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ภาคผนวก

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โปรแกรม MRVENT

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*-------------------------------------------------------------*
*  MRVENT PROGRAM (MULTI ROOM VENTILATION)                    *
*  by Mr. Surasit  Hoamsawatanachai                           *
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*-------------------------------------------------------------*
*  This program can used for calculate multi-room ventilation.*
*-------------------------------------------------------------*
      PARAMETER(MZ=2,MZ=6,LZ=3,IZ=1,ERRA=0.001,HZ=0.0001,MXIT=200,NF=0,
     &          IFLCON=1)
C------ MZ    = NUMBER OF ROOM
C------ NZ    = NUMBER OF OPENING
C------ LZ    = NUMBER OF LOOP
C------ IZ    = NUMBER OF FAN VENT (INTERGER MORE THAN 0)
C------ ERRA  = ERROR ACCEPT
C------ HZ    = STEP IN DIFFERENTIAL
C------ MXIT  = MAX ITTERATION
C------ NZ    = TRUE NUMBER OF FAN (=0 IF NO FAN ,=IZ IF HAVE FAN)
C------ IFLCON = 1;FOR FIX FLOW FAN , 0;FOR USE FAN CURVE
*-------------------------------------------------------------*
      DOUBLE PRECISION GL(LZ,1),PL(LZ,1),GLF(IZ,1),PLF(IZ,1)
      DOUBLE PRECISION GO(NZ,1),FRR(NZ,MZ),FFR(IZ,MZ),FFF(IZ,IZ),
     &                 ALFAA(NZ,1),PO(NZ,1),PF(IZ,1),FLEVEL(MZ,1)
      DOUBLE PRECISION IO(MZ,NZ),IFAN(MZ,IZ),ILO(LZ,NZ),ILFAN(IZ,NZ),
     &                 HIGHO(NZ,1),HIGHF(IZ,1),AFAN(IZ,3)
      DOUBLE PRECISION H(MZ,MZ),U(MZ,MZ),WF(MZ,1),TR(MZ,1),TF(IZ,1),
     &                 TO(NZ,1),TOF(IZ,1),RHOR(MZ,1),RHOO(NZ,1)
      DOUBLE PRECISION ST(MZ,1),SW(MZ,1),WR(MZ,1),C(MZ,1),X(MZ,1),
     &                 R(MZ,MZ),RHE(MZ,MZ),E(MZ,MZ),RHOF(IZ,1)
      DOUBLE PRECISION PWOUT(LZ,1),PWIN(LZ,1),PWFOUT(IZ,1),
     &                 PWFIN(IZ,1),HFIN(IZ,1),TYPEF(IZ,1),PR(MZ,1)
      DOUBLE PRECISION TEMNL1(NZ,LZ),TEMN1(NZ,1),TEMN2(NZ,1),
     &                 TEMN1(NZ,IZ),TEMNM1(NZ,MZ),TEMNM2(NZ,MZ)
      DOUBLE PRECISION TEM1M1(1,MZ),TEM11(IZ,1),TEMM1(IZ,MZ),
     &                 TEMM2(IZ,MZ),TEM111(1,IZ),TEMI1(IZ,IZ)
      DOUBLE PRECISION TEMNN1(NZ,NZ),TEMMM1(MZ,MZ),TEMMM2(MZ,MZ),
     &                 TEMMM3(MZ,MZ),TEM,TEMI2(IZ,1),TEMM1(MZ,1)
      DOUBLE PRECISION TEMM2(MZ,1),TEML1(LZ,1),OUTO(NZ,1),OUTP(NZ,2)
      DOUBLE PRECISION CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-------------------------------------------------------------*
      CHARACTER*50 NAOUT
*-------------------------------------------------------------*
*----USE AND COMMON WITH SUBROUTINE MULTI
      DOUBLE PRECISION GLL(LZ,5*(LZ+NF)),GLLF(IZ,5*(LZ+NF))
      DOUBLE PRECISION WINDEX(5*(LZ+NF))
      INTEGER INSOL(5*(LZ+NF))
*-------------------------------------------------------------*
      COMMON/CB1/GO,FRR,FFR,FFF,ALFAA,PO,PF,FLEVEL
      COMMON/CB2/IO,IFAN,ILO,ILFAN,HIGHO,HIGHF,AFAN
      COMMON/CB3/H,U,WF,TR,TF,TO,TOF,RHOR,RHOO
      COMMON/CB4/ST,SW,WR,C,X,R,RHE,E,RHOF
      COMMON/CB5/PWOUT,PWIN,PWFOUT,PWFIN,HFIN,TYPEF,PR
      COMMON/TEM1/TEMNL1,TEMN1,TEMN2,TEMNI1,TEMNM1,TEMNM2
      COMMON/TEM2/TEM1M1,TEMI1,TEMMI1,TEMMI2,TEM1I1,TEMI1
      COMMON/TEM3/TEMNN1,TEMMM1,TEMMM2,TEMMM3,TEM,TEMI2,TEMM1
      COMMON/TEM4/TEMM2,TEML1,OUTO,OUTP
      COMMON/CON/CP,T0,RHO0,GRAV,RMAX,RMIN,P0
      COMMON/GGL/GL,PL,GLF,PLF
      COMMON/MULTI/GLL,GLLF,INSOL,WINDEX
*-------------------------------------------------------------*

*-------------------------------------------------------------*
      CALL INPUT(INP)
      IF (INP.EQ.3) GOTO 2000
   14 WRITE(6,15)
   15 FORMAT(/,' PLEASE ENTER OUTPUT FILE NAME TO BUILT:  ')
      READ(5,' (A) ',ERR=14) NAOUT
      OPEN(UNIT=9,FILE=NAOUT, STATUS='NEW',ERR=14)
      CALL MULTI(NSOL)
      WRITE(9,*) 'NUMBER OF SOLUTION     ',NSOL
      DO 10 I=1,NSOL,1
      DO 20 J=1,LZ,1
      GL(J,1)=GLL(J,I)
   20 CONTINUE
      IF(NF.GT.0) THEN
      DO 30 J=1,IZ,1
      IF(IFLCON.EQ.1) GLLF(J,I)=GLF(J,1)
      GLF(J,1)=GLLF(J,I)
   30 CONTINUE
      CALL LOOPWF(GL,PL,GLF,PLF)
      ELSE
      CALL LOOP(GL,PL,GLF,PLF)
      ENDIF
      WRITE(9,*) 'SOLUTION NO.           ',I
      WRITE(9,*) '*--------GL--------*'
      DO 40 J=1,LZ,1
      XX1= GL(J,1)*60
      WRITE(9,*) 'GL',J,' = ',XX1,' KG/MIN'
   40 CONTINUE
      IF (NF.GT.0) THEN
      WRITE(9,*) '*--------GLF--------*'
      DO 41 J=1,IZ,1
      XX1=GLF(J,1)*60.
      WRITE(9,*) 'GLF',J,' = ',XX1,' KG/MIN'
   41 CONTINUE
      ENDIF
      WRITE(9,*) '*--------GO--------*'
      DO 42 J=1,NZ,1
      XX1= GO(J,1)*60
      XX2= GO(J,1)*1000/RHOO(J,1)
      WRITE(9,*) 'GO',J,' = ',XX1,' KG/MIN ',XX2,' L/S'
   42 CONTINUE
      WRITE(9,*) '*--------PO--------*'
      DO 44 J=1,MZ,1
      XX1=PO(J,1)
      WRITE(9,*) 'PO',J,' = ',XX1,' PASCAL '
   44 CONTINUE
      WRITE(9,*) '*--------TR--------*'
      DO 46 J=1,MZ,1
      XX1=TR(J,1)
      WRITE(9,*) 'TR',J,' = ',XX1,' K '
   46 CONTINUE
      WRITE(9,*) '*--------RHOR--------*'
      DO 48 J=1,MZ,1
      XX1=RHOR(J,1)
      WRITE(9,*) 'RHOR',J,' = ',XX1,' KG/M**3 '
   48 CONTINUE
      WRITE(9,*) '*--------PR--------*'
      DO 50 J=1,MZ,1
      XX1=PR(J,1)
      WRITE(9,*) 'PR',J,' = ',XX1,' PASCAL '
   50 CONTINUE
      WRITE(9,*) '*--------WINDEX--------*'
      XX1=WINDEX(I)
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      WRITE(9,*) 'WINDEX',I,' = ',XX1,' W '
      WRITE(9,*) '-------------------------------'
      WRITE(9,*) ' '
10    CONTINUE
2000  CONTINUE
      STOP
      END
*-----------------------------------------------------------------------*
*-----------------------------------------------------------------------*
*-----------------------------------------------------------------------*
      SUBROUTINE INPUT(INP)
      PARAMETER(MZ=2,NZ=6,LZ=3,IZ=1,ERRA=0.001,HZ=0.0001,MXIT=200,MF=0,
     &          IFLOOR=1)
*-----------------------------------------------------------------------*
      DOUBLE PRECISION GL(LZ,1),PL(LZ,1),GLF(IZ,1),PLF(IZ,1)
      DOUBLE PRECISION GO(NZ,1),FRR(NZ,MZ),FFR(IZ,MZ),FFF(IZ,IZ),
     &                 ALFAA(NZ,1),PO(NZ,1),PF(IZ,1),FLEVEL(MZ,1)
      DOUBLE PRECISION IO(MZ,NZ),IFAN(MZ,IZ),LO(LZ,NZ),LFAN(IZ,NZ),
     &                 HIGHO(NZ,1),HIGHF(IZ,1),AFAN(IZ,3)
      DOUBLE PRECISION H(MZ,MZ),U(MZ,MZ),WF(MZ,1),TR(MZ,1),TF(IZ,1),
     &                 TO(NZ,1),TOF(IZ,1),RHOR(MZ,1),RHOO(NZ,1)
      DOUBLE PRECISION ST(MZ,1),SW(MZ,1),WR(MZ,1),C(MZ,1),X(MZ,1),
     &                 R(MZ,MZ),RHE(MZ,MZ),E(MZ,MZ),RHOF(IZ,1)
      DOUBLE PRECISION PWOUT(LZ,1),PWIN(LZ,1),PWFOUT(IZ,1),
     &                 PWFIN(IZ,1),HFIN(IZ,1),TYPEF(IZ,1),PR(MZ,1)
      DOUBLE PRECISION TEMNL1(NZ,LZ),TEMN1(NZ,1),TEMN2(NZ,1),
     &                 TEMNI1(NZ,IZ),TEMNM1(NZ,MZ),TEMNM2(NZ,MZ)
      DOUBLE PRECISION TEMIM1(1,MZ),TEMI1(IZ,1),TEMM1(IZ,MZ),
     &                 TEMM2(IZ,MZ),TEMI1I1(1,IZ),TEMI1(IZ,IZ)
      DOUBLE PRECISION TEMNN1(NZ,NZ),TEMMM1(MZ,MZ),TEMMM2(MZ,MZ),
     &                 TEMMM3(MZ,MZ),TEM,TEMI2(IZ,1),TEMM1(MZ,1)
      DOUBLE PRECISION TEMM2(MZ,1),TEML1(LZ,1),OUTO(NZ,1),OUTP(NZ,2)
      DOUBLE PRECISION CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-----------------------------------------------------------------------*
      CHARACTER*50 NINPUT,NTITLE
*-----------------------------------------------------------------------*
      COMMON/CB1/GO,FRR,FFR,FFF,ALFAA,PO,PF,FLEVEL
      COMMON/CB2/IO,IFAN,LO,LFAN,HIGHO,HIGHF,AFAN
      COMMON/CB3/H,U,WF,TR,TF,TO,TOF,RHOR,RHOO
      COMMON/CB4/ST,SW,WR,C,X,R,RHE,E,RHOF
      COMMON/CB5/PWOUT,PWIN,PWFOUT,PWFIN,HFIN,TYPEF,PR
      COMMON/TEM1/TEMNL1,TEMN1,TEMN2,TEMNI1,TEMNM1,TEMNM2
      COMMON/TEM2/TEMI1M1,TEMI1,TEMIM1,TEMM2,TEMI1I1,TEMI1
