC1=CX(I,J,K)*(QE-QW)+EX(I,J,K)*(QN-QS)+SX(I,J,K)*(QT-QB)                                   1059     203
269  009DA4I        QE=GAE*(VCE*CXE+VEE*EXE+VSE*SXE)                                                             1060     204
270  009DD8I        QW=GAW*(VCW*CXW+VEW*EXW+VSW*SXW)                                                             1061     205
271  009E0CI        QN=GAN*(VCN*CXN+VEN*EXN+VSN*SXN)                                                             1062     206
272  009E40I        QS=GAS*(VCS*CXS+VES*EXS+VSS*SXS)                                                             1063     207
273  009E74I        QT=GAT*(VCT*CXT+VET*EXT+VST*SXT)                                                             1064     208
274  009EA8I        QB=GAB*(VCB*CXB+VEB*EXB+VSB*SXB)                                                             1065     209
275  009EDCI        SOC2=CY(I,J,K)*(QE-QW)+EY(I,J,K)*(QN-QS)+SY(I,J,K)*(QT-QB)                                   1066     210
276  009F7CI        QE=GAE*(WCE*CXE+WEE*EXE+WSE*SXE)                                                             1067     211
277  009FB0I        QW=GAW*(WCW*CXW+WEW*EXW+WSW*SXW)                                                             1068     212
278  009FE4I        QN=GAN*(WCN*CXN+WEN*EXN+WSN*SXN)                                                             1069     213
279  00A018I        QS=GAS*(WCS*CXS+WES*EXS+WSS*SXS)                                                             1070     214
280  00A04CI        QT=GAT*(WCT*CXT+WET*EXT+WST*SXT)                                                             1071     215
281  00A080I        QB=GAB*(WCB*CXB+WEB*EXB+WSB*SXB)                                                             1072     216
282  00A0B4I        SOC3=CZ(I,J,K)*(QE-QW)+EZ(I,J,K)*(QN-QS)+SZ(I,J,K)*(QT-QB)                                   1073     217
283  00A154I        SU(I,J,K)=SU(I,J,K)+SOC1+SOC2+SOC3+APO(I,J,K)*FO(I,J,K)                                      1074     218
284  00A206I        CYE=(CY(I+1,J,K)+CY(I,J,K))*0.5                                                              1075     219
285  00A262I        CYW=(CY(I,J,K)+CY(I-1,J,K))*0.5                                                              1076     220
```

```
286  00A28EI        CYN=(CY(I,J+1,K)+CY(I,J,K))*0.5                                                    1077  221
287  00A31AI        CYS=(CY(I,J,K)+CY(I,J-1,K))*0.5                                                    1078  222
288  00A376I        CYT=(CY(I,J,K+1)+CY(I,J,K))*0.5                                                    1079  223
289  00A300I        CYB=(CY(I,J,K)+CY(I,J,K-1))*0.5                                                    1080  224
290  00A42AI        EYE=(EY(I+1,J,K)+EY(I,J,K))*0.5                                                    1081  225
291  00A486I        EYW=(EY(I,J,K)+EY(I-1,J,K))*0.5                                                    1082  226
292  00A4E2I        EYN=(EY(I,J+1,K)+EY(I,J,K))*0.5                                                    1083  227
293  00A53EI        EYS=(EY(I,J,K)+EY(I,J-1,K))*0.5                                                    1084  228
294  00A59AI        EYT=(EY(I,J,K+1)+EY(I,J,K))*0.5                                                    1085  229
295  00A5F4I        EYB=(EY(I,J,K)+EY(I,J,K-1))*0.5                                                    1086  230
296  00A64EI        SYE=(SY(I+1,J,K)+SY(I,J,K))*0.5                                                    1087  231
297  00A6AAI        SYW=(SY(I,J,K)+SY(I-1,J,K))*0.5                                                    1088  232
298  00A706I        SYN=(SY(I,J+1,K)+SY(I,J,K))*0.5                                                    1089  233
299  00A762I        SYS=(SY(I,J,K)+SY(I,J-1,K))*0.5                                                    1090  234
300  00A7BEI        SYT=(SY(I,J,K+1)+SY(I,J,K))*0.5                                                    1091  235
301  00A818I        SYB=(SY(I,J,K)+SY(I,J,K-1))*0.5                                                    1092  236
302  00A872I        QE=GAE*(UCE*CYE+UEE*EYE+USE*SYE)                                                   1093  237
303  00A8A6I        QW=GAW*(UCW*CYW+UEW*EYW+USW*SYW)                                                   1094  238
304  00A8DAI        QN=GAN*(UCN*CYN+UEN*EYN+USN*SYN)                                                   1095  239
305  00A90EI        QS=GAS*(UCS*CYS+UES*EYS+USS*SYS)                                                   1096  240
306  00A942I        QT=GAT*(UCT*CYT+UET*EYT+UST*SYT)                                                   1097  241
307  00A976I        QB=GAB*(UCB*CYB+UEB*EYB+USB*SYB)                                                   1098  242
308  00A9AAI        SOC1=CX(I,J,K)*(QE-QW)+EX(I,J,K)*(QN-QS)+SX(I,J,K)*(QT-QB)                         1099  243
309  00AA4AI        QE=GAE*(VCE*CYE+VEE*EYE+VSE*SYE)                                                   1100  244
310  00AA7EI        QW=GAW*(VCW*CYW+VEW*EYW+VSW*SYW)                                                   1101  245
311  00AAB2I        QN=GAN*(VCN*CYN+VEN*EYN+VSN*SYN)                                                   1102  246
312  00AAE6I        QS=GAS*(VCS*CYS+VES*EYS+VSS*SYS)                                                   1103  247
313  00AB1AI        QT=GAT*(VCT*CYT+VET*EYT+VST*SYT)                                                   1104  248
314  00AB4EI        QB=GAB*(VCB*CYB+VEB*EYB+VSB*SYB)                                                   1105  249
315  00AB82I        SOC2=CY(I,J,K)*(QE-QW)+EY(I,J,K)*(QN-QS)+SY(I,J,K)*(QT-QB)                         1106  250
316  00AC22I        QE=GAE*(WCE*CYE+WEE*EYE+WSE*SYE)                                                   1107  251
317  00AC56I        QW=GAW*(WCW*CYW+WEW*EYW+WSW*SYW)                                                   1108  252
318  00AC8AI        QN=GAN*(WCN*CYN+WEN*EYN+WSN*SYN)                                                   1109  253
319  00ACBEI        QS=GAS*(WCS*CYS+WES*EYS+WSS*SYS)                                                   1110  254
320  00ACF2I        QT=GAT*(WCT*CYT+WET*EYT+WST*SYT)                                                   1111  255
321  00AD26I        QB=GAB*(WCB*CYB+WEB*EYB+WSB*SYB)                                                   1112  256
322  00AD5AI        SOC3=CZ(I,J,K)*(QE-QW)+EZ(I,J,K)*(QN-QS)+SZ(I,J,K)*(QT-QB)                         1113  257
323  00ADFAI        DV(I,J,K)=DV(I,J,K)+SOC1+SOC2+SOC3                                                 1114  258
324  00AE58I        CZE=(CZ(I+1,J,K)+CZ(I,J,K))*0.5                                                    1115  259
325  00AE94I        CZW=(CZ(I,J,K)+CZ(I-1,J,K))*0.5                                                    1116  260
326  00AF10I        CZN=(CZ(I,J+1,K)+CZ(I,J,K))*0.5                                                    1117  261
327  00AF6CI        CZS=(CZ(I,J,K)+CZ(I,J-1,K))*0.5                                                    1118  262
328  00AFC8I        CZT=(CZ(I,J,K+1)+CZ(I,J,K))*0.5                                                    1119  263
329  00B022I        CZB=(CZ(I,J,K)+CZ(I,J,K-1))*0.5                                                    1120  264
330  00B07CI        EZE=(EZ(I+1,J,K)+EZ(I,J,K))*0.5                                                    1121  265
331  00B0D8I        EZW=(EZ(I,J,K)+EZ(I-1,J,K))*0.5                                                    1122  266
332  00B134I        EZN=(EZ(I,J+1,K)+EZ(I,J,K))*0.5                                                    1123  267
333  00B190I        EZS=(EZ(I,J,K)+EZ(I,J-1,K))*0.5                                                    1124  268
334  00B1ECI        EZT=(EZ(I,J,K+1)+EZ(I,J,K))*0.5                                                    1125  269
335  00B246I        EZB=(EZ(I,J,K)+EZ(I,J,K-1))*0.5                                                    1126  270
336  00B2A0I        SZE=(SZ(I+1,J,K)+SZ(I,J,K))*0.5                                                    1127  271
337  00B2FCI        SZW=(SZ(I,J,K)+SZ(I-1,J,K))*0.5                                                    1128  272
338  00B358I        SZN=(SZ(I,J+1,K)+SZ(I,J,K))*0.5                                                    1129  273
339  00B3B4I        SZS=(SZ(I,J,K)+SZ(I,J-1,K))*0.5                                                    1130  274
340  00B410I        SZT=(SZ(I,J,K+1)+SZ(I,J,K))*0.5                                                    1131  275
341  00B46AI        SZB=(SZ(I,J,K)+SZ(I,J,K-1))*0.5                                                    1132  276
342  00B4C4I        QE=GAE*(UCE*CZE+UEE*EZE+USE*SZE)                                                   1133  277
```