      COMMON/TEM3/TEMNN1,TEMMM1,TEMMM2,TEMMM3,TEM,TEMI2,TEMM1
      COMMON/TEM4/TEMM2,TEML1,OUTO,OUTP
      COMMON/CON/CP,T0,RHO0,GRAV,RMAX,RMIN,P0
      COMMON/GG/GL,PL,GLF,PLF
*-----------------------------------------------------------------------*
*-----------------------------------------------------------------------*
    5 WRITE(9,10)
   10 FORMAT(/,' PLEASE SELECT AN OPTION:(INTEGER) ', /,
     &       ' 1: ENTER INPUT FROM INPUT FILE    ', /,
     &       ' 2: ENTER INPUT ON SCREEN          ', /,
     &       ' 3: QUIT                           ' )
      READ(5,*,ERR=5) INP
      IF (INP.EQ.3) GOTO 1000
      IF ((INP.NE.1).AND.(INP.NE.2)) GOTO 5
*-----------------------OPTION READ INPUT FROM SCREEN-------------------*
      IF (INP.EQ.2) THEN
   25 WRITE (9,30)
   30 FORMAT(/,' PLEASE ENTER INPUT FILE NAME TO BUILT:  ')
      READ(5,' (A) ',ERR=25) NINPUT
      OPEN(UNIT=4,FILE=NINPUT, STATUS='NEW',ERR=25)
   32 WRITE(6,*) 'PLEASE ENTER THE PROJECT NAME  '
      READ(5,'(A)',ERR=32) NTITLE
      WRITE(8,*) NTITLE
   33 WRITE(6,*) 'PLEASE ENTER OUTSIDE TEMPERATURE (K) '
      READ(5,*,ERR=33) XINP
      WRITE(8,*) 'PLEASE ENTER OUTSIDE TEMPERATURE (K) '
      WRITE(8,*) XINP
      T0=XINP
   34 WRITE(6,*) 'PLEASE ENTER OUTSIDE AIR DENSITY (KG/M**3) '
      READ(5,*,ERR=34) XINP
      WRITE(8,*) 'PLEASE ENTER OUTSIDE AIR DENSITY (KG/M**3) '
      WRITE(8,*) XINP
      RHO0=XINP
   35 WRITE(6,*) 'PLEASE ENTER OUTSIDE ABSOLUTE PRESSURE (PASCAL)'
      READ(5,*,ERR=35) XINP
      WRITE(8,*) 'PLEASE ENTER OUTSIDE ABSOLUTE PRESSURE (PASCAL)'
      WRITE(8,*) XINP
      P0=XINP
   36 WRITE(6,*) 'PLEASE ENTER SPECIFIC HEAT OF AIR (J/KG.K) '
      READ(5,*,ERR=36) XINP
      WRITE(8,*) 'PLEASE ENTER SPECIFIC HEAT OF AIR (J/KG.K) '
      WRITE(8,*) XINP
      CP=XINP
   37 WRITE(6,*) 'PLEASE ENTER GRAVITY ACCELATION (M/S**2) '
      READ(5,*,ERR=37) XINP
      WRITE(8,*) 'PLEASE ENTER GRAVITY ACCELATION (M/S**2) '
      WRITE(8,*) XINP
      GRAV=XINP
   38 WRITE(6,*) 'PLEASE ENTER WALL THERMAL CONDUCTIVITY (W/M**2)'
      READ(5,*,ERR=38) XCON
      WRITE(8,*) 'PLEASE ENTER WALL THERMAL CONDUCTIVITY (W/M**2)'
      WRITE(8,*) XCON
   39 WRITE(6,*) 'PLEASE ENTER RANGE OF ITERATE:RMIN?,RMAX?(KG/MIN)'
      READ(5,*,ERR=39) XX1,XX2
      WRITE(8,*) 'PLEASE ENTER RANGE OF ITERATE:RMIN?,RMAX?(KG/MIN)'
      RMIN=XX1/60.0
      RMAX=XX2/60.0
      WRITE(8,*) XX1,XX2
   40 WRITE(6,*) 'PLEASE ENTER NUMBER OF '
      WRITE(6,*) 'ROOM?,OPENING?,LOOP?,FAN?, '
      READ(5,*,ERR=40) NROOM,NOPEN,NLOOP,NFAN
      WRITE(8,*) 'PLEASE ENTER NUMBER OF '
      WRITE(8,*) 'ROOM?,OPENING?,LOOP?,FAN? '
      WRITE(8,*) NROOM,NOPEN,NLOOP,NFAN
      INP=0
      IF (NROOM.NE.MZ) THEN
      WRITE(6,*) 'PLEASE CHANGE PARAMETER OF ROOM (MZ)'
      INP=5
      ENDIF
      IF (NOPEN.NE.NZ) THEN
      WRITE(6,*) 'PLEASE CHANGE PARAMETER OF OPENING (NZ)'
      INP=3
      ENDIF
      IF (NLOOP.NE.LZ) THEN
      WRITE(6,*) 'PLEASE CHANGE PARAMETER OF LOOP (LZ)'
      INP=3
```

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      ENDIF
      IF (NFAN.NE.NF) THEN
       WRITE(6,*) 'PLEASE CHANGE PARAMETER OF FAN (NF) '
       INP=3
      ENDIF
      IF (NFAN.GT.0) THEN
       IF (IZ.NE.NFAN) THEN
       WRITE(6,*) 'PLEASE CHANGE (IZ) EQUAL TO FAN?'
        INP=3
       ENDIF
      ELSE
       IF (IZ.NE.1) THEN
       WRITE(6,*) 'PLEASE CHANGE (IZ) EQUAL TO 1'
        INP=3
       ENDIF
      ENDIF
      IF (INP.EQ.3) GOTO 1000
      DO 47 IL=1,NROOM,1
      TEMM2(IL,1)=0.0
      DO 48 IK=1,NROOM,1
       TEMMM2(IK,1)=0.0
48    CONTINUE
47    CONTINUE
      DO 60 I=1,NROOM,1
      WRITE(6,*) 'PLEASE ENTER THE CHARACTER OF ROOM',I,':'
      WRITE(8,*) 'PLEASE ENTER THE CHARACTER OF ROOM',I,':'
60     WRITE(6,*) 'HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)'
       READ(5,*,ERR=60) JJ1
       WRITE(8,*) 'HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)'
       TEMM1(I,1)=JJ1
       WRITE(8,*) JJ1
       DO 80 J=1,JJ1,1
75      WRITE(6,*) J,': ROOM NUMBER?,WALL AREA BETWEEN?(M**2) '
        READ(5,*,ERR=75) JJJ,XXX
        WRITE(8,*) J,': ROOM NUMBER?,WALL AREA BETWEEN?(M**2) '
        WRITE(8,*) JJJ,XXX
        IF (JJJ.EQ.0) THEN
         TEMM2(I,1)=XXX
        ELSE
         TEMMM2(I,JJJ)=XXX
        ENDIF
80     CONTINUE
82      WRITE(6,*) 'PLEASE ENTER FLOOR LEVEL OF ROOM ',I,':'
        READ(5,*,ERR=82) XXX
        WRITE(8,*) 'PLEASE ENTER FLOOR LEVEL OF ROOM ',I,':'
        FLEVEL(I,1)=XXX
        WRITE(6,*) XXX
50     CONTINUE
       DO 99 I1=1,MZ,1
       DO 95 J1=1,I1,1
        IF (TEMMM2(I1,J1).NE.TEMMM2(J1,I1)) THEN
92       WRITE(6,*) 'AREA PROBLEM OF ROOM',I1,'&',J1
         WRITE(6,*) 'SELECT 1(CONTINUE) OR 2(QUIT)'
         READ(5,*,ERR=92) KK
         IF (KK.EQ.2) THEN
          INP=3
          GOTO 1000
         ENDIF
        ENDIF
        IF (I1.EQ.J1) THEN
         TEM=0.0
         DO 100 K1=1,MZ,1
          TEM=TEM+TEMMM2(I1,K1)
100      CONTINUE
         U(I1,J1)=-(TEM+TEMM2(I1,1))*XDON
        ELSE
         U(I1,J1)=TEMMM2(I1,J1)*XOON
         U(J1,I1)=U(I1,J1)
        ENDIF
95     CONTINUE
99    CONTINUE
      WRITE(6,*)'PLEASE ENTER DATA OF INCIDENT MATRIX'
      WRITE(8,*)'PLEASE ENTER DATA OF INCIDENT MATRIX'
      DO 102 I1=1,MZ,1
       DO 103 I2=1,NZ,1
        IO(I1,I2)=0
103     CONTINUE
102    CONTINUE
       DO 110 I=1,NZ,1
105     WRITE(6,*)'PLEASE ENTER CHARACTER OF OPENING',I,':'
        WRITE(6,*)'FROM ROOM?,TO ROOM?,HEIGHT(M)?,NET AREA?'
        READ(5,*,ERR=105) I1,I2,XX2,XX1
        WRITE(8,*)'PLEASE ENTER CHARACTER OF OPENING',I,':'
        WRITE(8,*)'FROM ROOM?,TO ROOM?,HEIGHT(M)?,NET AREA?'
        IF(I1.NE.0) IO(I1,I)=1
        IF(I2.NE.0) IO(I2,I)=-1
        HEIGHO(I,1)=XX2
        ALFAA(I,1)=XX1
        WRITE(8,*) I1,I2,XX2,XX1
        IF(I1*I2.EQ.0) THEN
         IF(I1.EQ.0) OUTO(I,1)=1.0
         IF(I2.EQ.0) OUTO(I,1)=-1.0
        ELSE
         OUTO(I,1)=0.0
        ENDIF
110    CONTINUE
       WRITE(6,*)'PLEASE ENTER DATA OF LOOP '
       WRITE(8,*)'PLEASE ENTER DATA OF LOOP '
       DO 120 I=1,LZ,1
112     WRITE(6,*)'HOW MANY OPENINGS THAT LOOP',I,'PASS :'
        READ(5,*,ERR=112) I1
        WRITE(8,*)'HOW MANY OPENINGS THAT LOOP',I,'PASS :'
        WRITE(8,*) I1
        I5=0
        I6=0
        DO 130 J=1,I1,1
114      WRITE(6,*) J,': OPENING NUMBER?,FROM ROOM?,TO ROOM? '
         READ(5,*,ERR=114) I2,I3,I4
         WRITE(8,*) J,': OPENING NUMBER?,FROM ROOM?,TO ROOM? '
         WRITE(8,*) I2,I3,I4
         IF(I3.NE.0) THEN
          LO(I,I2)=IO(I3,I2)
         ELSE
          LO(I,I2)=-IO(I4,I2)
         ENDIF
         IF(I3.EQ.0) I5=I2
         IF(I4.EQ.0) I6=I2
130     CONTINUE
132     WRITE(6,*) 'PLEASE ENTER WIND PRESSURE DATA OF LOOP',I,':'
        WRITE(6,*) 'PWIN?,PWOUT?'
        READ(5,*,ERR=132) XX1,XX2
        WRITE(8,*) 'PLEASE ENTER WIND PRESSURE DATA OF LOOP',I,':'
        WRITE(8,*) 'PWIN?,PWOUT?'
        PWIN(I,1)=XX1
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      PWOUT(I,1)=XX2
      WRITE(6,*) XX1,XX2
      OUTP(5,1)=1
      OUTP(5,2)=1
      OUTP(6,1)=1
      OUTP(6,2)=2
120   CONTINUE
      DO 140 I=1,MZ,1
142   WRITE(6,*) 'PLEASE ENTER PROPERTY OF ROOM',I,':'
      WRITE(6,*) 'ST?,SW?,TR?,WR?'
      READ(5,*,ERR=142) IST,ISW,XTR,XWR
      IF(IST.EQ.ISW) THEN
      WRITE(6,*) 'PROBLEM ON ST = SW PLESE ENTER AGAIN'
      GOTO 142
      ENDIF
      ST(I,1)=IST
      SW(I,1)=ISW
      TR(I,1)=XTR
      WR(I,1)=XWR
      WRITE(6,*) 'PLEASE ENTER PROPERTY OF ROOM',I,':'
      WRITE(6,*) 'ST?,SW?,TR?,WR?'
      WRITE(6,*) IST,ISW,XTR,XWR
140   CONTINUE
      IF (NF.GT.0) THEN
      DO 150 I=1,IZ,1
152   WRITE(6,*) 'PLEASE ENTER INCIDENT METRIX OF FAN',I,':'
      WRITE(6,*) 'FLOW TO ROOM?,OPENING HEIGHT?,HEIGHT FAN IN?'