```
343  0084F8I          QW=GAW*(UCW*CZW+UEW*EZW+USW*SZW)                                    1134     278
344  00852CI          QN=GAN*(UCN*CZN+UEN*EZN+USN*SZN)                                    1135     279
345  00856CI          QS=GAS*(UCS*CZS+UES*EZS+USS*SZS)                                    1136     280
346  00859CI          QT=GAT*(UCT*CZT+UET*EZT+UST*SZT)                                    1137     281
347  0085C8I          QB=GAB*(UCB*CZB+UEB*EZB+USB*SZB)                                    1138     282
348  0085FCI          SOC1=CX(I,J,K)*(QE-QW)+EX(I,J,K)*(QN-QS)+SX(I,J,K)*(QT-QB)          1139     283
349  00869CI          QE=GAE*(VCE*CZE+VEE*EZE+VSE*SZE)                                    1140     284
350  0086D0I          QW=GAW*(VCW*CZW+VEW*EZW+VSW*SZW)                                    1141     285
351  00870CI          QN=GAN*(VCN*CZN+VEN*EZN+VSN*SZN)                                    1142     286
352  00873CI          QS=GAS*(VCS*CZS+VES*EZS+VSS*SZS)                                    1143     287
353  00876CI          QT=GAT*(VCT*CZT+VET*EZT+VST*SZT)                                    1144     288
354  0087A0I          QB=GAB*(VCB*CZB+VEB*EZB+VSB*SZB)                                    1145     289
355  0087D4I          SOC2=CY(I,J,K)*(QE-QW)+EY(I,J,K)*(QN-QS)+SY(I,J,K)*(QT-QB)          1146     290
356  00880CI          QE=GAE*(WCE*CZE+WEE*EZE+WSE*SZE)                                    1147     291
357  00884CI          QW=GAW*(WCW*CZW+WEW*EZW+WSW*SZW)                                    1148     292
358  00888CI          QN=GAN*(WCN*CZN+WEN*EZN+WSN*SZN)                                    1149     293
359  00891CI          QS=GAS*(WCS*CZS+WES*EZS+WSS*SZS)                                    1150     294
360  00894CI          QT=GAT*(WCT*CZT+WET*EZT+WST*SZT)                                    1151     295
361  00897CI          QB=GAB*(WCB*CZB+WEB*EZB+WSB*SZB)                                    1152     296
362  0089ACI          SOC3=CZ(I,J,K)*(QE-QW)+EZ(I,J,K)*(QN-QS)+SZ(I,J,K)*(QT-QB)          1153     297
363  0089A4CI         DW(I,J,K)=DW(I,J,K)+SOC1+SOC2+SOC3                                  1154     298
364  0089AAAI         SU(I,J,K)=SU(I,J,K)*TJO(I,J,K)                                      1155     299
365  0089B1CI         SP(I,J,K)=SPK(I,J,K)*TJO(I,J,K)                                     1156     300
366  0089B8EI       15  CONTINUE                                                         1157     301
367  0089BDCI           GO TO 6C                                                          1158     302
368               C-----V-SOURCE                                                       1159
369  0089E2I        2   CONTINUE                                                        1160     303
370  0089E2I            DO 25 I=IS,IT                                                   1161     304
371  0089EAI            DO 25 J=JS,JT                                                   1162     305
372  0089C12I           DO 25 K=KS,KT                                                   1163     306
373  0089C2AI           SU(I,J,K)=(DV(I,J,K)+APC(I,J,K)*FO(I,J,K))*TJO(I,J,K)           1164     307
374  0089CEEI       25  CONTINUE                                                        1165     308
375  0089D36I           GO TO 6C                                                        1166     309
376               C-----W-SOURCE                                                       1167
377  0089D3CI       3   CONTINUE                                                        1168     310
378  0089D3CI           DO 35 I=IS,IT                                                   1169     311
379  0089D54I           DO 35 J=JS,JT                                                   1170     312
380  0089D6CI           DO 35 K=KS,KT                                                   1171     313
381  0089D84I           SU(I,J,K)=(DW(I,J,K)+APO(I,J,K)*FO(I,J,K))*TJO(I,J,K)           1172     314
382  0089E48I       35  CONTINUE                                                        1173     315
383  0089E90I           GO TO 6C                                                        1174     316
384               C-----TM-SOURCE                                                      1175
385  0089E96I       4   CONTINUE                                                        1176     317
386  0089E96I           GO TO 6C                                                        1177     318
387               C-----K-SOURCE                                                       1178
388  0089E9CI       5   CONTINUE                                                        1179     319
389  0089E9CI           DO 55 I=IS,IT                                                   1180     320
390  0089E34I           DO 55 J=JS,JT                                                   1181     321
391  0089ECCI           DO 55 K=KS,KT                                                   1182     322
392  0089EE4I           SU(I,J,K)=GEN(I,J,K)+PP(I,J,K)+APO(I,J,K)*FO(I,J,K)             1183     323
393  0089FAAI           P1=DEN(I,J,K)**2                                                1184     324
394  0089FDEI           SP(I,J,K)=SPK(I,J,K)-CMU*P1*F(I,J,K)/VISE(I,J,K)                1185     325
395  008C08AI           SU(I,J,K)=SU(I,J,K)*TJO(I,J,K)                                  1186     326
396  008C0FCI           SP(I,J,K)=SP(I,J,K)*TJO(I,J,K)                                  1187     327
397  008C16EI       55  CONTINUE                                                        1188     328
398  008C186I           GO TO 6C                                                        1189     329
399               C-----E-SOURCE                                                       1190
```

```
400  00C18CI      6   CONTINUE                                                          1191    330
401  00C18CI          DO 65 I=IS,IT                                                     1192    331
402  00C104I          DO 65 J=JS,JT                                                     1193    332
403  00C1ECI          DO 65 K=KS,KT                                                     1194    333
404  00C204I          P1=DEN(I,J,K)**2                                                  1195    334
405  00C238I          SU(I,J,K)=SU(I,J,K)+C1*CMU*GEN(I,J,K)*P1*DK(I,J,K)/               1196    335
406                  1          VISE(I,J,K)+APO(I,J,K)*FO(I,J,K)                      1197
407  00C35CI          TMDK=DK(I,J,K)+SMNUM                                              1198    336
408  00C38EI          SP(I,J,K)=SPK(I,J,K)-C2*DEN(I,J,K)*F(I,J,K)/TMDK                  1199    337
409  00C43AI          SU(I,J,K)=SU(I,J,K)*TJO(I,J,K)                                    1200    338
410  00C4ACI          SP(I,J,K)=SP(I,J,K)*TJO(I,J,K)                                    1201    339
411  00C51EI      65  CONTINUE                                                          1202    340
412  00C566I          GO TO 6C                                                          1203    341
413               C-----PF-SOURCE                                                      1204
414  00C56CI      7   CONTINUE                                                          1205    342
415  00C56CI          DO 75 I=IS,IT                                                     1206    343
416  00C584I          DO 75 J=JS,JT                                                     1207    344
417  00C59CI          DO 75 K=KS,KT                                                     1208    345
418  00C5B4I          SU(I,J,K)=SU(I,J,K)+0.85*GEN(I,J,K)+APO(I,J,K)*FO(I,J,K)          1209    346
419  00C680I          TMDK=DK(I,J,K)+SMNUM                                              1210    347
420  00C682I          SP(I,J,K)=SPK(I,J,K)-DE(I,J,K)/TMDK                               1211    348
421  00C72CI          SU(I,J,K)=SU(I,J,K)*TJO(I,J,K)                                    1212    349
422  00C79EI          SP(I,J,K)=SP(I,J,K)*TJO(I,J,K)                                    1213    350
423  00C810I      75  CONTINUE                                                          1214    351
424  00C858I      60  CONTINUE                                                          1215    352
425               C-----MODIFY WALL BOUNDARY CONDITIONS THRU WALL FUNCTIONS             1216
426  00C858I          IF(IG .NE. 2) GO TO 410                                           1217    353
427  00C86EI          CALL BOUNC(IE,F)                                                  1218    355
428  00C89CI  410    CONTINUE                                                           1219    356
429               C-----SET SYMMETRIC, CYCLIC AND EXIT LINK COEFF.                     1220
430  00C89CI          CALL SYMOUT(2,IE,IS,IT,JS,JT,KS,KT)                               1221    357
431               C-----LINK COEFF. ASSEMBLY AND BLOCKAGES                             1222
432  00C808I          DO 500 I=IS,IT                                                    1223    358
433  00C8F0I          DO 500 J=JS,JT                                                    1224    359
434  00C908I          DO 500 K=KS,KT                                                    1225    360
435  00C920I          F1(I,J,K)=F(I,J,K)                                                1226    361
436  00C972I          ANAB=AE(I,J,K)+AW(I,J,K)+AN(I,J,K)+AS(I,J,K)+AT(I,J,K)+           1227    362
437                  1     AB(I,J,K)+APO(I,J,K)                                        1228
438  00CA82I          AP(I,J,K)=ANAB-SP(I,J,K)                                          1229    363
439  00CAD4I          PDUV=1.0                                                          1230    364
440  00CAE0I          IF(MC(I,J,K) .LT. 1) GO TO 530                                    1231    365
441  00CB16I          AP(I,J,K)=ALF                                                     1232    367
442  00CB42I          AN(I,J,K)=0.0                                                     1233    368
443  00CB6EI          AS(I,J,K)=0.0                                                     1234    369
444  00CB9AI          AE(I,J,K)=0.0                                                     1235    370
445  00CBC6I          AW(I,J,K)=0.0                                                     1236    371
446  00CBF2I          AT(I,J,K)=0.0                                                     1237    372
447  00CC1EI          AB(I,J,K)=0.0                                                     1238    373
448  00CC4AI          SU(I,J,K)=F(I,J,K)                                                1239    374
449  00CC9CI          PDUV=0.C                                                          1240    375
450  00CCA8I  530    CONTINUE                                                           1241    376
451               C-----UNDER-RELAXATION                                               1242
452  00CCA8I          P1=1.2*AP(I,J,K)                                                  1243    377
453  00CCDAI          AP(I,J,K)=AP(I,J,K)/ALF                                           1244    378
454  00CD2CI          SU(I,J,K)=SU(I,J,K)+PDUV*(1.0-ALF)*AP(I,J,K)*F(I,J,K)             1245    379
455  00CDDCI          IF(IE .EQ. 1) DU(I,J,K)=TJO(I,J,K)*PDUV/(P1-ANAB)                 1246    380
456  00CE4CI  500    CONTINUE                                                           1247    382
```

```
457                C-----LINEAR EQUATIONS SLOVER                                                    1248
458   00CE94I            DO 550 I=1,ISWF                                                          1249     383
459   00CEA8I     550    CALL LINERX(1,IS,JS,KS,IT,JT,KT,F)                                       1250     384
460                C-----CALCULATE MAXIMUM CORRECTION OF CURRENT ITERATION                         1251
461   00CF0CI            DO 555 I=IS,IT                                                           1252     385
462   00CF24I            DO 555 J=JS,JT                                                           1253     386
463   00CF3CI            DO 555 K=KS,KT                                                           1254     387
464   00CF54I            P1=ABS(F(I,J,K)-F1(I,J,K))                                               1255     388
465   00CFCAI            ERRF=AMAX1(ERRF,P1)                                                      1256     389
466   00CFEAI     555    CONTINUE                                                                 1257     390
467   00D032I            RETURN                                                                   1258     391
468                C-------------------------------------------------------------------------     1259
469                C-----P EQUATION                                                                1260
470   00D03AI       10   CONTINUE                                                                 1261     392
471   00D03AI            IS=2                                                                     1262     393
472   00D042I            IT=L                                                                     1263     394
473   00D04EI            JS=2                                                                     1264     395
474   00D056I            JT=M                                                                     1265     396
475   00D062I            KS=2                                                                     1266     397
476   00D06AI            KT=N                                                                     1267     398
477                C-----SOURCE AT PX LOCATIONS                                                    1268
478   00D076I            DO 310 I=IS,IT                                                           1269     399
479   00D08EI            DO 310 J=JS,JT                                                           1270     400
480   00D0A6I            DO 310 K=KS,KT                                                           1271     401
481   00D0BEI            F(I,J,K)=0.0                                                             1272     402
482   00D0F0I            SUK(I,J,K)=0.0                                                           1273     403
483   00D11CI            SPK(I,J,K)=0.0                                                           1274     404
484   00D148I            SP(I,J,K)=0.0                                                            1275     405
485   00D174I            DENE=DEN(I,J,K)                                                          1276     406
486   00D1A0I            DENW=DEN(I-1,J,K)                                                        1277     407
487   00D1D0I            DENN=0.25*(DEN(I,J,K)+DEN(I-1,J,K)+DEN(I,J+1,K)+DEN(I-1,J+1,K))          1278     408
488   00D284I            DENS=0.25*(DEN(I,J,K)+DEN(I-1,J,K)+DEN(I,J-1,K)+DEN(I-1,J-1,K))          1279     409
489   00D338I            DENT=0.25*(DEN(I,J,K)+DEN(I-1,J,K)+DEN(I,J,K+1)+DEN(I-1,J,K+1))          1280     410
490   00D3E8I            DENB=0.25*(DEN(I,J,K)+DEN(I-1,J,K)+DEN(I,J,K-1)+DEN(I-1,J,K-1))          1281     411
491   00D498I            UE=U(I,J,K)                                                              1282     412
492   00D4C4I            UW=U(I-1,J,K)                                                            1283     413
493   00D4F4I            UN=0.25*(U(I,J,K)+U(I-1,J,K)+U(I,J+1,K)+U(I-1,J+1,K))                    1284     414
494   00D5A8I            US=0.25*(U(I,J,K)+U(I-1,J,K)+U(I,J-1,K)+U(I-1,J-1,K))                    1285     415
495   00D65CI            UT=0.25*(U(I,J,K)+U(I-1,J,K)+U(I,J,K+1)+U(I-1,J,K+1))                    1286     416
496   00D70CI            UB=0.25*(U(I,J,K)+U(I-1,J,K)+U(I,J,K-1)+U(I-1,J,K-1))                    1287     417
497   00D7BCI            VE=V(I,J,K)                                                              1288     418
498   00D7E8I            VW=V(I-1,J,K)                                                            1289     419
499   00D818I            VN=0.25*(V(I,J,K)+V(I-1,J,K)+V(I,J+1,K)+V(I-1,J+1,K))                    1290     420
500   00D8CCI            VS=0.25*(V(I,J,K)+V(I-1,J,K)+V(I,J-1,K)+V(I-1,J-1,K))                    1291     421
501   00D980I            VT=0.25*(V(I,J,K)+V(I-1,J,K)+V(I,J,K+1)+V(I-1,J,K+1))                    1292     422
502   00DA30I            VB=0.25*(V(I,J,K)+V(I-1,J,K)+V(I,J,K-1)+V(I-1,J,K-1))                    1293     423
503   00DAE0I            WE=W(I,J,K)                                                              1294     424
504   00DB0CI            WW=W(I-1,J,K)                                                            1295     425
505   00DB3CI            WN=0.25*(W(I,J,K)+W(I-1,J,K)+W(I,J+1,K)+W(I-1,J+1,K))                    1296     426
506   00DBF0I            WS=0.25*(W(I,J,K)+W(I-1,J,K)+W(I,J-1,K)+W(I-1,J-1,K))                    1297     427
507   00DCA4I            WT=0.25*(W(I,J,K)+W(I-1,J,K)+W(I,J,K+1)+W(I-1,J,K+1))                    1298     428
508   00DD54I            WB=0.25*(W(I,J,K)+W(I-1,J,K)+W(I,J,K-1)+W(I-1,J,K-1))                    1299     429
509   00DE04I            CXQ=0.5*(CX(I,J,K)+CX(I-1,J,K))                                          1300     430
510   00DE60I            EXQ=0.5*(EX(I,J,K)+EX(I-1,J,K))                                          1301     431
511   00DE6CI            SXQ=0.5*(SX(I,J,K)+SX(I-1,J,K))                                          1302     432
512   00DF18I            CYQ=0.5*(CY(I,J,K)+CY(I-1,J,K))                                          1303     433
513   00DF74I            EYQ=0.5*(EY(I,J,K)+EY(I-1,J,K))                                          1304     434
```

```
514  000F90I          SYQ=0.5*(SY(I,J,K)+SY(I-1,J,K))                                                                  1305     435
515  00E02CI          CZQ=0.5*(CZ(I,J,K)+CZ(I-1,J,K))                                                                  1306     436
516  00E088I          EZQ=0.5*(EZ(I,J,K)+EZ(I-1,J,K))                                                                  1307     437
517  00E0E4I          SZQ=0.5*(SZ(I,J,K)+SZ(I-1,J,K))                                                                  1308     438
518  00E140I          CE=DENE*(UE*CXQ+VE*CYQ+WE*CZQ)                                                                   1309     439
519  00E174I          CW=DENW*(UW*CXQ+VW*CYQ+WW*CZQ)                                                                   1310     440
520  00E1A8I          CN=DENN*(UN*EXQ+VN*EYQ+WN*EZQ)                                                                   1311     441
521  00E1DCI          CS=DENS*(US*EXQ+VS*EYQ+WS*EZQ)                                                                   1312     442
522  00E210I          CT=DENT*(UT*SXQ+VT*SYQ+WT*SZQ)                                                                   1313     443
523  00E244I          CB=DENB*(UB*SXQ+VB*SYQ+WB*SZQ)                                                                   1314     444
524  00E278I          SUK(I,J,K)=-(CE-CW+CN-CS+CT-CB)*(TJO(I-1,J,K)+TJO(I,J,K))*0.5                                    1315     445
525  00E322I    310   CONTINUE                                                                                         1316     446
526               C-----SOURCE AT PY LOCATIONS                                                                        1317
527  00E36AI          DO 311 I=IS,IT                                                                                   1318     447
528  00E382I          DO 311 J=JS,JT                                                                                   1319     448
529  00E39AI          DO 311 K=KS,KT                                                                                   1320     449
530  00E3B2I          DENN=DEN(I,J,K)                                                                                  1321     450
531  00E3DEI          DENS=DEN(I,J-1,K)                                                                                1322     451
532  00E40EI          DENE=0.25*(DEN(I,J,K)+DEN(I,J-1,K)+DEN(I+1,J,K)+DEN(I+1,J-1,K))                                  1323     452
533  00E4C2I          DENW=0.25*(DEN(I,J,K)+DEN(I,J-1,K)+DEN(I-1,J,K)+DEN(I-1,J-1,K))                                  1324     453
534  00E576I          DENT=0.25*(DEN(I,J,K)+DEN(I,J-1,K)+DEN(I,J,K+1)+DEN(I,J-1,K+1))                                  1325     454
535  00E626I          DENB=0.25*(DEN(I,J,K)+DEN(I,J-1,K)+DEN(I,J,K-1)+DEN(I,J-1,K-1))                                  1326     455
536  00E6D6I          UN=U(I,J,K)                                                                                      1327     456
537  00E702I          US=U(I,J-1,K)                                                                                    1328     457
538  00E732I          UE=0.25*(U(I,J,K)+U(I,J-1,K)+U(I+1,J,K)+U(I+1,J-1,K))                                            1329     458
539  00E7E6I          UW=0.25*(U(I,J,K)+U(I,J-1,K)+U(I-1,J,K)+U(I-1,J-1,K))                                            1330     459
540  00E89AI          UT=0.25*(U(I,J,K)+U(I,J-1,K)+U(I,J,K+1)+U(I,J-1,K+1))                                            1331     460
541  00E94AI          UB=0.25*(U(I,J,K)+U(I,J-1,K)+U(I,J,K-1)+U(I,J-1,K-1))                                            1332     461
542  00E9FAI          VN=V(I,J,K)                                                                                      1333     462
543  00EA26I          VS=V(I,J-1,K)                                                                                    1334     463
544  00EA56I          VE=0.25*(V(I,J,K)+V(I,J-1,K)+V(I+1,J,K)+V(I+1,J-1,K))                                            1335     464
545  00EB0AI          VW=0.25*(V(I,J,K)+V(I,J-1,K)+V(I-1,J,K)+V(I-1,J-1,K))                                            1336     465
546  00EB8EI          VT=0.25*(V(I,J,K)+V(I,J-1,K)+V(I,J,K+1)+V(I,J-1,K+1))                                            1337     466
547  00EC6EI          VB=0.25*(V(I,J,K)+V(I,J-1,K)+V(I,J,K-1)+V(I,J-1,K-1))                                            1338     467
548  00ED1EI          WN=W(I,J,K)                                                                                      1339     468
549  00ED4AI          WS=W(I,J-1,K)                                                                                    1340     469
550  00ED7AI          WE=0.25*(W(I,J,K)+W(I,J-1,K)+W(I+1,J,K)+W(I+1,J-1,K))                                            1341     470
551  00EE2EI          WW=0.25*(W(I,J,K)+W(I,J-1,K)+W(I-1,J,K)+W(I-1,J-1,K))                                            1342     471
552  00EEE2I          WT=0.25*(W(I,J,K)+W(I,J-1,K)+W(I,J,K+1)+W(I,J-1,K+1))                                            1343     472
553  00EF92I          WB=0.25*(W(I,J,K)+W(I,J-1,K)+W(I,J,K-1)+W(I,J-1,K-1))                                            1344     473
554  00F042I          CXQ=0.5*(CX(I,J,K)+CX(I,J-1,K))                                                                  1345     474
555  00F09EI          EXQ=0.5*(EX(I,J,K)+EX(I,J-1,K))                                                                  1346     475
556  00F0FAI          SXQ=0.5*(SX(I,J,K)+SX(I,J-1,K))                                                                  1347     476
557  00F156I          CYQ=0.5*(CY(I,J,K)+CY(I,J-1,K))                                                                  1348     477
558  00F192I          EYQ=0.5*(EY(I,J,K)+EY(I,J-1,K))                                                                  1349     478
559  00F20EI          SYQ=0.5*(SY(I,J,K)+SY(I,J-1,K))                                                                  1350     479
560  00F26AI          CZQ=0.5*(CZ(I,J,K)+CZ(I,J-1,K))                                                                  1351     480
561  00F2C6I          EZQ=0.5*(EZ(I,J,K)+EZ(I,J-1,K))                                                                  1352     481
562  00F322I          SZQ=0.5*(SZ(I,J,K)+SZ(I,J-1,K))                                                                  1353     482
563  00F37EI          CE=DENE*(UE*CXQ+VE*CYQ+WE*CZQ)                                                                   1354     483
564  00F3B2I          CW=DENW*(UW*CXQ+VW*CYQ+WW*CZQ)                                                                   1355     484
565  00F3E6I          CN=DENN*(UN*EXQ+VN*EYQ+WN*EZQ)                                                                   1356     485
566  00F41AI          CS=DENS*(US*EXQ+VS*EYQ+WS*EZQ)                                                                   1357     486
567  00F44EI          CT=DENT*(UT*SXQ+VT*SYQ+WT*SZQ)                                                                   1358     487
568  00F482I          CB=DENB*(UB*SXQ+VB*SYQ+WB*SZQ)                                                                   1359     488
569  00F486I          SPK(I,J,K)=-(CE-CW+CN-CS+CT-CB)*(TJO(I,J-1,K)+TJO(I,J,K))*0.5                                    1360     489
570  00F560I    311   CONTINUE                                                                                         1361     490
```