      READ(5,*,ERR=152) I1,XX1,XX2
      WRITE(6,*) 'PLEASE ENTER INCIDENT METRIX OF FAN',I,':'
      WRITE(6,*) 'FLOW TO ROOM?,OPENING HEIGHT?,HEIGHT FAN IN?'
      IFAN(I1,I)=-1
      HIGHF(I,1)=XX1
      HFIN(I,1)=XX2
      WRITE(6,*) I1,XX1,XX2
163   WRITE(6,*) 'HOW MANY OPENINGS THAT LOOP FAN',I,'PASS:'
      WRITE(6,*) 'NOT INCLUDE FAN'S OPENING:'
      READ(5,*,ERR=163) I2
      WRITE(6,*) 'HOW MANY OPENINGS THAT LOOP FAN',I,'PASS:'
      WRITE(6,*) 'NOT INCLUDE FAN'S OPENING:'
      WRITE(6,*) I2
      DO 160 J=1,I2,1
154   WRITE(6,*) J,':  OPENING NUMBER?,FROM ROOM?,TO ROOM? '
      READ(5,*,ERR=154) J2,J3,J4
      WRITE(6,*) J,':  OPENING NUMBER?,FROM ROOM?,TO ROOM? '
      WRITE(6,*) J2,J3,J4
      IF(J3.NE.0) THEN
      LFAN(I,J2)=IO(J3,J2)
      ENDIF
160   CONTINUE
162   WRITE(6,*) 'PWFIN?,PWFOUT?,TYPE FAN?(1:-1),FAN AIR TEMP?'
      READ(5,*,ERR=162) XX1,XX2,J1,XX3
      WRITE(6,*) 'PWFIN?,PWFOUT?,TYPE FAN?(1:-1),FAN AIR TEMP?'
      WRITE(6,*) XX1,XX2,J1,XX3
      PWFIN(I,1)=XX1
      PWFOUT(I,1)=XX2
      TF(I,1)=XX3
      TYPEF(I,1)=J1
167   WRITE(6,*) 'ENTER COEFFICIENT OF FAN CURVE P=A+BX+CX**2'
      WRITE(6,*) 'PRESSURE P(PASCAL) & FLOW RATE X(M**3/SEC)'
      WRITE(6,*) 'A=?,B=?,C=?'
      READ(5,*,ERR=167) XX1,XX2,XX3
      WRITE(6,*) 'ENTER COEFFICIENT OF FAN CURVE P=A+BX+CX**2'
      WRITE(6,*) 'PRESSURE P(PASCAL) & FLOW RATE X(M**3/SEC)'
      WRITE(6,*) 'A=?,B=?,C=?'
      AFAN(I,1)=XX1
      AFAN(I,2)=XX2
      AFAN(I,3)=XX3
      WRITE(6,*) XX1,XX2,XX3
      IF (IFLCON.EQ.1) THEN
168   WRITE(6,*) 'ENTER FIX FLOW OF FAN (KG/MIN) ?'
      READ(5,*,ERR=168) XX1
      WRITE(6,*) 'ENTER FIX FLOW OF FAN (KG/MIN) ?'
      GLF(I,1)=XX1/60.0
      WRITE(6,*) XX1
      ENDIF
150   CONTINUE
      ENDIF
      ENDIF

*-----------OPTION READ INPUT FROM INPUT FILE-----------*
      IF (INP.EQ.1) THEN
170   WRITE(6,180)
180   FORMAT(/,' PLEASE ENTER THE INPUT FILE NAME:  ')
      READ(5,' (A) ',ERR=170) NINPUT
      OPEN(UNIT=7,FILE=NINPUT, STATUS='OLD',ERR=170)
      READ(7,'(A)') NTITLE
      READ(7,*)
      READ(7,*) T0
      READ(7,*)
      READ(7,*) RHO0
      READ(7,*)
      READ(7,*) P0
      READ(7,*)
      READ(7,*) CP
      READ(7,*)
      READ(7,*) GRAV
      READ(7,*)
      READ(7,*) XCON
      READ(7,*)
      READ(7,*) XX1,XX2
      RMIN=XX1/60.0
      RMAX=XX2/60.0
      READ(7,*)
      READ(7,*)
      READ(7,*) NROOM,NOPEN,NLOOP,NFAN
      INP=0
      IF (NROOM.NE.MZ) THEN
      WRITE(6,*) 'PLEASE CHANGE PARAMETER OF ROOM (MZ)'
      INP=3
      ENDIF
      IF (NOPEN.NE.NZ) THEN
      WRITE(6,*) 'PLEASE CHANGE PARAMETER OF OPENING (NZ)'
      INP=3
      ENDIF
      IF (NLOOP.NE.LZ) THEN
      WRITE(6,*) 'PLEASE CHANGE PARAMETER OF LOOP (LZ)'
      INP=3
      ENDIF
      IF (NFAN.NE.NF) THEN
      WRITE(6,*) 'PLEASE CHANGE PARAMETER OF FAN (NF) '
      INP=3
      ENDIF
      IF (NFAN.GT.0) THEN
      IF (IZ.NE.NFAN) THEN
```

```
      WRITE(6,*) 'PLEASE CHANGE (IZ) EQUAL TO FANT'
      INP=3
     ENDIF
     ELSE
      IF (IZ.NE.1) THEN
      WRITE(6,*) 'PLEASE CHANGE (IZ) EQUAL TO 1'
      INP=3
     ENDIF
     ENDIF
     IF (INP.EQ.3) GOTO 1000
     DO 190 IJJ=1,NROOM,1
     TEMM2(IJJ,1)=0.0
     DO 200 IIK=1,NROOM,1
      TEMMM2(IIK,1)=0.0
200   CONTINUE
190   CONTINUE
     DO 210 I=1,NROOM,1
      READ(7,*)
      READ(7,*)
      READ(7,*) JJ1
      TEMM1(I,1)=JJ1
     DO 220 J=1,JJ1,1
      READ(7,*)
      READ(7,*) JJJ,XXX
      IF (JJJ.EQ.0) THEN
       TEMM2(I,1)=XXX
      ELSE
       TEMMM2(I,JJJ)=XXX
      ENDIF
220   CONTINUE
      READ(7,*)
      READ(7,*) XXX
      FLEVEL(I,1)=XXX
210   CONTINUE
     DO 230 I1=1,MZ,1
      DO 240 J1=1,I1,1
       IF (I1.EQ.J1) THEN
        TEM=0.0
        DO 250 K1=1,MZ,1
         TEM=TEM+TEMMM2(I1,K1)
250      CONTINUE
        U(I1,J1)=-(TEM+TEMM2(I1,1))*XCON
       ELSE
        U(I1,J1)=TEMMM2(I1,J1)*XCON
        U(J1,I1)=U(I1,J1)
       ENDIF
240   CONTINUE
230   CONTINUE
     DO 260 I1=1,MZ,1
      DO 270 I2=1,NZ,1
       IO(I1,I2)=0
270   CONTINUE
260   CONTINUE
     READ(7,*)
     DO 280 I=1,NZ,1
      READ(7,*)
      READ(7,*)
      READ(7,*) I1,I2,XX3,XX1
      IF(I1.NE.0) IO(I1,I)=1
      IF(I2.NE.0) IO(I2,I)=-1
      HIGHO(I,1)=XX2
      ALFAA(I,1)=XX1
      IF(I1*I2.EQ.0) THEN
       IF(I1.EQ.0) OUTO(I,1)=1.0
       IF(I2.EQ.0) OUTO(I,1)=-1.0
      ELSE
       OUTO(I,1)=0.0
      ENDIF
280   CONTINUE
     READ(7,*)
     DO 290 I=1,IZ,1
      READ(7,*)
      READ(7,*) I1
      I5=0
      I6=0
      DO 300 J=1,I1,1
       READ(7,*)
       READ(7,*) I2,I3,I4
       IF(I3.NE.0) THEN
        LO(I,I2)=IO(I3,I2)
       ELSE
        LO(I,I2)=-IO(I4,I2)
       ENDIF
       IF(I3.EQ.0) I5=I2
       IF(I4.EQ.0) I6=I2
300   CONTINUE
      READ(7,*)
      READ(7,*)
      READ(7,*) XX1,XX2
      PWIN(I,1)=XX1
      PWOUT(I,1)=XX2
      OUTP(I5,1)=I
      OUTP(I5,2)=1
      OUTP(I6,1)=I
      OUTP(I6,2)=2
290   CONTINUE
     DO 310 I=1,MZ,1
      READ(7,*)
      READ(7,*)
      READ(7,*) IST,ISW,XTR,XWR
      ST(I,1)=IST
      SW(I,1)=ISW
      TR(I,1)=XTR
      WR(I,1)=XWR
310   CONTINUE
     IF (NF.GT.0) THEN
      DO 320 I=1,IZ,1
       READ(7,*)
       READ(7,*)
       READ(7,*) H,XX1,XX2
       IFAN(11,I)=-1
       HIGHF(I,1)=XX1
       HFIN(I,1)=XX2
       READ(7,*)
       READ(7,*)
       READ(7,*) I2
       DO 330 J=1,I2,1
        READ(7,*)
        READ(7,*) J2,J3,J4
        IF(J3.NE.0) THEN
         LFAN(I,J2)=IO(J3,J2)
        ENDIF
330    CONTINUE
       READ(7,*)
```

```
      READ(7,*) XX1,XX2,J1,XX3
      PWFIN(I,1)=XX1
      PWFOUT(I,1)=XX2
      TF(I,1)=XX3
      TYPEF(I,1)=J1
      READ(7,*)
      READ(7,*)
      READ(7,*)
      READ(7,*) XX1,XX2,XX3
      AFAN(I,1)=XX1
      AFAN(I,2)=XX2
      AFAN(I,3)=XX3
      IF (IFLOON.EQ.1) THEN
       READ(7,*)
       READ(7,*) XX1
       GLF(I,1)=XX1/60.0
      ENDIF
320   CONTINUE
     ENDIF
     ENDIF
*-----------------------------------------------------------------*
1000 CONTINUE
     RETURN
     END
*****************************************************************
*****************************************************************
*-----------------------------------------------------------------*
     SUBROUTINE MULTI(NSOL)
     PARAMETER(MZ=2,NZ=6,LZ=3,IZ=1,ERRA=0.001,NZ=0.0001,MXIT=200,NF=0,
    &         IFLOON=1)
*-----------------------------------------------------------------*
     DOUBLE PRECISION GL(LZ,1),PL(LZ,1),GLF(IZ,1),PLF(IZ,1)
     DOUBLE PRECISION GO(NZ,1),FRR(NZ,MZ),FFR(IZ,MZ),FFF(IZ,IZ),
    &                ALFAA(NZ,1),PO(NZ,1),PF(IZ,1),FLEVEL(MZ,1)
     DOUBLE PRECISION IO(MZ,NZ),IFAN(MZ,IZ),LO(LZ,NZ),LFAN(IZ,NZ),
    &                HIGHO(NZ,1),HIGHF(IZ,1),AFAN(IZ,3)
     DOUBLE PRECISION H(MZ,MZ),U(MZ,MZ),WF(MZ,1),TR(MZ,1),TF(IZ,1),
    &                TO(NZ,1),TOF(IZ,1),RHOR(MZ,1),RHOO(NZ,1)
     DOUBLE PRECISION ST(MZ,1),SW(MZ,1),WR(MZ,1),C(MZ,1),X(MZ,1),
    &                R(MZ,MZ),RHE(MZ,MZ),E(MZ,MZ),RHOF(IZ,1)
     DOUBLE PRECISION PWOUT(LZ,1),PWIN(LZ,1),PWFOUT(IZ,1),
    &                PWFIN(IZ,1),HFIN(IZ,1),TYPEF(IZ,1),PR(MZ,1)
     DOUBLE PRECISION TEMNL1(NZ,LZ),TEMN1(NZ,1),TEMN2(NZ,1),
    &                TEMNI1(NZ,IZ),TEMNMI1(NZ,MZ),TEMNMI2(NZ,MZ)
     DOUBLE PRECISION TEM1M1(1,MZ),TEMI1(IZ,1),TEMIM1(IZ,MZ),
    &                TEMIM2(IZ,MZ),TEM1I1(1,IZ),TEMII1(IZ,IZ)
     DOUBLE PRECISION TEMNN1(NZ,NZ),TEMMM1(MZ,MZ),TEMMM2(MZ,MZ),
    &                TEMMM3(MZ,MZ),TEM,TEMI2(IZ,1),TEMM1(MZ,1)
     DOUBLE PRECISION TEMM2(MZ,1),TEML1(LZ,1),OUTO(NZ,1),OUTP(NZ,2)
     DOUBLE PRECISION CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-----------------------------------------------------------------*
     DOUBLE PRECISION GLL(LZ,5*(LZ+NF)),GLLF(IZ,5*(LZ+NF))
     DOUBLE PRECISION WINDEX(5*(LZ+NF))
     INTEGER INSOL(5*(LZ+NF))
*-----------------------------------------------------------------*
     COMMON/CB1/GO,FRR,FFR,FFF,ALFAA,PO,PF,FLEVEL
     COMMON/CB2/IO,IFAN,LO,LFAN,HIGHO,HIGHF,AFAN
     COMMON/CB3/H,U,WF,TR,TF,TO,TOF,RHOR,RHOO
     COMMON/CB4/ST,SW,WR,C,X,R,RHE,E,RHOF
     COMMON/CB5/PWOUT,PWIN,PWFOUT,PWFIN,HFIN,TYPEF,PR
     COMMON/TEM1/TEMNL1,TEMN1,TEMN2,TEMNI1,TEMNMI1,TEMNMI2
     COMMON/TEM2/TEM1M1,TEMI1,TEMIM1,TEMIM2,TEM1I1,TEMII1
     COMMON/TEM3/TEMNN1,TEMMM1,TEMMM2,TEMMM3,TEM,TEMI2,TEMM1
     COMMON/TEM4/TEMM2,TEML1,OUTO,OUTP
     COMMON/CON/CP,T0,RHO0,GRAV,RMAX,RMIN,P0
     COMMON/GG/GL,PL,GLF,PLF
     COMMON/MUL/TGLL,GLLF,INSOL,WINDEX
*-----------------------------------------------------------------*
     NNN1=0
     NNN2=0
     NSOL=0
     DO 5 J=1,(5*(LZ+NF)),1
      INSOL(J)=0
5    CONTINUE
     ISTART=199
     DO 10 I=ISTART,ISTART+200,1
      WRITE(*,*) 'NUMBER OF ITERATE IN MULTI=',I-ISTART+1
      NNN1=NNN1+1
      DO 20 J=1,LZ+NF,1
       IF (J.LE.LZ) THEN
        GL(J,1)=RAND(J*I)*(RMAX-RMIN)+RMIN
        IF(I.EQ.ISTART) THEN
         GL(J,1)=0.0
        ENDIF
       ELSE
        IF (IFLOON.EQ.0) THEN
         GLF(J-LZ,1)=RAND(J*I)*(RMAX-RMIN)+RMIN
         IF(I.EQ.ISTART) THEN
          GLF(J-LZ,1)=0.0
         ENDIF
        ENDIF
       ENDIF
20    CONTINUE
      CALL NEWTON(GL,PL,GLF,PLF,ITER,ISOL)
      WRITE(*,*) 'N OF ITER FROM NEWTON=',ITER,'  N OF SOLUTION=',ISOL
      IF (ISOL.EQ.1) THEN
       IF(NNN2.EQ.0) THEN
        NNN2=2
        NSOL=NSOL+1
        DO 30 JJ=1,LZ+NF,1
         IF (JJ.LE.LZ) THEN
          GLL(JJ,1)=GL(JJ,1)
         ELSE
          IF(NF.GT.0) THEN
           GLLF(JJ-LZ,1)=GLF(JJ-LZ,1)
          ENDIF
         ENDIF
30      CONTINUE
       ENDIF
       IF (NNN2.GT.1) THEN
        DO 40 J=1,NSOL,1
         NNN3=0
         DO 50 K=1,LZ,1
          ABSX=ABS(GL(K,1)-GLL(K,J))
          IF(ABSX.LT.0.01) THEN
           NNN3=NNN3+1
          ENDIF
50       CONTINUE
         IF(NF.GT.0) THEN
          DO 60 KK=1,IZ,1
           ABSX=ABS(GLF(KK,1)-GLLF(KK,J))
```

```
      IF(ABSX.LT.0.01)THEN
       NNN3=NNN3+1
      ENDIF
60    CONTINUE
     ENDIF
     IF(NNN3.EQ.(LZ+NF)) THEN
      INSOL(J)=INSOL(J)+1
      GOTO 70
     ENDIF
     IF(J.EQ.NSOL) THEN
      NSOL=NSOL+1
      INSOL(NSOL)=INSOL(NSOL)+1
      DO 80 JJ=1,LZ+NF,1
       IF (JJ.LE.LZ) THEN
        GLL(JJ,NSOL)=GL(JJ,1)
       ELSE
        GLLF(JJ-LZ,NSOL)=GLF(JJ-LZ,1)
       ENDIF
80     CONTINUE
     ENDIF
40    CONTINUE
70     CONTINUE
    ENDIF
   ENDIF
10  CONTINUE
   CALL WORKINDEX(NSOL)
   RETURN
   END
*-----------------------------------------------------------------------*

*-----------------------------------------------------------------------*
   SUBROUTINE WORKINDEX(NSOL)
   PARAMETER(MZ=2,NZ=6,LZ=3,IZ=1,ERRA=0.001,HZ=0.0001,MXIT=200,NF=0,
  &        IFLOOP=1)
*-----------------------------------------------------------------------*
   DOUBLE PRECISION GL(LZ,1),PL(LZ,1),GLF(IZ,1),PLF(IZ,1)
   DOUBLE PRECISION GO(NZ,1),FRR(NZ,MZ),FFR(IZ,MZ),FFF(IZ,IZ),
  &        ALFAA(NZ,1),PO(NZ,1),PF(IZ,1),FLEVEL(MZ,1)
   DOUBLE PRECISION IO(MZ,NZ),IFAN(MZ,IZ),LO(LZ,NZ),LFAN(IZ,NZ),
  &        HIGHO(NZ,1),HIGHF(IZ,1),AFAN(IZ,3)
   DOUBLE PRECISION H(MZ,MZ),U(MZ,MZ),WF(MZ,1),TR(MZ,1),TF(IZ,1),
  &        TO(NZ,1),TOF(IZ,1),RHOR(MZ,1),RHOO(NZ,1)
   DOUBLE PRECISION ST(MZ,1),SW(MZ,1),WR(MZ,1),C(MZ,1),X(MZ,1),
  &        R(MZ,MZ),RHE(MZ,MZ),E(MZ,MZ),RHOF(IZ,1)
   DOUBLE PRECISION PWOUT(LZ,1),PWIN(LZ,1),PWPOUT(IZ,1),
  &        PWFIN(IZ,1),HFIN(IZ,1),TYPEF(IZ,1),PR(MZ,1)
   DOUBLE PRECISION TEMNL1(NZ,LZ),TEMN1(NZ,1),TEMN2(NZ,1),
  &        TEMN1(NZ,IZ),TEMNM1(NZ,MZ),TEMNM2(NZ,MZ)
   DOUBLE PRECISION TEM1M1(1,MZ),TEM11(IZ,1),TEMM1(IZ,MZ),
  &        TEMM2(IZ,MZ),TEM111(1,IZ),TEM11(IZ,IZ)
   DOUBLE PRECISION TEMNN1(NZ,NZ),TEMMM1(MZ,MZ),TEMMM2(MZ,MZ),
  &        TEMMM3(MZ,MZ),TEM,TEM12(IZ,1),TEMM1(MZ,1)
   DOUBLE PRECISION TEMM2(MZ,1),TEML1(LZ,1),OUTO(NZ,1),OUTP(NZ,2)
   DOUBLE PRECISION CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-----------------------------------------------------------------------*
   DOUBLE PRECISION GLL(LZ,6*(LZ+NF)),GLLF(IZ,6*(LZ+NF))
   DOUBLE PRECISION WINDEX(6*(LZ+NF))
   INTEGER INSOL(6*(LZ+NF))
*-----------------------------------------------------------------------*
   COMMON/CB1/GO,FRR,FFR,FFF,ALFAA,PO,PF,FLEVEL
   COMMON/CB2/IO,IFAN,LO,LFAN,HIGHO,HIGHF,AFAN
   COMMON/CB3/H,U,WF,TR,TF,TO,TOF,RHOR,RHOO
   COMMON/CB4/ST,SW,WR,C,X,R,RHE,E,RHOF
   COMMON/CB5/PWOUT,PWIN,PWPOUT,PWFIN,HFIN,TYPEF,PR
   COMMON/TEM1/TEMNL1,TEMN1,TEMN2,TEMNN1,TEMNM1,TEMNM2
   COMMON/TEM2/TEM1M1,TEM11,TEMM1,TEMM2,TEM111,TEM11
   COMMON/TEM3/TEMNN1,TEMMM1,TEMMM2,TEMMM3,TEM,TEM12,TEMM1
   COMMON/TEM4/TEMM2,TEML1,OUTO,OUTP
   COMMON/CON/CP,T0,RHO0,GRAV,RMAX,RMIN,P0
   COMMON/GG/GL,PL,GLF,PLF
   COMMON/MULT/GLL,GLLF,INSOL,WINDEX
*-----------------------------------------------------------------------*
   DO 110 I=1,6*(LZ+NF),1
    WINDEX(I)=0.0
110  CONTINUE
   DO 100 I=1,NSOL,1
    DO 200 J=1,LZ,1
     GL(J,1)=GLL(J,I)
200  CONTINUE
    IF(NF.GT.0) THEN
     DO 300 J=1,NF,1
      GLF(J,1)=GLLF(J,I)
300   CONTINUE
    ENDIF
    IF(NF.GT.0) THEN
     CALL LOOPWP(GL,PL,GLF,PLF)
    ELSE
     CALL LOOP(GL,PL,GLF,PLF)
    ENDIF
    DO 400 J=1,NZ,1
     IF(GO(J,1).NE.0) THEN
      TEM=GO(J,1)/(ABS(GO(J,1)))
     ELSE
      TEM=0
     ENDIF
     TEM=TEM*OUTO(J,1)
     J1=OUTP(J,1)
     J2=OUTP(J,2)
     IF(J1.NE.0) THEN
      IF(J2.EQ.1) XX1=PWIN(J1,1)
      IF(J2.EQ.2) XX1=PWOUT(J1,1)
     ENDIF
     IF(TEM.EQ.1.0) THEN
      XXX=XX1-RHO0*GRAV*HIGHO(J,1)
      XXX=XXX*(ABS(GO(J,1)))/RHOO(J,1)*(-1.0)
      WINDEX(I)=WINDEX(I)+XXX
     ENDIF
     IF(TEM.EQ.(-1.0)) THEN
      XXX=GO(J,1)**2/2/RHOO(J,1)/ALFAA(J,1)**2
      XXX=XXX+XX1-RHO0*GRAV*HIGHO(J,1)
      XXX=XXX*(ABS(GO(J,1)))/RHOO(J,1)
      WINDEX(I)=WINDEX(I)+XXX
     ENDIF
400  CONTINUE
100 CONTINUE
   RETURN
   END
*-----------------------------------------------------------------------*

*-----------------------------------------------------------------------*

*-----------------------------------------------------------------------*
   SUBROUTINE NEWTON(GL,PL,GLF,PLF,ITER,ISOL)
   PARAMETER(MZ=2,NZ=6,LZ=3,IZ=1,ERRA=0.001,HZ=0.0001,MXIT=200,NF=0,
```

```
     &       IFLCON=1)
C-----------------------------------------------------------------------
      DOUBLE PRECISION GL(LZ,1),PL(LZ,1),GLF(IZ,1),PLF(IZ,1)
      DOUBLE PRECISION GO(NZ,1),FRR(NZ,MZ),FFR(IZ,MZ),FFF(IZ,IZ),
     &                 ALFAA(NZ,1),PO(NZ,1),PF(IZ,1),FLEVEL(MZ,1)
      DOUBLE PRECISION IO(MZ,NZ),IFAN(MZ,IZ),LO(LZ,NZ),LFAN(IZ,NZ),
     &                 HIGHO(NZ,1),HIGHF(IZ,1),AFAN(IZ,3)
      DOUBLE PRECISION H(MZ,MZ),U(MZ,MZ),WF(MZ,1),TR(MZ,1),TF(IZ,1),