```
571            C-----SOURCE AT PZ LOCATIONS                                                                                    1362
572   00F5A8I          DO 312 I=IS,IT                                                                                         1363      491
573   00F5C0I          DO 312 J=JS,JT                                                                                         1364      492
574   00F5D8I          DO 312 K=KS,KT                                                                                         1365      493
575   00F5F0I          DENT=DEN(I,J,K)                                                                                        1366      494
576   00F61CI          DENS=DEN(I,J,K-1)                                                                                      1367      495
577   00F64AI          DENN=0.25*(DEN(I,J,K)+DEN(I,J,K-1)+DEN(I,J+1,K)+DEN(I,J+1,K-1))                                        1368      496
578   00F6FAI          DENS=0.25*(DEN(I,J,K)+DEN(I,J,K-1)+DEN(I,J-1,K)+DEN(I,J-1,K-1))                                        1369      497
579   00F7AAI          DENE=0.25*(DEN(I,J,K)+DEN(I,J,K-1)+DEN(I+1,J,K)+DEN(I+1,J,K-1))                                        1370      498
580   00F85AI          DENW=0.25*(DEN(I,J,K)+DEN(I,J,K-1)+DEN(I-1,J,K)+DEN(I-1,J,K-1))                                        1371      499
581   00F90AI          UT=U(I,J,K)                                                                                            1372      500
582   00F936I          UB=U(I,J,K-1)                                                                                          1373      501
583   00F964I          UN=0.25*(U(I,J,K)+U(I,J,K-1)+U(I,J+1,K)+U(I,J+1,K-1))                                                  1374      502
584   00FA14I          US=0.25*(U(I,J,K)+U(I,J,K-1)+U(I,J-1,K)+U(I,J-1,K-1))                                                  1375      503
585   00FAC4I          UE=0.25*(U(I,J,K)+U(I,J,K-1)+U(I+1,J,K)+U(I+1,J,K-1))                                                  1376      504
586   00FB74I          UW=0.25*(U(I,J,K)+U(I,J,K-1)+U(I-1,J,K)+U(I-1,J,K-1))                                                  1377      505
587   00FC24I          VT=V(I,J,K)                                                                                            1378      506
588   00FC50I          VB=V(I,J,K-1)                                                                                          1379      507
589   00FC7EI          VN=0.25*(V(I,J,K)+V(I,J,K-1)+V(I,J+1,K)+V(I,J+1,K-1))                                                  1380      508
590   00FD2EI          VS=0.25*(V(I,J,K)+V(I,J,K-1)+V(I,J-1,K)+V(I,J-1,K-1))                                                  1381      509
591   00FDDEI          VE=0.25*(V(I,J,K)+V(I,J,K-1)+V(I+1,J,K)+V(I+1,J,K-1))                                                  1382      510
592   00FE8EI          VW=0.25*(V(I,J,K)+V(I,J,K-1)+V(I-1,J,K)+V(I-1,J,K-1))                                                  1383      511
593   00FF3EI          WT=W(I,J,K)                                                                                            1384      512
594   00FF6AI          WB=W(I,J,K-1)                                                                                          1385      513
595   00FF98I          WN=0.25*(W(I,J,K)+W(I,J,K-1)+W(I,J+1,K)+W(I,J+1,K-1))                                                  1386      514
596   0100A8I          WS=0.25*(W(I,J,K)+W(I,J,K-1)+W(I,J-1,K)+W(I,J-1,K-1))                                                  1387      515
597   0100F8I          WE=0.25*(W(I,J,K)+W(I,J,K-1)+W(I+1,J,K)+W(I+1,J,K-1))                                                  1388      516
598   0101A8I          WW=0.25*(W(I,J,K)+W(I,J,K-1)+W(I-1,J,K)+W(I-1,J,K-1))                                                  1389      517
599   010258I          CXQ=0.5*(CX(I,J,K)+CX(I,J,K-1))                                                                        1390      518
600   0102B2I          EXQ=0.5*(EX(I,J,K)+EX(I,J,K-1))                                                                        1391      519
601   01030CI          SXQ=0.5*(SX(I,J,K)+SX(I,J,K-1))                                                                        1392      520
602   010366I          CYQ=0.5*(CY(I,J,K)+CY(I,J,K-1))                                                                        1393      521
603   0103C0I          EYQ=0.5*(EY(I,J,K)+EY(I,J,K-1))                                                                        1394      522
604   01041AI          SYQ=0.5*(SY(I,J,K)+SY(I,J,K-1))                                                                        1395      523
605   010474I          CZQ=0.5*(CZ(I,J,K)+CZ(I,J,K-1))                                                                        1396      524
606   0104CEI          EZQ=0.5*(EZ(I,J,K)+EZ(I,J,K-1))                                                                        1397      525
607   010528I          SZQ=0.5*(SZ(I,J,K)+SZ(I,J,K-1))                                                                        1398      526
608   0105B2I          CE=DENE*(UE*CXQ+VE*CYQ+WE*CZQ)                                                                         1399      527
609   0105B6I          CW=DENW*(UW*CXQ+VW*CYQ+WW*CZQ)                                                                         1400      528
610   0105EAI          CN=DENN*(UN*EXQ+VN*EYQ+WN*EZQ)                                                                         1401      529
611   01061EI          CS=DENS*(US*EXQ+VS*EYQ+WS*EZQ)                                                                         1402      530
612   0106B2I          CT=DENT*(UT*SXQ+VT*SYQ+WT*SZQ)                                                                         1403      531
613   0106B6I          CB=DENB*(UB*SXQ+VB*SYQ+WB*SZQ)                                                                         1404      532
614   01063AI          SP(I,J,K)=-(CE-CW+CN-CS+CT-CB)*(TJO(I,J,K-1)+TJO(I,J,K))*0.5                                           1405      533
615   0107B2I    312   CONTINUE                                                                                               1406      534
616            C-----LINK COEFF. AND SOURCE TERM AT CELL CENTER                                                               1407
617   0107AAI          DO 100 I=IS,IT                                                                                         1408      535
618   0107C2I          DO 100 J=JS,JT                                                                                         1409      536
619   0107DAI          DO 100 K=KS,KT                                                                                         1410      537
620   0107F2I          II=I-1                                                                                                 1411      538
621   0108C0I          JJ=J-1                                                                                                 1412      539
622   01080EI          KK=K-1                                                                                                 1413      540
623   01081CI          GAE=(DU(I,J,K)+DU(I,JJ,K)+DU(I,J,KK)+DU(I,JJ,KK))*0.25                                                 1414      541
624   0108C0I          GAW=(DU(II,J,K)+DU(II,JJ,K)+DU(II,J,KK)+DU(II,JJ,KK))*0.25                                             1415      542
625   0109B4I          GAN=(DU(I,J,K)+DU(II,J,K)+DU(I,J,KK)+DU(II,J,KK))*0.25                                                 1416      543
626   0104D8I          GAS=(DU(I,JJ,K)+DU(II,JJ,K)+DU(I,JJ,KK)+DU(II,JJ,KK))*0.25                                             1417      544
627   010AACI          GAT=(DU(I,J,K)+DU(II,J,K)+DU(I,JJ,K)+DU(II,JJ,K))*0.25                                                 1418      545
```