     &                 TO(NZ,1),TOP(IZ,1),RHOR(MZ,1),RHOO(NZ,1)
      DOUBLE PRECISION ST(MZ,1),SW(MZ,1),WR(MZ,1),C(MZ,1),X(MZ,1),
     &                 R(MZ,MZ),RHE(MZ,MZ),E(MZ,MZ),RHOF(IZ,1)
      DOUBLE PRECISION PWOUT(LZ,1),PWIN(LZ,1),PWFOUT(IZ,1),
     &                 PWFIN(IZ,1),HFIN(IZ,1),TYPEF(IZ,1),PR(MZ,1)
      DOUBLE PRECISION TEMNL1(NZ,LZ),TEMN1(NZ,1),TEMN2(NZ,1),
     &                 TEMN1(NZ,IZ),TEMNM1(NZ,MZ),TEMNM2(NZ,MZ)
      DOUBLE PRECISION TEM1M1(1,MZ),TEM1(IZ,1),TEMM1(IZ,MZ),
     &                 TEMM2(IZ,MZ),TEM1I1(1,IZ),TEMI1(IZ,IZ)
      DOUBLE PRECISION TEMNN1(NZ,NZ),TEMMM1(MZ,MZ),TEMMM2(MZ,MZ),
     &                 TEMMM3(MZ,MZ),TEM,TEMI2(IZ,1),TEMM1(MZ,1)
      DOUBLE PRECISION TEMM2(MZ,1),TEML1(LZ,1),OUTO(NZ,1),OUTP(NZ,2)
      DOUBLE PRECISION CP,T0,RHO0,GRAV,RMAX,RMIN,P0
C-----------------------------------------------------------------------
      DOUBLE PRECISION GLG1(LZ,1),GLG2(LZ,1),PLP1(LZ,1),PLP2(LZ,1),
     &                 GLGF1(IZ,1),GLGF2(IZ,1),PLPF1(IZ,1),PLPF2(IZ,1)
      DOUBLE PRECISION DJI(LZ+NF*(1-IFLCON),LZ+NF*(1-IFLCON)),
     &                 DJI(LZ+NF*(1-IFLCON),LZ+NF*(1-IFLCON)),
     &                 PLAF(LZ+NF*(1-IFLCON),1),
     &                 DJJ(LZ+NF*(1-IFLCON),LZ+NF*(1-IFLCON)),
     &                 DELTA(LZ+NF*(1-IFLCON),1)
C-----------------------------------------------------------------------
      COMMON/OB1/GO,FRR,FFR,FFF,ALFAA,PO,PF,FLEVEL
      COMMON/OB2/IO,IFAN,LO,LFAN,HIGHO,HIGHF,AFAN
      COMMON/OB3/H,U,WF,TR,TF,TO,TOP,RHOR,RHOO
      COMMON/OB4/ST,SW,WR,C,X,R,RHE,E,RHOF
      COMMON/OB5/PWOUT,PWIN,PWFOUT,PWFIN,HFIN,TYPEF,PR
      COMMON/TEM1/TEMNL1,TEMN1,TEMN2,TEMNN1,TEMNM1,TEMNM2
      COMMON/TEM2/TEM1M1,TEM11,TEMM1,TEMM2,TEM1I1,TEMI1
      COMMON/TEM3/TEMNN1,TEMMM1,TEMMM2,TEMMM3,TEM,TEMI2,TEMM1
      COMMON/TEM4/TEMM2,TEML1,OUTO,OUTP
      COMMON/CON/CP,T0,RHO0,GRAV,RMAX,RMIN,P0
C-----------------------------------------------------------------------
      ISOL=0
      DO 950 ITER=1,MXIT,1
       IF(NF.EQ.0) THEN
        CALL LOOP(GL,PL,GLF,PLF)
       ENDIF
       IF(NF.GT.0) THEN
        CALL LOOPWF(GL,PL,GLF,PLF)
       ENDIF
       DO 900 I=1,LZ+NF*(1-IFLCON),1
        DO 910 J=1,LZ+NF*(1-IFLCON),1
         IF (J.EQ.I) THEN
          IF(J.LE.LZ) THEN
           GLG1(J,1)=GL(J,1)+HZ/2.0
           GLG2(J,1)=GL(J,1)-HZ/2.0
          ELSE
           GLGF1(J-LZ,1)=GLF(J-LZ,1)+HZ/2.0
           GLGF2(J-LZ,1)=GLF(J-LZ,1)-HZ/2.0
          ENDIF
         ELSE
          IF (J.LE.LZ) THEN
           GLG1(J,1)=GL(J,1)
           GLG2(J,1)=GL(J,1)
          ELSE
           GLGF1(J-LZ,1)=GLF(J-LZ,1)
           GLGF2(J-LZ,1)=GLF(J-LZ,1)
          ENDIF
         ENDIF
  910   CONTINUE
        IF(NF.EQ.0) THEN
         CALL LOOP(GLG1,PLP1,GLF,PLF)
         CALL LOOP(GLG2,PLP2,GLF,PLF)
        ELSE
         IF (IFLCON.EQ.0) THEN
          CALL LOOPWF(GLG1,PLP1,GLGF1,PLPF1)
          CALL LOOPWF(GLG2,PLP2,GLGF2,PLPF2)
         ELSE
          CALL LOOPWF(GLG1,PLP1,GLF,PLF)
          CALL LOOPWF(GLG2,PLP2,GLF,PLF)
         ENDIF
        ENDIF
        DO 920 K=1,LZ+NF*(1-IFLCON),1
         IF (K.LE.LZ) THEN
          DJI(K,I)=(PLP1(K,1)-PLP2(K,1))/HZ
         ELSE
          DJI(K,1)=(PLPF1(K-LZ,1)-PLPF2(K-LZ,1))/HZ
         ENDIF
  920   CONTINUE
  900   CONTINUE
        CALL INV(DJI,LZ+NF*(1-IFLCON),DJI,DJJ)
        TEM = -1.0
        CALL DOT(TEM,DJI,LZ+NF*(1-IFLCON),LZ+NF*(1-IFLCON),DJJ)
        DO 925 I=1,LZ+NF*(1-IFLCON),1
         IF (I.LE.LZ) THEN
          PLAF(I,1)=PL(I,1)
         ELSE
          PLAF(I,1)=PLF(I-LZ,1)
         ENDIF
  925   CONTINUE
        CALL MDOT(DJJ,PLAF,LZ+NF*(1-IFLCON),LZ+NF*(1-IFLCON),1,DELTA)
        DO 930 I=1,LZ+NF*(1-IFLCON),1
         IF(I.LE.LZ) THEN
          ABSPL=ABS(PL(I,1))
          ABSGL=ABS(DELTA(I,1))
         ELSE
          ABSPL=ABS(PLF(I-LZ,1))
          ABSGL=ABS(DELTA(I,1))
         ENDIF
         IF((ABSPL.GT.ERRA).OR.(ABSGL.GT.ERRA)) THEN
          DO 940 J=1,LZ+NF*(1-IFLCON),1
           IF (J.LE.LZ) THEN
            GL(J,1)=GL(J,1)+DELTA(J,1)
           ELSE
            GLF(J-LZ,1)=GLF(J-LZ,1)+DELTA(J,1)
           ENDIF
  940     CONTINUE
          GOTO 960
         ELSE
          CONTINUE
         ENDIF
  930   CONTINUE
        GOTO 970
  960    CONTINUE
  950  CONTINUE
```

```
970   CONTINUE
      IF (ITER.LT.MXIT) THEN
       ISOL=1
      ENDIF
      RETURN
      END
*-----------------------------------------------------------------------*
*-----------------------------------------------------------------------*
      SUBROUTINE ROOMPRES()
      PARAMETER(MZ=2,NZ=6,LZ=3,IZ=1,ERRA=0.001,HZ=0.0001,MXIT=200,NF=0,
     &          IFLCON=1)
*-----------------------------------------------------------------------*
      DOUBLE PRECISION GL(LZ,1),PL(LZ,1),GLF(IZ,1),PLF(IZ,1)
      DOUBLE PRECISION GO(NZ,1),FRR(NZ,MZ),FFR(IZ,MZ),FFF(IZ,IZ),
     &                 ALFAA(NZ,1),PO(NZ,1),PF(IZ,1),FLEVEL(MZ,1)
      DOUBLE PRECISION IO(MZ,NZ),IFAN(MZ,IZ),LO(LZ,NZ),LFAN(IZ,NZ),
     &                 HIGHO(NZ,1),HIGHF(IZ,1),AFAN(IZ,3)
      DOUBLE PRECISION H(MZ,MZ),U(MZ,MZ),WF(MZ,1),TR(MZ,1),TF(IZ,1),
     &                 TO(NZ,1),TOF(IZ,1),RHOR(MZ,1),RHOO(NZ,1)
      DOUBLE PRECISION ST(MZ,1),SW(MZ,1),WR(MZ,1),C(MZ,1),X(MZ,1),
     &                 R(MZ,MZ),RHE(MZ,MZ),E(MZ,MZ),RHOF(IZ,1)
      DOUBLE PRECISION PWOUT(LZ,1),PWIN(LZ,1),PWFOUT(IZ,1),
     &                 PWFIN(IZ,1),HFIN(IZ,1),TYPEF(IZ,1),PR(MZ,1)
      DOUBLE PRECISION TEMNL1(NZ,LZ),TEMN1(NZ,1),TEMN2(NZ,1),
     &                 TEMN1(NZ,IZ),TEMNM1(NZ,MZ),TEMNM2(NZ,MZ)
      DOUBLE PRECISION TEM1M1(1,MZ),TEM1(IZ,1),TEMM1(IZ,MZ),
     &                 TEMM2(IZ,MZ),TEM1I1(1,IZ),TEMI1(IZ,IZ)
      DOUBLE PRECISION TEMNN1(NZ,NZ),TEMMM1(MZ,MZ),TEMMM2(MZ,MZ),
     &                 TEMMM3(MZ,MZ),TEM,TEMI2(IZ,1),TEMMI1(MZ,1)
      DOUBLE PRECISION TEMM2(MZ,1),TEML1(LZ,1),OUTO(NZ,1),OUTP(NZ,2)
      DOUBLE PRECISION CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-----------------------------------------------------------------------*
      COMMON/CB1/GO,FRR,FFR,FPF,ALFAA,PO,PF,FLEVEL
      COMMON/CB2/IO,IFAN,LO,LFAN,HIGHO,HIGHF,AFAN
      COMMON/CB3/H,U,WF,TR,TF,TO,TOF,RHOR,RHOO
      COMMON/CB4/ST,SW,WR,C,X,R,RHE,E,RHOF
      COMMON/CB5/PWOUT,PWIN,PWFOUT,PWFIN,HFIN,TYPEF,PR
      COMMON/TEM1/TEMNL1,TEMN1,TEMN2,TEMN11,TEMNM1,TEMNM2
      COMMON/TEM2/TEM1M1,TEMI1,TEMMM1,TEMMM2,TEM1I1,TEMII1
      COMMON/TEM3/TEMNN1,TEMMM1,TEMMM2,TEMMM3,TEM,TEMI2,TEMM1
      COMMON/TEM4/TEMM2,TEML1,OUTO,OUTP
      COMMON/CON/CP,T0,RHO0,GRAV,RMAX,RMIN,P0
      COMMON/GG/GL,PL,GLF,PLF
*-----------------------------------------------------------------------*
      DO 10 I=1,MZ,1
       TEMM1(I,1)=0.0
       PR(I,1)=0.0
10    CONTINUE
      DO 20 I=1,MZ,1
       I1=0
       DO 30 J=1,MZ,1
        I1=I1+TEMM1(J,1)
30    CONTINUE
      IF(I1.EQ.MZ) THEN
       GOTO 111
      ENDIF
      DO 40 J=1,MZ,1
       IF(TEMM1(J,1).EQ.0.0) THEN
        DO 50 K=1,NZ,1
         IF(TEMM1(J,1).EQ.1.0) GOTO 222
         IF(ABS(IO(J,K)).EQ.1.0) THEN
          IF (OUTO(K,1).EQ.0.0) THEN
           DO 60 J1=1,MZ,1
            I2=IO(J,K)+IO(J1,K)
            IF (I2.EQ.0) THEN
             IF(TEMM1(J1,1).EQ.1.0) THEN
              TEM=PR(J1,1)-RHOR(J1,1)*GRAV*(HIGHO(K,1)-FLEVEL(J1,1))