```
628  010B50I          GAB=(DU(I,J,KK)+DU(II,J,KK)+DU(I,JJ,KK)+DU(II,JJ,KK))*0.25                1419     546
629  010BF4I          TXXEQ=(TXXE(I,J,K)+TXXE(II,JJ,KK))*0.5                                   1420     547
630  010C4CI          TXXWQ=(TXXW(I,J,K)+TXXW(II,JJ,KK))*0.5                                   1421     548
631  010CA4I          TYYNQ=(TYYN(I,J,K)+TYYN(II,JJ,KK))*0.5                                   1422     549
632  010CFCI          TYYSQ=(TYYS(I,J,K)+TYYS(II,JJ,KK))*0.5                                   1423     550
633  010D54I          TZZTQ=(TZZT(I,J,K)+TZZT(II,JJ,KK))*0.5                                   1424     551
634  010DACI          TZZBQ=(TZZB(I,J,K)+TZZB(II,JJ,KK))*0.5                                   1425     552
635  010E04I          TQ=(TJC(I,J,K)+TJC(II,JJ,KK))*0.5                                        1426     553
636  010E5CI          AE(I,J,K)=TQ*(GAE*TXXEQ)                                                  1427     554
637  010E94I          AW(I,J,K)=TQ*(GAW*TXXWQ)                                                  1428     555
638  010ECCI          AN(I,J,K)=TQ*(GAN*TYYNQ)                                                  1429     556
639  010F04I          AS(I,J,K)=TQ*(GAS*TYYSQ)                                                  1430     557
640  010F3CI          AT(I,J,K)=TQ*(GAT*TZZTQ)                                                  1431     558
641  010F74I          AB(I,J,K)=TQ*(GAB*TZZBQ)                                                  1432     559
642                C-----P' SOURCE                                                             1433
643  010FACI          P1=1.0                                                                    1434     560
644  010FB8I          P2=1.0                                                                    1435     561
645  010FC4I          P3=1.0                                                                    1436     562
646  010FD0I          P4=1.0                                                                    1437     563
647  010FDCI          P5=1.0                                                                    1438     564
648  010FE8I          P6=1.0                                                                    1439     565
649  010FF4I          IF(GAN .EQ. 0.0) P1=0.0                                                   1440     566
650  011012I          IF(GAS .EQ. 0.0) P2=0.0                                                   1441     568
651  011030I          IF(GAE .EQ. 0.0) P3=0.0                                                   1442     570
652  01104EI          IF(GAW .EQ. 0.0) P4=0.0                                                   1443     572
653  01106CI          IF(GAT .EQ. 0.0) P5=0.0                                                   1444     574
654  01108AI          IF(GAB .EQ. 0.0) P6=0.0                                                   1445     576
655  0110A8I          PQ=0.5*((P1+P2)*(P3+P4+P5+P6)+(P3+P4)*(P1+P2+P5+P6)+                      1446     578
656                   1         (P5+P6)*(P1+P2+P3+P4))                                          1447
657  01112AI          IF(PQ .EQ. 0.0) PQ=1.0                                                    1448     579
658  011148I          SU(I,J,K)=(P1*P5*SUK(I,J,K)+P5*P2*SUK(I,J-1,K)+                           1449     581
659                   1            P2*P6*SUK(I,J-1,K-1)+P6*P1*SUK(I,J,K-1)+                     1450
660                   2            P3*P5*SPK(I,J,K)+P5*P4*SPK(I-1,J,K)+                         1451
661                   3            P4*P6*SPK(I-1,J,K-1)+P6*P3*SPK(I,J,K-1)+                     1452
662                   4            P1*P3*SP(I,J,K)+P3*P2*SP(I,J-1,K)+                           1453
663                   5            P2*P4*SP(I-1,J-1,K)+P4*P1*SP(I-1,J,K))/PQ                    1454
664  01140AI     100  CONTINUE                                                                  1455     582
665                C-----LINK COEFF. ASSEMBLY AND BLOCKAGES                                    1456
666  011452I          DO 870 I=IS,IT                                                            1457     583
667  01146AI          DO 870 J=JS,JT                                                            1458     584
668  011482I          DO 870 K=KS,KT                                                            1459     585
669  01149AI          ANAB=AE(I,J,K)+AW(I,J,K)+AN(I,J,K)+AS(I,J,K)+AT(I,J,K)+AB(I,J,K)          1460     586
670  0114B4I          AP(I,J,K)=ANAB                                                            1461     587
671  0114B0I          IF(MC(I,J,K) .LT. 2) GO TO 870                                            1462     588
672  0115E6I          AP(I,J,K)=1.0                                                             1463     590
673  011612I          AE(I,J,K)=0.0                                                             1464     591
674  01163EI          AW(I,J,K)=0.0                                                             1465     592
675  01166AI          AN(I,J,K)=0.0                                                             1466     593
676  011696I          AS(I,J,K)=0.0                                                             1467     594
677  0116C2I          AT(I,J,K)=0.0                                                             1468     595
678  0116EEI          AB(I,J,K)=0.0                                                             1469     596
679  01171AI          SU(I,J,K)=0.0                                                             1470     597
680  011746I     870  CONTINUE                                                                  1471     598
681                C-----LINEAR EQUATIONS SOLVER                                               1472
682  01178EI          CALL LINERX(2,IS,JS,KS,IT,JT,KT,F)                                        1473     599
683  0117DCI          DO 850 I=1,ISWF                                                           1474     600
684  0117F0I     850  CALL LINERX(1,IS,JS,KS,IT,JT,KT,F)                                        1475     601
```

```
685                C-----PRESSURE AND VELOCITIES CORRECTIONS                                                    1476
686   011854I            PPREF=F(2,2,2)                                                                        1477      602
687   011864I            DO 880 I=IS,IT                                                                        1478      603
688   01187CI            DO 880 J=JS,JT                                                                        1479      604
689   011894I            DO 880 K=KS,KT                                                                        1480      605
690   0118ACI            IF(MC(I,J,K) .GE. 2) GO TO 880                                                        1481      606
691   0118E2I            P1=F(I,J,K)-PPREF                                                                     1482      608
692   01191AI            P(I,J,K)=P(I,J,K)+ALP*P1                                                              1483      609
693   011972I            ERRF=AMAX1(ERRF,ABS(P1))                                                              1484      610
694   0119AEI     880    CONTINUE                                                                              1485      611
695   0119F6I            DO 600 I=2,LT                                                                         1486      612
696   011A0AI            DO 600 J=2,MT                                                                         1487      613
697   011A1EI            DO 600 K=2,NT                                                                         1488      614
698   011A32I            IF(MC(I,J,K) .GE. 1) GO TO 600                                                        1489      615
699   011A68I            II=I+1                                                                                1490      617
700   011A76I            JJ=J+1                                                                                1491      618
701   011A84I            KK=K+1                                                                                1492      619
702   011A92I            PE=(F(II,J,K)+F(II,JJ,K)+F(II,J,KK)+F(II,JJ,KK))*0.25                                 1493      620
703   011B4EI            PW=(F(I,J,K)+F(I,JJ,K)+F(I,J,KK)+F(I,JJ,KK))*0.25                                     1494      621
704   011C0AI            PN=(F(I,JJ,K)+F(II,JJ,K)+F(I,JJ,KK)+F(II,JJ,KK))*0.25                                 1495      622
705   011CC6I            PS=(F(I,J,K)+F(II,J,K)+F(I,J,KK)+F(II,J,KK))*0.25                                     1496      623
706   011D82I            PT=(F(I,J,KK)+F(II,J,KK)+F(I,JJ,KK)+F(II,JJ,KK))*0.25                                 1497      624
707   011E3EI            PB=(F(I,J,K)+F(II,J,K)+F(I,JJ,K)+F(II,JJ,K))*0.25                                     1498      625
708   011EFAI            PCXI=PE-PW                                                                            1499      626
709   011F0CI            PEDA=PN-PS                                                                            1500      627
710   011F1EI            PSCI=PT-PB                                                                            1501      628
711   011F30I            CXQ=CX(I,J,K)                                                                         1502      629
712   011F5CI            EXQ=EX(I,J,K)                                                                         1503      630
713   011F88I            SXQ=SX(I,J,K)                                                                         1504      631
714   011FB4I            CYQ=CY(I,J,K)                                                                         1505      632
715   011FE0I            EYQ=EY(I,J,K)                                                                         1506      633
716   01200CI            SYQ=SY(I,J,K)                                                                         1507      634
717   012038I            CZQ=CZ(I,J,K)                                                                         1508      635
718   012064I            EZQ=EZ(I,J,K)                                                                         1509      636
719   012090I            SZQ=SZ(I,J,K)                                                                         1510      637
720   0120BCI            PXX=PCXI*CXQ+PEDA*EXQ+PSCI*SXQ                                                        1511      638
721   0120EAI            PYY=PCXI*CYQ+PEDA*EYQ+PSCI*SYQ                                                        1512      639
722   012118I            PZZ=PCXI*CZQ+PEDA*EZQ+PSCI*SZQ                                                        1513      640
723   012146I            U(I,J,K)=U(I,J,K)-DU(I,J,K)*PXX                                                       1514      641
724   0121C0I            V(I,J,K)=V(I,J,K)-DU(I,J,K)*PYY                                                       1515      642
725   01223AI            W(I,J,K)=W(I,J,K)-DU(I,J,K)*PZZ                                                       1516      643
726   0122B4I     600    CONTINUE                                                                              1517      644
727   0122FCI            RETURN                                                                                1518      645
728   012304I            END                                                                                   1519      646

NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  SOLVEQ    02/21/86  09:58:31  TABLE SPACE:  18 KB
STATEMENT BUFFER:   20 LINES/1321 BYTES    STACK SPACE: 203 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
 1  000000I          SUBROUTINE LINERX(ISOL,IS,JS,KS,LT,MT,NT,F)                    1520
 2  000004I          DIMENSION A(20),B(20),C(20),D(20),F(21,18,10),BB(21,18,10)     1521
 3  000004I          COMMON                                                         1522
                    1/COEF/ AP(21,18,10),SU(21,18,10),SP(21,18,10),SUK(21,18,10),  1523
 5                  2   SPK(21,18,10),AE(21,18,10),AW(21,18,10),AN(21,18,10),      1524
 6                  3   AS(21,18,10),AT(21,18,10),AB(21,18,10),APO(21,18,10)       1525
 7                C-----LINEAR EQUATIONS SOLVERS                                   1526
 8  000004I          GO TO (1,2),ISOL                                               1527      1
 9                C-----LINE-RELAXATION USING TOMA                                 1528
10  003C86I       1  CONTINUE                                                       1529      2
11  003C86I          DO 10 I=IS,LT                                                  1530      3
12  003C9EI          DO 10 J=JS,MT                                                  1531      4
13  003C86I          DO 10 K=KS,NT                                                  1532      5
14  003CCEI          BB(I,J,K)=AE(I,J,K)*F(I+1,J,K)+AN(I,J,K)*F(I,J+1,K)+           1533      6
15                 1          SU(I,J,K)                                           1534
16  003DC8I      10  CONTINUE                                                       1535      7
17  003E10I          A(KS-1)=0.0                                                    1536      8
18  003E24I          DO 100 I=IS,LT                                                 1537      9
19  003E3CI          DO 100 J=JS,MT                                                 1538     10
20  003E54I          C(KS-1)=F(I,J,KS-1)                                            1539     11
21  003E90I          DO 101 K=KS,NT                                                 1540     12
22  003EA8I          A(K)=AT(I,J,K)                                                 1541     13
23  003EDAI          B(K)=AB(I,J,K)                                                 1542     14
24  003F0CI          C(K)=BB(I,J,K)+AW(I,J,K)*F(I-1,J,K)+                           1543     15
25                 1      AS(I,J,K)*F(I,J-1,K)                                    1544
26  003FECI          D(K)=AP(I,J,K)                                                 1545     16
27  00401EI          TERM1=C(K)-B(K)*A(K-1)+1.E-30                                  1546     17
28  0040541          TERM=1.C/TERM1                                                 1547     18
29  004066I          A(K)=A(K)*TERM                                                 1548     19
30  004088I    101   C(K)=(C(K)+B(K)*C(K-1))*TERM                                   1549     20
31  0040E0I          DO 102 KK=KS,NT                                                1550     21
32  0040F8I          K=KS+NT-KK                                                     1551     22
33  004110I    102   F(I,J,K)=A(K)*F(I,J,K+1)+C(K)                                  1552     23
34  00419EI    100   CONTINUE                                                       1553     24
35  0041CEI          RETURN                                                         1554     25
36                C-----BLOCK CORRECTION FOR PRESSURE FIELD                        1555
37  004106I       2  CONTINUE                                                       1556     26
38  004106I          DO 201 I=IS,LT                                                 1557     27
39  0041EEI          A(I)=0.C                                                       1558     28
40  004202I          B(I)=0.C                                                       1559     29
41  004216I          C(I)=0.C                                                       1560     30
42  00422AI          D(I)=0.0                                                       1561     31
43  00423EI          DO 201 J=JS,MT                                                 1562     32
44  004256I          DO 201 K=KS,NT                                                 1563     33
45  00426EI          A(I)=A(I)-AE(I,J,K)                                            1564     34
46  004280I          B(I)=B(I)-AW(I,J,K)                                            1565     35
47  0042F2I          C(I)=C(I)+SU(I,J,K)                                            1566     36
48  004334I    201   CONTINUE                                                       1567     37
49  00437CI          DO 202 I=IS,LT                                                 1568     38
50  004394I          ANAB=-A(I)-B(I)                                                1569     39
51  00433CI    202   D(I)=ANAB*1.5                                                  1570     40
52  0043EEI          DO 203 I=IS+1,LT                                               1571     41
53  00440AI          TERM=B(I)/D(I-1)                                               1572     42
54  00442EI          D(I)=D(I)-TERM*A(I-1)                                          1573     43
55  004462I    203   C(I)=C(I)-TERM*C(I-1)                                          1574     44
56  0044AEI          F(LT,JS,KS)=C(LT)/D(LT)                                        1575     45
57  0044F6I          DO 204 II=IS+1,LT                                              1576     46
```

```
 58  004512I          I=IS+LT-II                                                  1577      47
 59  00452AI     204  F(I,JS,KS)=(C(I)-A(I)*F(I+1,JS,KS))/D(I)                   1578      48
 60  0045CAI          DO 205 I=IS,LT                                              1579      49
 61  0045E2I          PPBLK=F(I,JS,KS)                                            1580      50
 62  004614I          DO 205 J=JS+1,MT                                            1581      51
 63  004630I          DO 205 K=KS+1,NT                                            1582      52
 64  00464CI          F(I,J,K)=PPBLK                                              1583      53
 65  00467EI     205  CONTINUE                                                    1584      54
 66  0046C6I          RETURN                                                      1585      55
 67  0046CEI          END                                                         1586      56

NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  LINERX    02/21/86  09:59:43  TABLE SPACE:    3 KB
STATEMENT BUFFER:    20 LINES/1321 BYTES    STACK SPACE: 199 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
      SUBROUTINE BOUNC(IE,F)                                            1587
      DIMENSION F(21,18,10)                                             1588
      COMMON                                                            1589
     1/VAR/U(21,18,10),V(21,18,10),P(21,18,10),DK(21,18,10),            1590
     2  DE(21,18,10),ERRU,ERRV,ERRM,ERRK,ERRE,ERRW,                     1591
     3  PP(21,18,10),W(21,18,10),TM(21,18,10)                           1592
     1/PROP/ VISE(21,18,10),DEN(21,18,10),VISC,DENIN,FLOWIN             1593
     1/PCOR/ DU(21,18,10),DV(21,18,10),DW(21,18,10)                     1594
     1/TUR/ SIGK,SIGE,CMU,C1,C2,CMU1,CMU2,E,CK,HINUM,SMNUM,ANV1(800),   1595
     2 YN(800),YN1(800),SINX(800),SINY(800),SINZ(800),ANW1(800),        1596
     3 YPLN(800),TAUN(800),I8C(800),J8C(800),K8C(800),IITY(800),        1597
     4 TALW(800),GEN(21,18,10),MC(21,18,10),IJLO(21,18,10),IITO         1598
     1/COEF/ AP(21,18,10),SU(21,18,10),SP(21,18,10),SUK(21,18,10),      1599
     2   SPK(21,18,10),AE(21,18,10),AW(21,18,10),AN(21,18,10),          1600
     3   AS(21,18,10),AT(21,18,10),AB(21,18,10),APO(21,18,10)           1601
      COMMON                                                            1602
     1/TRAN/ X(21,18,10),Y(21,18,10),Z(21,18,10),TJO(21,18,10),         1603
     2   CX(21,18,10),CY(21,18,10),CZ(21,18,10),                        1604
     3   EX(21,18,10),EY(21,18,10),EZ(21,18,10),                        1605
     3   SX(21,18,10),SY(21,18,10),SZ(21,18,10)                         1606
     1/LIMT/ L,M,LT,MT,L1,L2,M1,M2,LO,MO,ISWU,ISWV,ISWP,ISWK,ISWE,       1607
     2   ALU,ALV,ALP,ALK,ALE,ALVIS,ALW,N,N1,N2,NO,ISWW,IG,NT,ALC,DTT    1608
C-----EVALUATE WALL BOUNDARY CONDITIONS USING WALL FUNCTIONS            1609
      DO 150 III=1,IITO                                                 1610      1
      I=I8C(III)                                                        1611      2
      J=J8C(III)                                                        1612      3
      K=K8C(III)                                                        1613      4
      GO TO (1,2,3,4,5,6), IITY(III)                                    1614      5
    1 CONTINUE                                                          1615      6
C-----NORTH                                                             1616
      YP=YN(III)                                                        1617      7
      YP1=YN1(III)                                                      1618      8
      CDK=DK(I,J,K)                                                     1619      9
      CDE=DE(I,J,K)                                                     1620     10
      CDEN=DEN(I,J,K)                                                   1621     11
      CALL WALLFN(IE,YP,YP1,CDK,CDE,CDEN,SINX(III),SINY(III),           1622     12
     1      SINZ(III),F(I,J+1,K),AN(I,J,K),SU(I,J,K),SP(I,J,K),        1623
     2      TAUN(III),YPLN(III),GEN(I,J,K),VISE(I,J,K),                1624
     3      U(I,J+1,K),V(I,J+1,K),W(I,J+1,K),U(I,J,K),V(I,J,K),        1625
     4      W(I,J,K),U(I,J-1,K),V(I,J-1,K),W(I,J-1,K),                 1626
     5     -SPK(I,J,K),SPK(I,J,K),ANV1(III),ANW1(III),TJO(I,J,K))      1627
      GO TO 150                                                         1628     13
    2 CONTINUE                                                          1629     14
C-----SOUTH                                                             1630
      YP=YN(III)                                                        1631     15
      YP1=YN1(III)                                                      1632     16
      CDK=DK(I,J,K)                                                     1633     17
      CDE=DE(I,J,K)                                                     1634     18
      CDEN=DEN(I,J,K)                                                   1635     19
      CALL WALLFN(IE,YP,YP1,CDK,CDE,CDEN,SINX(III),SINY(III),           1636     20
     1      SINZ(III),F(I,J-1,K),AN(I,J,K),SU(I,J,K),SP(I,J,K),        1637
     2      TAUN(III),YPLN(III),GEN(I,J,K),VISE(I,J,K),                1638
     3      U(I,J-1,K),V(I,J-1,K),W(I,J-1,K),U(I,J,K),V(I,J,K),        1639
     4      W(I,J,K),U(I,J+1,K),V(I,J+1,K),W(I,J+1,K),                 1640
     5     -SPK(I,J,K),SPK(I,J,K),ANV1(III),ANW1(III),TJO(I,J,K))      1641
      GO TO 150                                                         1642     21
    3 CONTINUE                                                          1643     22
```