              TEM=TEM+IO(J,K)*PO(K,1)
              TEM=TEM+RHOR(J,1)*GRAV*(HIGHO(K,1)-FLEVEL(J,1))
              PR(J,1)=TEM
              TEMM1(J,1)=1.0
             ENDIF
            ENDIF
60         CONTINUE
           ELSE
            J1=OUTP(K,1)
            J2=OUTP(K,2)
            IF(J1.NE.0) THEN
             IF(J2.EQ.1) XX1=PWIN(J1,1)
             IF(J2.EQ.2) XX1=PWOUT(J1,1)
            ENDIF
            TEM=XX1-RHO0*GRAV*HIGHO(K,1)
            TEM=TEM+IO(J,K)*PO(K,1)
            TEM=TEM+RHOR(J,1)*GRAV*(HIGHO(K,1)-FLEVEL(J,1))
            PR(J,1)=TEM
            TEMM1(J,1)=1.0
           ENDIF
          ENDIF
50       CONTINUE
222      CONTINUE
        ENDIF
40    CONTINUE
20    CONTINUE
111   CONTINUE
      RETURN
      END
*-----------------------------------------------------------------------*
*-----------------------------------------------------------------------*
      SUBROUTINE LOOPWF(GL,PL,GLF,PLF)
      PARAMETER(MZ=2,NZ=6,LZ=3,IZ=1,ERRA=0.001,HZ=0.0001,MXIT=200,NF=0,
     &          IFLCON=1)
*-----------------------------------------------------------------------*
      DOUBLE PRECISION GL(LZ,1),PL(LZ,1),GLF(IZ,1),PLF(IZ,1)
      DOUBLE PRECISION GO(NZ,1),FRR(NZ,MZ),FFR(IZ,MZ),FFF(IZ,IZ),
     &                 ALFAA(NZ,1),PO(NZ,1),PF(IZ,1),FLEVEL(MZ,1)
      DOUBLE PRECISION IO(MZ,NZ),IFAN(MZ,IZ),LO(LZ,NZ),LFAN(IZ,NZ),
     &                 HIGHO(NZ,1),HIGHF(IZ,1),AFAN(IZ,3)
      DOUBLE PRECISION H(MZ,MZ),U(MZ,MZ),WF(MZ,1),TR(MZ,1),TF(IZ,1),
     &                 TO(NZ,1),TOF(IZ,1),RHOR(MZ,1),RHOO(NZ,1)
      DOUBLE PRECISION ST(MZ,1),SW(MZ,1),WR(MZ,1),C(MZ,1),X(MZ,1),
     &                 R(MZ,MZ),RHE(MZ,MZ),E(MZ,MZ),RHOF(IZ,1)
      DOUBLE PRECISION PWOUT(LZ,1),PWIN(LZ,1),PWFOUT(IZ,1),
     &                 PWFIN(IZ,1),HFIN(IZ,1),TYPEF(IZ,1),PR(MZ,1)
      DOUBLE PRECISION TEMNL1(NZ,LZ),TEMN1(NZ,1),TEMN2(NZ,1),
     &                 TEMN1(NZ,IZ),TEMNM1(NZ,MZ),TEMNM2(NZ,MZ)
      DOUBLE PRECISION TEM1M1(1,MZ),TEM1(IZ,1),TEMM1(IZ,MZ),
     &                 TEMM2(IZ,MZ),TEM1I1(1,IZ),TEMI1(IZ,IZ)
      DOUBLE PRECISION TEMNN1(NZ,NZ),TEMMM1(MZ,MZ),TEMMM2(MZ,MZ),
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     &              TEMMM3(MZ,MZ),TEM,TEMI2(IZ,1),TEMMI1(MZ,1)
      DOUBLE PRECISION TEMM2(MZ,1),TEML1(LZ,1),OUTO(NZ,1),OUTP(NZ,2)
      DOUBLE PRECISION CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-----------------------------------------------------------------------*
      COMMON/CB1/GO,FRR,FFR,FFF,ALFAA,PO,PF,FLEVEL
      COMMON/CB2/IO,IFAN,LO,LFAN,HIGHO,HIGHF,AFAN
      COMMON/CB3/H,U,WF,TR,TF,TO,TOF,RHOR,RHOO
      COMMON/CB4/ST,SW,WR,C,X,R,RHE,E,RHOF
      COMMON/CB5/PWOUT,PWIN,PWFOUT,PWFIN,HFIN,TYPEF,PR
      COMMON/TEM1/TEMNL1,TEMN1,TEMN2,TEMNN1,TEMNM1,TEMNM2
      COMMON/TEM2/TEM1M1,TEMI1,TEMMM1,TEMMM2,TEM1I1,TEMII1
      COMMON/TEM3/TEMNN1,TEMMM1,TEMMM2,TEMMM3,TEM,TEMI2,TEMM1
      COMMON/TEM4/TEMM2,TEML1,OUTO,OUTP
      COMMON/CON/CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-----------------------------------------------------------------------*

*-------------------------------FIND GO---------------------------------*
      CALL MTRP(LO,LZ,NZ,TEMNL1)
      CALL MDOT(TEMNL1,GL,NZ,LZ,1,TEMN1)
      CALL MTRP(LFAN,IZ,NZ,TEMN1)
      CALL MDOT(TEMN1,GLF,NZ,IZ,1,TEMN2)
      CALL MSUM(TEMN1,TEMN2,NZ,1,GO)
*-----------------------------------------------------------------------*

*-------------------------------FIND FRR--------------------------------*
      DO 200 I=1,NZ,1
       IF (GO(I,1).NE.0) THEN
        TEMN1(I,1)=GO(I,1)/ABS(GO(I,1))
       ELSE
        TEMN1(I,1)=0.0
       ENDIF
  200  CONTINUE
      DO 210 I=1,MZ,1
       TEM1M1(1,I)=1.0
  210  CONTINUE
      CALL MDOT(TEMN1,TEM1M1,NZ,1,MZ,TEMNM1)
      CALL MTRP(IO,MZ,NZ,FRR)
      CALL MSUM(FRR,TEMNM1,NZ,MZ,TEMNM2)
      TEM = 0.5
      CALL DOT(TEM,TEMNM2,NZ,MZ,TEMNM1)
      DO 220 I=1,NZ,1
       DO 230 J=1,MZ,1
        IF (ABS(TEMNM1(I,J)).LT.1) THEN
         FRR(I,J)=0.0
        ELSE
         FRR(I,J)=1.0
        ENDIF
  230  CONTINUE
  220  CONTINUE
*-----------------------------------------------------------------------*

*-------------------------------FIND FFR--------------------------------*
      DO 240 I=1,IZ,1
       IF (GLF(I,1).NE.0) THEN
        TEMI1(I,1)=GLF(I,1)/ABS(GLF(I,1))
       ELSE
        TEMI1(I,1)=0.0
       ENDIF
  240  CONTINUE
      DO 250 I=1,MZ,1
       TEM1M1(1,I)=1.0
  250  CONTINUE
      CALL MDOT(TEMI1,TEM1M1,IZ,1,MZ,TEMIM1)
      CALL MTRP(IFAN,MZ,IZ,FFR)
      CALL MSUM(FFR,TEMIM1,IZ,MZ,TEMIM2)
      TEM = 0.5
      CALL DOT(TEM,TEMIM2,IZ,MZ,TEMIM1)
      DO 260 I=1,IZ,1
       DO 270 J=1,MZ,1
        IF (ABS(TEMIM1(I,J)).LT.1) THEN
         FFR(I,J)=0.0
        ELSE
         FFR(I,J)=1.0
        ENDIF
  270  CONTINUE
  260  CONTINUE
*-----------------------------------------------------------------------*

*-------------------------------FIND FFF--------------------------------*
      DO 280 I=1,IZ,1
       IF (GLF(I,1).NE.0) THEN
        TEMI1(I,1)=GLF(I,1)/ABS(GLF(I,1))
       ELSE
        TEMI1(I,1)=0.0
       ENDIF
  280  CONTINUE
      DO 290 I=1,IZ,1
       TEMII1(1,I)=1.0
  290  CONTINUE
      CALL MDOT(TEMI1,TEMII1,IZ,1,IZ,FFF)
      DO 300 I=1,IZ,1
       DO 310 J=1,IZ,1
        IF(I.EQ.J) THEN
         TEMII1(I,J)=0.5*(FFF(I,J)+1.0)
        ELSE
         TEMII1(I,J)=0.5*FFF(I,J)
        ENDIF
  310  CONTINUE
  300  CONTINUE
      DO 320 I=1,IZ,1
       DO 330 J=1,IZ,1
        IF (ABS(TEMII1(I,J)).LT.1) THEN
         FFF(I,J)=0.0
        ELSE
         FFF(I,J)=1.0
        ENDIF
  330  CONTINUE
  320  CONTINUE
*-----------------------------------------------------------------------*

*-------------------------------FIND H----------------------------------*
      CALL MDIA(GO,NZ,TEMNN1)
      CALL MDOT(TEMNN1,FRR,NZ,NZ,MZ,TEMNM1)
      CALL MDOT(IO,TEMNM1,MZ,NZ,MZ,TEMMM1)
      TEM=CP
      CALL DOT(TEM,TEMMM1,MZ,MZ,TEMMM2)


      CALL MDIA(GLF,IZ,TEMII1)
      CALL MDOT(TEMII1,FFR,IZ,IZ,MZ,TEMIM1)
      CALL MDOT(IFAN,TEMIM1,MZ,IZ,MZ,TEMMM1)
      TEM=CP
      CALL DOT(TEM,TEMMM1,MZ,MZ,TEMMM3)
```

```
      CALL MSUM(TEMMM2,TEMMM3,MZ,MZ,TEMMM1)
      TEM = -1.0
      CALL DOT(TEM,U,MZ,MZ,TEMMM2)
      CALL MSUM(TEMMM1,TEMMM2,MZ,MZ,H)
*-------------------------------------------------------------------*

*-------------------------------FIND WF-----------------------------*
      CALL MDOT(FFF,TF,IZ,IZ,1,TEMI1)
      CALL MDIA(GLF,IZ,TEMII1)
      CALL MDOT(TEMI1,TEMI1,IZ,IZ,1,TEMI2)
      CALL MDOT(IFAN,TEMI2,MZ,IZ,1,TEMM1)
      TEM = -CP
      CALL DOT(TEM,TEMM1,MZ,1,WF)
*-------------------------------------------------------------------*

*-----------FIND ROOM TEMPERATURE AND HEAT SUPPLY-------------------*
      CALL MDIA(ST,MZ,TEMMM1)
      CALL MDIA(SW,MZ,TEMMM2)
*--FIND C
      CALL MDOT(TEMMM1,TR,MZ,MZ,1,TEMM1)
      CALL MDOT(TEMMM2,WR,MZ,MZ,1,TEMM2)
      CALL MSUM(TEMM1,TEMM2,MZ,1,C)
*--FIND X
      TEM=-1.0
      CALL DOT(TEM,TEMMM1,MZ,MZ,TEMMM3)
      CALL MDOT(H,TEMMM2,MZ,MZ,MZ,TEMMM1)
      CALL MSUM(TEMMM1,TEMMM3,MZ,MZ,R)
*-----
      DO 340 I=1,MZ,1
       DO 350 J=1,MZ,1
        IF (I.EQ.J) THEN
         E(I,J)=1.0
        ELSE
         E(I,J)=0.0
        ENDIF