```
                C-----EAST                                                                1644
0004D6I                 YP=YN(III)                                                        1645        23
0004E4I                 YP1=YN1(III)                                                      1646        24
0004F2I                 CDK=DK(I,J,K)                                                     1647        25
000B2AI                 CDE=DE(I,J,K)                                                     1648        26
000B56I                 CDEN=DEN(I,J,K)                                                   1649        27
000B82I                 CALL WALLFN(IE,YP,YP1,CDK,CDE,CDEN,SINX(III),SINY(III),           1650        28
                       1      SINZ(III),F(I+1,J,K),AN(I,J,K),SU(I,J,K),SP(I,J,K),       1651
                       2      TAUN(III),YPLN(III),GEN(I,J,K),VISE(I,J,K),               1652
                       3      U(I+1,J,K),V(I+1,J,K),W(I+1,J,K),U(I,J,K),V(I,J,K),       1653
                       4      W(I,J,K),U(I-1,J,K),V(I-1,J,K),W(I-1,J,K),                1654
                       5     -SPK(I,J,K),SPK(I,J,K),ANV1(III),ANW1(III),TJC(I,J,K))     1655
000FECI                 GO TO 150                                                         1656        29
000FF2I            4    CONTINUE                                                          1657        30
                C-----WEST                                                                1658
000FF2I                 YP=YN(III)                                                        1659        31
001006I                 YP1=YN1(III)                                                      1660        32
001014I                 CDK=DK(I,J,K)                                                     1661        33
001046I                 CDE=DE(I,J,K)                                                     1662        34
001072I                 CDEN=DEN(I,J,K)                                                   1663        35
00109EI                 CALL WALLFN(IE,YP,YP1,CDK,CDE,CDEN,SINX(III),SINY(III),           1664        36
                       1      SINZ(III),F(I-1,J,K),AN(I,J,K),SU(I,J,K),SP(I,J,K),       1665
                       2      TAUN(III),YPLN(III),GEN(I,J,K),VISE(I,J,K),               1666
                       3      U(I-1,J,K),V(I-1,J,K),W(I-1,J,K),U(I,J,K),V(I,J,K),       1667
                       4      W(I,J,K),U(I+1,J,K),V(I+1,J,K),W(I+1,J,K),                1668
                       5     -SPK(I,J,K),SPK(I,J,K),ANV1(III),ANW1(III),TJC(I,J,K))     1669
001508I                 GO TO 150                                                         1670        37
00150EI            5    CONTINUE                                                          1671        38
                C-----TOP                                                                 1672
00150EI                 YP=YN(III)                                                        1673        39
001522I                 YP1=YN1(III)                                                      1674        40
001536I                 CDK=DK(I,J,K)                                                     1675        41
001562I                 CDE=DE(I,J,K)                                                     1676        42
00158EI                 CDEN=DEN(I,J,K)                                                   1677        43
00159AI                 CALL WALLFN(IE,YP,YP1,CDK,CDE,CDEN,SINX(III),SINY(III),           1678        44
                       1      SINZ(III),F(I,J,K+1),AN(I,J,K),SU(I,J,K),SP(I,J,K),       1679
                       2      TAUN(III),YPLN(III),GEN(I,J,K),VISE(I,J,K),               1680
                       3      U(I,J,K+1),V(I,J,K+1),W(I,J,K+1),U(I,J,K),V(I,J,K),       1681
                       4      W(I,J,K),U(I,J,K-1),V(I,J,K-1),W(I,J,K-1),                1682
                       5     -SPK(I,J,K),SPK(I,J,K),ANV1(III),ANW1(III),TJC(I,J,K))     1683
001A18I                 GO TO 150                                                         1684        45
001A1EI            6    CONTINUE                                                          1685        46
                C-----BOTTOM                                                              1686
001A1EI                 YP=YN(III)                                                        1687        47
001A32I                 YP1=YN1(III)                                                      1688        48
001A46I                 CDK=DK(I,J,K)                                                     1689        49
001A72I                 CDE=DE(I,J,K)                                                     1690        50
001A9EI                 CDEN=DEN(I,J,K)                                                   1691        51
001ACAI                 CALL WALLFN(IE,YP,YP1,CDK,CDE,CDEN,SINX(III),SINY(III),           1692        52
                       1      SINZ(III),F(I,J,K-1),AN(I,J,K),SU(I,J,K),SP(I,J,K),       1693
                       2      TAUN(III),YPLN(III),GEN(I,J,K),VISE(I,J,K),               1694
                       3      U(I,J,K-1),V(I,J,K-1),W(I,J,K-1),U(I,J,K),V(I,J,K),       1695
                       4      W(I,J,K),U(I,J,K+1),V(I,J,K+1),W(I,J,K+1),                1696
                       5     -SPK(I,J,K),SPK(I,J,K),ANV1(III),ANW1(III),TJC(I,J,K))     1697
001F28I            150  CONTINUE                                                          1698        53
001F40I                 RETURN                                                            1699        54
001F46I                 END                                                               1700        55
```

```
NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  BOUNC      02/21/86  10:00:46  TABLE SPACE:    7 KB
STATEMENT BUFFER:    20 LINES/1321 BYTES     STACK SPACE: 136 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
      SUBROUTINE WALLFN(IE,YP,YP1,DK1,DE1,DEN1,SINX1,SINY1,                1701
     1      SINZ1,P1,AN1,SU1,SP1,                                          1702
     2      TAUN1,YPLN1,GEN1,VISE1,                                        1703
     3      U1,V1,W1,UC,VC,                                                1704
     4      WC,U2,V2,W2,                                                   1705
     5      SUK1,SPK1,ANV2,ANW2,TJC1)                                      1706
      COMMON                                                              1707
     1/PROP/ VISE(21,18,10),GEN(21,18,10),VISC,DENIN,FLOWIN               1708
     1/TUR/ SIGK,SIGE,CMU,C1,C2,CMU1,CMU2,E,CK,MINUM,SMNUM,ANV1(800),     1709
     2 YN(800),YN1(800),SINX(800),SINY(800),SINZ(800),ANW1(800),          1710
     3 YPLN(800),TAUN(800),IBC(800),JBC(800),KBC(800),IITY(800),          1711
     4 TAUW(800),GEN(21,18,10),MC(21,18,10),IJLO(21,18,10),IITO           1712
C-----WALL FUNCTIONS USING LOGARITHMIC WALL LAW                           1713
      GO TO (1,2,3,4,5,6,7), IE                                           1714        1
    1 CONTINUE                                                            1715        2
C-----U                                                                   1716
      SQRTK=SQRT(DK1)                                                     1717        3
      YPLN1=DEN1*SQRTK*CMU1*YP/VISC                                       1718        4
      IF(YPLN1 .LE. 11.63) GO TO 111                                      1719        5
      TMULT=DEN1*CMU1*SQRTK*CK/ALOG(E*YPLN1)                              1720        7
      GO TO 112                                                           1721        8
  111 TMULT=VISC/YP                                                       1722        9
  112 TAUN1=-TMULT                                                        1723       10
      PTA=TJC1*SINX1*TMULT/YP1                                            1724       11
      SP1=SP1-PTA                                                         1725       12
      SU1=SU1+PTA*P1                                                      1726       13
      P1=SQRT(1.-SINX1**2)                                                1727       14
      ANV2=AN1*SQRT(1.-SINY1**2)                                          1728       15
      ANW2=AN1*SQRT(1.-SINZ1**2)                                          1729       16
      AN1=P1*AN1                                                          1730       17
      RETURN                                                              1731       18
    2 CONTINUE                                                            1732       19
C-----V                                                                   1733
      TMULT=-TAUN1                                                        1734       20
      PTA=TJC1*SINY1*TMULT/YP1                                            1735       21
      SP1=SP1-PTA                                                         1736       22
      SU1=SU1+PTA*P1                                                      1737       23
      AN1=ANV2                                                            1738       24
      RETURN                                                              1739       25
    3 CONTINUE                                                            1740       26
C-----W                                                                   1741
      TMULT=-TAUN1                                                        1742       27
      PTA=TJC1*SINZ1*TMULT/YP1                                            1743       28
      SP1=SP1-PTA                                                         1744       29
      SU1=SU1+PTA*P1                                                      1745       30
      AN1=ANW2                                                            1746       31
      RETURN                                                              1747       32
    4 CONTINUE                                                            1748       33
C-----TM                                                                  1749
      RETURN                                                              1750       34
    5 CONTINUE                                                            1751       35
C-----K                                                                   1752
      SQRTK=SQRT(DK1)                                                     1753       36
      IF(YPLN1 .LE. 11.63) GO TO 511                                      1754       37
      DITM=DEN1*CMU2*SQRTK*ALOG(E*YPLN1)/(CK*YP)                          1755       39
      GO TO 512                                                           1756       40
  511 DITM=DEN1*CMU2*SQRTK*YPLN1/YP                                       1757       41
```

```
0003ACI    512  CONTINUE                                        42
0003ACI         DDU=U0-U1                                       43
00038EI         DDV=V0-V1                                       44
000300I         DDW=W0-W1                                       45
0003E2I         P1=DDU**2+DDV**2+DDW**2                         46
00042AI         DDU=U2-U1                                       47
00043CI         DDV=V2-V1                                       48
00044EI         DDW=W2-W1                                       49
000460I         P2=DDU**2+DDV**2+DDW**2                         50
0004A8I         YP2=2*YP1-YP                                    51
0004C0I         GENR=GEN1-VISE1*P2/YP2/YP2                      52
0004E6I         IF(GENR .LE. 0.0) GENR=0.0                      53
000504I         SU1=TJC1*(SUK1*CK1+(P1*TAUN1**2/VISE1+GENR))    55
00053EI         SP1=TJC1*(SPK1-CITM)                            56
000556I         AN1=0.0                                         57
000562I         RETURN                                          58
000568I      6  CONTINUE                                        59
          C-----E
000568I         TERM=CMU2/(CK*YP)                               60
000582I         SU1=HINUM*TERM*CK1**1.5                         61
000582I         SP1=-HINUM                                      62
0005C4I         RETURN                                          63
0005CAI      7  CONTINUE                                        64
          C-----PF
0005CAI         RETURN                                          65
0005D0I         END                                             66
```

NO ERRORS:F7D R05-01.0C SUBROUTINE WALLFN 02/21/86 10:01:12 TABLE SPACE: 5 KB
STATEMENT BUFFER: 20 LINES/1321 BYTES STACK SPACE: 122 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION

```
      SUBROUTINE SYMOUT(IC,IE,IS,IT,JS,JT,KS,KT)                                1784
      COMMON                                                                    1785
     1/VAR/U(21,18,10),V(21,18,10),P(21,18,10),DK(21,18,10),                    1786
     2  DE(21,18,10),ERRU,ERRV,ERRM,ERRK,ERRE,ERRW,                            1787
     3  PP(21,18,10),W(21,18,10),TM(21,18,10)                                  1788
     1/PROP/ VISE(21,18,10),DEN(21,18,10),VISC,DENIN,FLOWIN                     1789
     1/PCOR/ DU(21,18,10),DV(21,18,10),DW(21,18,10)                             1790
     1/COEF/ AP(21,18,10),SU(21,18,10),SP(21,18,10),SUK(21,18,10),              1791
     2   SPK(21,18,10),AE(21,18,10),AW(21,18,10),AN(21,18,10),                 1792
     3   AS(21,18,10),AT(21,18,10),AB(21,18,10),APO(21,18,10)                  1793
      COMMON                                                                    1794
     1/TRAN/ X(21,18,10),Y(21,18,10),Z(21,18,10),TJO(21,18,10),                 1795
     2   CX(21,18,10),CY(21,18,10),CZ(21,18,10),                               1796
     3   EX(21,18,10),EY(21,18,10),EZ(21,18,10),                               1797
     3   SX(21,18,10),SY(21,18,10),SZ(21,18,10)                                1798
     1/UNSTDY/UO(21,18,10),VO(21,18,10),WO(21,18,10),DKO(21,18,10),             1799
     2   DEO(21,18,10),DENO(21,18,10),TMO(21,18,10)                            1800
     1/LIMT/ L,M,LT,MT,L1,L2,M1,M2,LO,MO,ISWU,ISWV,ISWP,ISWK,ISWE,               1801
     2   ALU,ALV,ALP,ALK,ALE,ALVIS,ALW,N,N1,N2,NO,ISWW,IG,NT,ALC,DTT            1802
C-----SYMMETRIC, CYCLIC AND EXIT CONDITIONS AND LINK MODIFICATIONS               1803
      GO TO (1,2,3), IC                                                         1804        1
    1 CONTINUE                                                                  1805        2
C-----BOTTOM                                                                    1806
      K=1                                                                       1807        3
      DO 10 I=1,L                                                               1808        4
      DO 10 J=2,MT                                                              1809        5
      U(I,J,K)=U(I,J,K+1)                                                       1810        6
      V(I,J,K)=V(I,J,K+1)                                                       1811        7
      W(I,J,K)=0.0                                                              1812        8
      TM(I,J,K)=TM(I,J,K+1)                                                     1813        9
      DK(I,J,K)=DK(I,J,K+1)                                                     1814       10
      DE(I,J,K)=DE(I,J,K+1)                                                     1815       11
   10 CONTINUE                                                                  1816       12
C-----EAST OUT (BASED ON INFLOW MASS FLOW RATE)                                 1817
      I=IT                                                                      1818       13
      FLOW=0.0                                                                  1819       14
      ARDEN=0.0                                                                 1820       15
      DO 50 J=2,JT                                                              1821       16
      DO 50 K=2,KT                                                              1822       17
      UC=(V(I,J,K)+V(I,J-1,K)+V(I,J,K-1)+V(I,J-1,K-1))*0.25                     1823       18
      DENC=(DEN(I,J,K)+DEN(I,J-1,K)+DEN(I,J,K-1)+DEN(I,J-1,K-1))*0.25           1824       19
      P1=(X(I,J,K)+X(I,J,K-1)-X(I,J-1,K)-X(I,J-1,K-1))*0.5                      1825       20
      P2=(Y(I,J,K)+Y(I,J,K-1)-Y(I,J-1,K)-Y(I,J-1,K-1))*0.5                      1826       21
      P3=(Z(I,J,K)+Z(I,J,K-1)-Z(I,J-1,K)-Z(I,J-1,K-1))*0.5                      1827       22
      Q1=(X(I,J,K)+X(I,J-1,K)-X(I,J,K-1)-X(I,J-1,K-1))*0.5                      1828       23
      Q2=(Y(I,J,K)+Y(I,J-1,K)-Y(I,J,K-1)-Y(I,J-1,K-1))*0.5                      1829       24
      Q3=(Z(I,J,K)+Z(I,J-1,K)-Z(I,J,K-1)-Z(I,J-1,K-1))*0.5                      1830       25
      AREA=SQRT(P1*P1+P2*P2+P3*P3)*SQRT(Q1*Q1+Q2*Q2+Q3*Q3)                       1831       26
      FLOW=FLOW+DENC*AREA*UC                                                    1832       27
      ARDEN=ARDEN+DENC*AREA                                                     1833       28
   50 CONTINUE                                                                  1834       29
      UINC=(FLOW-FLOWIN)/ARDEN                                                  1835       30
      DO 60 J=2,JT                                                              1836       31
      DO 60 K=2,KT                                                              1837       32
      U(I+1,J,K)=U(I,J,K)                                                       1838       33
      V(I+1,J,K)=V(I,J,K)-UINC                                                  1839       34
      W(I+1,J,K)=W(I,J,K)                                                       1840       35
```

```
 58  000A44I          DK(I+1,J,K)=DK(I,J,K)                                  1841      36
 59  000A94I          DE(I+1,J,K)=DE(I,J,K)                                  1842      37
 60  000AE4I       60 CONTINUE                                               1843      38
 61  000B14I          RETURN                                                 1844      39
 62                C-----LINK COEFF. MODIFICATIONS                           1845
 63  000B1AI       2  CONTINUE                                               1846      40
 64                C-----EAST OUT                                            1847
 65  000B1AI          I=IT                                                   1848      41
 66  000B26I          DO 200 J=2,JT                                          1849      42
 67  000B3AI          DO 200 K=2,KT                                          1850      43
 68  000B4EI          AE(I,J,K)=0.0                                          1851      44
 69  000B7AI     200  CONTINUE                                               1852      45
 70  000BAAI          RETURN                                                 1853      46
 71                C-----UPDATE UNSTEADY COEFF.                              1854
 72  000BB0I       3  CONTINUE                                               1855      47
 73  000BB0I          IF(DTT .NE. 0.0) GO TO 301                             1856      48
 74  000BC8I          DO 300 I=IS,IT                                         1857      50
 75  000BE0I          DO 300 J=JS,JT                                         1858      51
 76  000BF8I          DO 300 K=KS,KT                                         1859      52
 77  000C10I     300  APO(I,J,K)=0.0                                         1860      53
 78  000C84I          RETURN                                                 1861      54
 79  000C8AI     301  CONTINUE                                               1862      55
 80  000C8AI          DO 310 I=IS,IT                                         1863      56
 81  000CA2I          DO 310 J=JS,JT                                         1864      57
 82  000CBAI          DO 310 K=KS,KT                                         1865      58
 83  000CD2I          APO(I,J,K)=DENO(I,J,K)/DTT                             1866      59
 84  000D24I          UO(I,J,K)=U(I,J,K)                                     1867      60
 85  000D70I          VO(I,J,K)=V(I,J,K)                                     1868      61
 86  000DBCI          WO(I,J,K)=W(I,J,K)                                     1869      62
 87  000E08I          TMO(I,J,K)=TM(I,J,K)                                   1870      63
 88  000E54I          DKO(I,J,K)=DK(I,J,K)                                   1871      64
 89  000EA0I          DEO(I,J,K)=DE(I,J,K)                                   1872      65
 90  000EECI     310  CONTINUE                                               1873      66
 91  000F34I          RETURN                                                 1874      67
 92  000F3AI          END                                                    1875      68

NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  SYMOUT    02/21/86  10:01:59  TABLE SPACE:   7 KB
STATEMENT BUFFER:   20 LINES/1321 BYTES    STACK SPACE: 181 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```

```
  1  0000001          SUBROUTINE WALVAL(PW,IS,IT,JS,JT,KS,KT,F)                                1876
  2  0000041          DIMENSION F(21,18,10)                                                    1877
  3  0000041          COMMON                                                                   1878
  4                  1/TUR/ SIGK,SIGE,CMU,C1,C2,CMU1,CMU2,E,CK,HINUM,SMNUM,ANV1(800),         1879
  5                  2 YN(800),YN1(800),SINX(800),SINY(800),SINZ(800),ANW1(800),              1880
  6                  3 YPLN(800),TAUN(800),I3C(800),J3C(800),K3C(800),IITY(800),              1881
  7                  4 TAUW(800),GEN(21,18,10),MC(21,18,10),IJLO(21,18,10),IITO               1882
  8            C-----ASSIGN WALL VALUES                                                       1883
  9  0000041          DO 10 J=JS,JT                                                            1884        1
 10  0000281          DO 10 K=KS,KT                                                            1885        2
 11  0000401          F(IS-1,J,K)=PW*F(IS,J,K)                                                 1886        3
 12  0000A21     10   F(IT+1,J,K)=PW*F(IT,J,K)                                                 1887        4
 13  0001341          DO 20 I=IS-1,IT+1                                                        1888        5
 14  0001521          DO 20 K=KS,KT                                                            1889        6
 15  00016A1          F(I,JS-1,K)=PW*F(I,JS,K)                                                 1890        7
 16  0001CC1     20   F(I,JT+1,K)=PW*F(I,JT,K)                                                 1891        8
 17  00025E1          DO 30 I=IS-1,IT+1                                                        1892        9
 18  0002701          DO 30 J=JS-1,JT+1                                                        1893       10
 19  00029A1          F(I,J,KS-1)=PW*F(I,J,KS)                                                 1894       11
 20  0002FA1     30   F(I,J,KT+1)=PW*F(I,J,KT)                                                 1895       12
 21  00038A1          DO 40 III=1,IITO                                                         1896       13
 22  00039E1          I=I3C(III)                                                               1897       14
 23  0003B21          J=J3C(III)                                                               1898       15
 24  0003C61          K=K3C(III)                                                               1899       16
 25  0003DA1          GO TO (1,2,3,4,5,6), IITY(III)                                           1900       17
 26  0004161     1    F(I,J+1,K)=PW*F(I,J,K)                                                   1901       18
 27  0004781          GO TO 40                                                                 1902       19
 28  0004781     2    F(I,J-1,K)=PW*F(I,J,K)                                                   1903       20
 29  0004E01          GO TO 40                                                                 1904       21
 30  0004E61     3    F(I+1,J,K)=PW*F(I,J,K)                                                   1905       22
 31  0005481          GO TO 40                                                                 1906       23
 32  0005461     4    F(I-1,J,K)=PW*F(I,J,K)                                                   1907       24
 33  0005801          GO TO 40                                                                 1908       25
 34  0005861     5    F(I,J,K+1)=PW*F(I,J,K)                                                   1909       26
 35  0006161          GO TO 40                                                                 1910       27
 36  00061C1     6    F(I,J,K-1)=PW*F(I,J,K)                                                   1911       28
 37  00067C1     40   CONTINUE                                                                 1912       29
 38  0006941          RETURN                                                                   1913       30
 39  00069A1          END                                                                      1914       31

NO  ERRORS:F7D  R05-01.0C  SUBROUTINE  WALVAL    02/21/86  10:02:24  TABLE SPACE:   3 KB
STATEMENT BUFFER:   20 LINES/1321 BYTES    STACK SPACE: 154 WORDS
SINGLE PRECISION FLOATING PT SUPPORT REQUIRED FOR EXECUTION
```