  350  CONTINUE
  340  CONTINUE
*-----
      TEM=-1.0
      CALL DOT(TEM,H,MZ,MZ,TEMMM1)
      CALL MSUM(R,TEMMM1,MZ,MZ,TEMMM2)
      CALL MSUM(TEMMM2,E,MZ,MZ,RHE)
*-----
      CALL INV(R,MZ,TEMMM1,TEMMM2)
      CALL MDOT(TEMMM1,RHE,MZ,MZ,MZ,TEMMM3)
      CALL MDOT(TEMMM3,C,MZ,MZ,1,TEMM1)
      CALL MDOT(TEMMM1,WF,MZ,MZ,1,TEMM2)
      CALL MSUM(TEMM1,TEMM2,MZ,1,X)
*-----

*--FIND TR
      CALL MDIA(ST,MZ,TEMMM1)
      CALL MDIA(SW,MZ,TEMMM2)
      CALL MDOT(TEMMM1,C,MZ,MZ,1,TEMM1)
      CALL MDOT(TEMMM2,X,MZ,MZ,1,TEMM2)
      CALL MSUM(TEMM1,TEMM2,MZ,1,TR)
*--FIND WR
      CALL MDOT(TEMMM2,C,MZ,MZ,1,TEMM1)
      CALL MDOT(TEMMM1,X,MZ,MZ,1,TEMM2)
      CALL MSUM(TEMM1,TEMM2,MZ,1,WR)
*-------------------------------------------------------------------*

*-----------------------FIND OPENING TEMPERATURE--------------------*
      CALL MDOT(FRR,TR,NZ,MZ,1,TO)
      CALL MDOT(FFR,TR,IZ,MZ,1,TEMI1)
      CALL MDOT(FFF,TF,IZ,IZ,1,TEMI2)
      CALL MSUM(TEMI1,TEMI2,IZ,1,TOF)
*-------------------------------------------------------------------*

*-----------------------FIND RHOR (ROOM DENSITY)--------------------*
      DO 360 I=1,MZ,1
       RHOR(I,1)=RHOO*T0/(T0+TR(I,1))
  360  CONTINUE
*-------------------------------------------------------------------*

*-----------------------FIND RHOO (OPENING DENSITY)-----------------*
      DO 370 I=1,NZ,1
       RHOO(I,1)=RHOO*T0/(T0+TO(I,1))
  370  CONTINUE
*-------------------------------------------------------------------*

*-----------------------FIND RHOF (FAN OPENING DENSITY)-------------*
      DO 380 I=1,IZ,1
       RHOF(I,1)=RHOO*T0/(T0+TOF(I,1))
  380  CONTINUE
*-------------------------------------------------------------------*

*-------------------------------FIND PO-----------------------------*
      DO 390 I=1,NZ,1
       TEM=GO(I,1)*ABS(GO(I,1))
       PO(I,1)=TEM/(2.0*RHOO(I,1)*ALFAA(I,1)*ALFAA(I,1))
  390  CONTINUE
*-------------------------------------------------------------------*

*-------------------------------FIND PF-----------------------------*
      DO 400 J=1,IZ,1
       IF(TYPEF(J,1).EQ.1.0) THEN
        PF(J,1)= -(AFAN(J,3)*(GLF(J,1)/RHOF(J,1))**2+AFAN(J,2)
     &          *(GLF(J,1)/RHOF(J,1))+AFAN(J,1))
       ENDIF
       IF(TYPEF(J,1).EQ.-1.0) THEN
        PF(J,1)= (AFAN(J,3)*(-GLF(J,1)/RHOF(J,1))**2+AFAN(J,2)
     &          *(-GLF(J,1)/RHOF(J,1))+AFAN(J,1))
       ENDIF
  400  CONTINUE
*-------------------------------------------------------------------*

*-------------------------------FIND PL & PLF-----------------------*
      DO 410 I=1,MZ,1
       TEMM1(I,1)=GRAV*(RHOR(I,1)-RHOO)
  410  CONTINUE
      CALL MTRP(IO,MZ,NZ,TEMNM1)
      CALL MDOT(TEMNM1,TEMM1,NZ,MZ,1,TEMN1)
      CALL MDIA(HIGHO,NZ,TEMNN1)
      CALL MDOT(TEMNN1,TEMN1,NZ,NZ,1,TEMN2)
      CALL MSUM(PO,TEMN2,NZ,1,TEMN1)
      CALL MDOT(LO,TEMN1,LZ,NZ,1,TEML1)
      DO 420 I=1,LZ,1
       PL(I,1)=TEML1(I,1)+PWOUT(I,1)-PWIN(I,1)
  420  CONTINUE
*-----
      CALL MDOT(LFAN,TEMN1,IZ,NZ,1,TEMI1)
      CALL MTRP(IFAN,MZ,IZ,TEMIM1)
      CALL MDIA(HIGHF,IZ,TEMII1)
```

```
      CALL MDOT(TEMM1,TEMM1,IZ,IZ,MZ,TEMM2)
      CALL MDOT(TEMM2,TEMM1,IZ,MZ,1,TEM2)
      DO 430 I=1,IZ,1
       PLF(I,1)=TEM1(I,1)+PF(I,1)+TEM2(I,1)+PWFOUT(I,1)-PWFIN(I,1)
     *       +RHOO*GRAV*(HFIN(I,1)-HIGHF(I,1))
  430 CONTINUE
*-------------------------------------------------------------------*
      CALL ROOMPRES()
*-------------------------------------------------------------------*
      RETURN
      END
*********************************************************************
*********************************************************************
*-------------------------------------------------------------------*
      SUBROUTINE LOOP(GL,PL,GLF,PLF)
      PARAMETER(MZ=2,NZ=6,LZ=3,IZ=1,ERRA=0.001,HZ=0.0001,MDOT=200,NF=0,
     &          IFLOOP=1)
*-------------------------------------------------------------------*
      DOUBLE PRECISION GL(LZ,1),PL(LZ,1),GLF(IZ,1),PLF(IZ,1)
      DOUBLE PRECISION GO(NZ,1),FRR(NZ,MZ),FFR(IZ,MZ),FFF(IZ,IZ),
     &          ALFAA(NZ,1),PO(NZ,1),PF(IZ,1),FLEVEL(MZ,1)
      DOUBLE PRECISION IO(MZ,NZ),IFAN(MZ,IZ),LO(LZ,NZ),LFAN(IZ,NZ),
     &          HIGHO(NZ,1),HIGHF(IZ,1),AFAN(IZ,3)
      DOUBLE PRECISION H(MZ,MZ),U(MZ,MZ),WF(MZ,1),TR(MZ,1),TF(IZ,1),
     &          TO(NZ,1),TOF(IZ,1),RHOR(MZ,1),RHOO(NZ,1)
      DOUBLE PRECISION ST(MZ,1),SW(MZ,1),WR(MZ,1),C(MZ,1),X(MZ,1),
     &          R(MZ,MZ),RHE(MZ,MZ),E(MZ,MZ),RHOF(IZ,1)
      DOUBLE PRECISION PWOUT(LZ,1),PWIN(LZ,1),PWFOUT(IZ,1),
     &          PWFIN(IZ,1),HFIN(IZ,1),TYPEP(IZ,1),PR(MZ,1)
      DOUBLE PRECISION TEMNL1(NZ,LZ),TEMN1(NZ,1),TEMN2(NZ,1),
     &          TEMNN1(NZ,IZ),TEMNMM1(NZ,MZ),TEMNM2(NZ,MZ)
      DOUBLE PRECISION TEM1M1(1,MZ),TEM1(IZ,1),TEMMM1(IZ,MZ),
     &          TEMM2(IZ,MZ),TEM11I(1,IZ),TEMII1(IZ,IZ)
      DOUBLE PRECISION TEMNN1(NZ,NZ),TEMMM1(MZ,MZ),TEMMM2(MZ,MZ),
     &          TEMMM3(MZ,MZ),TEM,TEM2(IZ,1),TEMM1(MZ,1)
      DOUBLE PRECISION TEMM2(MZ,1),TEML1(LZ,1),OUTO(NZ,1),OUTP(NZ,2)
      DOUBLE PRECISION CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-------------------------------------------------------------------*
      COMMON/CB1/GO,FRR,FFR,FFF,ALFAA,PO,PF,FLEVEL
      COMMON/CB2/IO,IFAN,LO,LFAN,HIGHO,HIGHF,AFAN
      COMMON/CB3/H,U,WF,TR,TF,TO,TOF,RHOR,RHOO
      COMMON/CB4/ST,SW,WR,C,X,R,RHE,E,RHOF
      COMMON/CB5/PWOUT,PWIN,PWFOUT,PWFIN,HFIN,TYPEP,PR
      COMMON/TEM1/TEMNL1,TEMN1,TEMN2,TEMNN1,TEMNMM1,TEMNM2
      COMMON/TEM2/TEM1M1,TEM1,TEMMM1,TEMM2,TEM1I1,TEMII1
      COMMON/TEM3/TEMNN1,TEMMM1,TEMMM2,TEMMM3,TEM,TEM2,TEMM1
      COMMON/TEM4/TEMM2,TEML1,OUTO,OUTP
      COMMON/CON/CP,T0,RHO0,GRAV,RMAX,RMIN,P0
*-------------------------------------------------------------------*
*-------------------------------FIND GO-----------------------------*
      DO 202 I=1,IZ,1
       GLF(I,1)=GLF(I,1)
       PLF(I,1)=PLF(I,1)
  202 CONTINUE
      IF (IFLOOP.EQ.0) THEN
       CALL MTRP(LO,LZ,NZ,TEMNL1)
       CALL MDOT(TEMNL1,GL,NZ,LZ,1,GO)
      ENDIF
      IF (IFLOOP.EQ.1) THEN
       CALL MTRP(LO,LZ,NZ,TEMNL1)
       CALL MDOT(TEMNL1,GL,NZ,LZ,1,TEMN1)
       CALL MTRP(LFAN,IZ,NZ,TEMNN1)
       CALL MDOT(TEMNN1,GLF,NZ,IZ,1,TEMN2)
       CALL MSUM(TEMN1,TEMN2,NZ,1,GO)
      ENDIF
*-------------------------------------------------------------------*
*-------------------------------FIND FRR----------------------------*
      DO 200 I=1,NZ,1
       IF (GO(I,1).NE.0) THEN
       TEMN1(I,1)=GO(I,1)/ABS(GO(I,1))
       ELSE
       TEMN1(I,1)=0.0
       ENDIF
  200 CONTINUE
      DO 210 I=1,MZ,1
       TEM1M1(1,I)=1.0
  210 CONTINUE
      CALL MDOT(TEMN1,TEM1M1,NZ,1,MZ,TEMNM1)
      CALL MTRP(IO,MZ,NZ,FRR)
      CALL MSUM(FRR,TEMNM1,NZ,MZ,TEMNM2)
      TEM = 0.5
      CALL DOT(TEM,TEMNM2,NZ,MZ,TEMNM1)
      DO 220 I=1,NZ,1
       DO 230 J=1,MZ,1
       IF (ABS(TEMNM1(I,J)).LT.1) THEN
        FRR(I,J)=0.0
       ELSE
        FRR(I,J)=1.0
       ENDIF
  230  CONTINUE
  220 CONTINUE
*-------------------------------------------------------------------*
*-------------------------------FIND H------------------------------*
      CALL MDIA(GO,NZ,TEMNN1)
      CALL MDOT(TEMNN1,FRR,NZ,NZ,MZ,TEMNM1)
      CALL MDOT(IO,TEMNM1,MZ,NZ,MZ,TEMMM1)
      TEM=CP
      CALL DOT(TEM,TEMMM1,MZ,MZ,TEMMM2)
      TEM = -1.0
      CALL DOT(TEM,U,MZ,MZ,TEMMM1)
      CALL MSUM(TEMMM1,TEMMM2,MZ,MZ,H)
*-------------------------------------------------------------------*
*-----------------FIND ROOM TEMPERATURE AND HEAT SUPPLY-------------*
      CALL MDIA(ST,MZ,TEMMM1)
      CALL MDIA(SW,MZ,TEMMM2)
*-FIND C
      CALL MDOT(TEMMM1,TR,MZ,MZ,1,TEMM1)
      CALL MDOT(TEMMM2,WR,MZ,MZ,1,TEMM2)
      CALL MSUM(TEMM1,TEMM2,MZ,1,C)
*-FIND X
      TEM=-1.0
      CALL DOT(TEM,TEMMM1,MZ,MZ,TEMMM3)
      CALL MDOT(H,TEMMM2,MZ,MZ,MZ,TEMMM1)
      CALL MSUM(TEMMM1,TEMMM3,MZ,MZ,R)
*-----
```

```
      DO 340 I=1,MZ,1
       DO 350 J=1,MZ,1
        IF (I.EQ.J) THEN
         E(I,J)=1.0
        ELSE
         E(I,J)=0.0
        ENDIF
  350  CONTINUE
  340  CONTINUE
*-----
      TEM=-1.0
      CALL DOT(TEM,H,MZ,MZ,TEMMM1)
      CALL MSUM(R,TEMMM1,MZ,MZ,TEMMM2)
      CALL MSUM(TEMMM2,E,MZ,MZ,RHE)
*-----
      CALL INV(R,MZ,TEMMM1,TEMMM2)
      CALL MDOT(TEMMM1,RHE,MZ,MZ,MZ,TEMMM3)
      CALL MDOT(TEMMM3,C,MZ,MZ,1,X)
*--FIND TR
      CALL MDIA(ST,MZ,TEMMM1)
      CALL MDIA(SW,MZ,TEMMM2)
      CALL MDOT(TEMMM1,C,MZ,MZ,1,TEMM1)
      CALL MDOT(TEMMM2,X,MZ,MZ,1,TEMM2)
      CALL MSUM(TEMM1,TEMM2,MZ,1,TR)
*--FIND WR
      CALL MDOT(TEMMM2,C,MZ,MZ,1,TEMM1)
      CALL MDOT(TEMMM1,X,MZ,MZ,1,TEMM2)
      CALL MSUM(TEMM1,TEMM2,MZ,1,WR)
*-------------------------------------------------------------------*

*-------------------FIND OPENING TEMPERATURE--------------------*
      CALL MDOT(FRR,TR,NZ,MZ,1,TO)
*-------------------------------------------------------------------*

*-------------------FIND RHOR ROOM DENSITY----------------------*
      DO 360 I=1,MZ,1
       RHOR(I,1)=RHOO*T0/(T0+TR(I,1))
  360  CONTINUE
*-------------------------------------------------------------------*

*-------------------FIND RHOO OPENING DENSITY-------------------*
      DO 370 I=1,NZ,1
       RHOO(I,1)=RHOO*T0/(T0+TO(I,1))
  370  CONTINUE
*-------------------------------------------------------------------*

*-------------------------FIND PO-------------------------------*
      DO 380 I=1,NZ,1
       TEM=GO(I,1)*ABS(GO(I,1))
       PO(I,1)=TEM/(2.0*RHOO(I,1)*ALFAA(I,1)*ALFAA(I,1))
  380  CONTINUE
*-------------------------------------------------------------------*

*-------------------------FIND PL-------------------------------*
      DO 410 I=1,MZ,1
       TEMM1(I,1)=GRAV*(RHOR(I,1)-RHOO)
  410  CONTINUE
      CALL MTRP(HO,MZ,NZ,TEMNM1)
      CALL MDOT(TEMNM1,TEMM1,NZ,MZ,1,TEMN1)
      CALL MDIA(HIGHO,NZ,TEMNN1)
      CALL MDOT(TEMNN1,TEMN1,NZ,NZ,1,TEMN2)
      CALL MSUM(PO,TEMN2,NZ,1,TEMN1)
      CALL MDOT(LO,TEMN1,LZ,NZ,1,TEML1)
      DO 420 I=1,LZ,1
       PL(I,1)=TEML1(I,1)+PWOUT(I,1)-PWIN(I,1)
  420  CONTINUE
*-------------------------------------------------------------------*
      CALL ROOMPRES()
*-------------------------------------------------------------------*
      RETURN
      END
*********************************************************************


*********************************************************************
*-----------------SUBROUTINE TO SOLVE MATRIX DOT MATRIX-------------*
      SUBROUTINE MDOT(A,B,L,M,N,C)
      DOUBLE PRECISION A(L,M),B(M,N),C(L,N)
      DO 10 I=1,L
       DO 20 J=1,N
        C(I,J)=0
   20  CONTINUE
   10 CONTINUE
      DO 30 I=1,L
       DO 40 J=1,N
        DO 50 K=1,M
         C(I,J)=C(I,J)+(A(I,K)*B(K,J))
   50   CONTINUE
   40  CONTINUE
   30 CONTINUE
      RETURN
      END
*********************************************************************


*********************************************************************
*-------------------SUBROUTINE TO SUM MATRIX--------------------*
      SUBROUTINE MSUM(A,B,L,M,C)
      DOUBLE PRECISION A(L,M),B(L,M),C(L,M)
      DO 10 I=1,L
       DO 20 J=1,M
        C(I,J)=0
   20  CONTINUE
   10 CONTINUE
      DO 30 I=1,L
       DO 40 J=1,M
        C(I,J)=A(I,J)+B(I,J)
   40  CONTINUE
   30 CONTINUE
      RETURN
      END
*********************************************************************


*********************************************************************
*---SUBROUTINE TO CHANGE 1 COLUMN MATRIX TO DIAGONAL MATRIX-----*
      SUBROUTINE MDIA(A,L,C)
      DOUBLE PRECISION A(L,1),C(L,L)
      DO 10 I=1,L
       DO 20 J=1,L
        C(I,J)=0
   20  CONTINUE
   10 CONTINUE
```

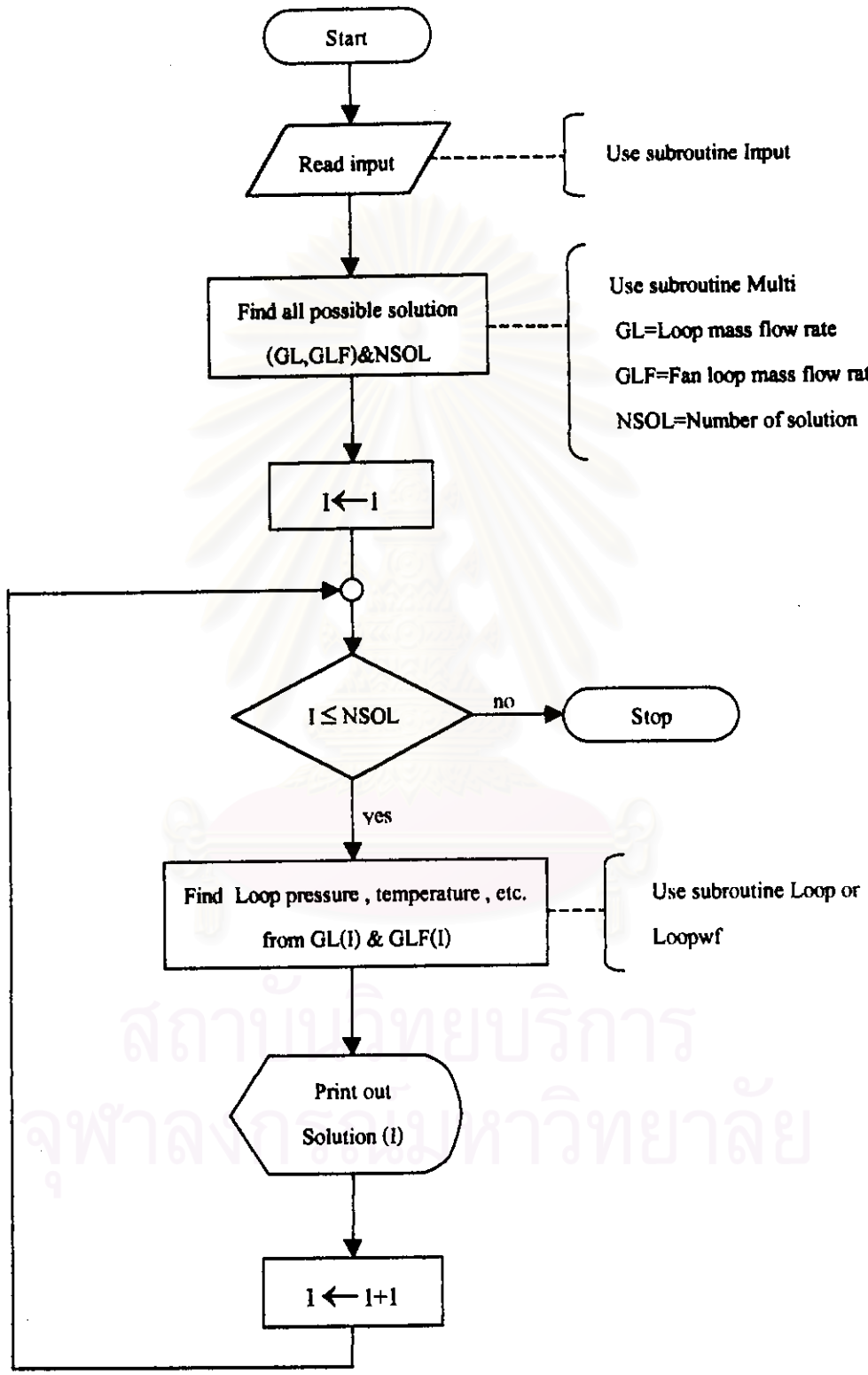
```
      DO 30 I=1,L
      DO 40 J=1,L
       IF (I.EQ.J) THEN
       C(I,J)=A(I,1)
       ELSE
       C(I,J)=0.0
       ENDIF
   40  CONTINUE
   30  CONTINUE
      RETURN
      END
*-----------------------------------------------------------------------
*-----------------------------------------------------------------------
*-----------------SUBROUTINE TO TRANSPOSE MATRIX-----------------*
      SUBROUTINE MTRP(B,L,M,C)
      DOUBLE PRECISION B(L,M),C(M,L)
      DO 10 I=1,L
       DO 20 J=1,M
       C(J,I)=0
   20  CONTINUE
   10  CONTINUE
      DO 30 I=1,L
       DO 40 J=1,M
       C(J,I)=B(I,J)
   40  CONTINUE
   30  CONTINUE
      RETURN
      END
*-----------------------------------------------------------------------
*-----------------------------------------------------------------------
*-----------------SUBROUTINE TO FIND INVERSE MATRIX-----------------*
      SUBROUTINE INV(AY,M,CY,BY)
      DOUBLE PRECISION AY(M,M),CY(M,M),BY(M,M)
      DOUBLE PRECISION XX,YY
       DO 10 I=1,M,1
       DO 20 J=1,M,1
       BY(I,J)=AY(I,J)
       IF (I.EQ.J) THEN
        CY(I,J)=1.0
       ELSE
        CY(I,J)=0.0
       ENDIF
   20  CONTINUE
   10  CONTINUE
      IF (M.EQ.1) THEN
       CY(1,1)=1.0/AY(1,1)
       GOTO 1000
      ENDIF
*-----
      DO 30 I=1,M,1
       IF (AY(I,I).EQ.0) THEN
        DO 34 J=1,M,1
         IF (AY(J,I).NE.0) THEN
          DO 35 K=1,M,1
          AY(I,K)=AY(I,K)+AY(J,K)/2.
          CY(I,K)=CY(I,K)+CY(J,K)/2.
   35     CONTINUE
          GOTO 37
         ENDIF
   34   CONTINUE
   37   CONTINUE
        ELSE
         CONTINUE
        ENDIF
   30  CONTINUE
*-----
      DO 40 I=1,M-1,1
       XX=AY(I,I)
       DO 50 J=I+1,M,1
        YY=AY(J,I)
        DO 60 K=I,M,1
        AY(J,K)=AY(J,K)-AY(I,K)*YY/XX
   60   CONTINUE
        DO 70 KK=1,M,1
        CY(J,KK)=CY(J,KK)-CY(I,KK)*YY/XX
   70   CONTINUE
   50  CONTINUE
   40  CONTINUE
       DO 80 I=1,M,1
        DO 90 J=1,M,1
         IF (I.GT.J) THEN
          AY(I,J)=0.0
         ELSE
          CONTINUE
         ENDIF
   90   CONTINUE
   80  CONTINUE
*-----
      DO 100 I=1,M,1
       XX=AY(I,I)
       DO 110 J=I,M,1
       AY(I,J)=AY(I,J)/XX
  110  CONTINUE
       DO 120 K=1,M,1
       CY(I,K)=CY(I,K)/XX
  120  CONTINUE
  100  CONTINUE
*-----
      DO 130 I=M,2,-1
       DO 140 J=I-1,1,-1
        DO 150 K=1,M
        CY(J,K)=CY(J,K)-CY(I,K)*AY(J,I)
  150   CONTINUE
        AY(J,I)=AY(J,I)-AY(I,I)*AY(J,I)
  140  CONTINUE
  130  CONTINUE
*-----
  160  CONTINUE
       DO 163 I=1,M,1
       DO 164 J=1,M,1
       AY(I,J)=BY(I,J)
  164  CONTINUE
  163  CONTINUE
 1000 CONTINUE
      RETURN
      END
*-----------------------------------------------------------------------
*-----------------------------------------------------------------------
```

```
*-----------SUBROUTINE TO CONSTANT DOT MATRIX-----------*
      SUBROUTINE DOT(A,B,L,M,C)
      DOUBLE PRECISION B(L,M),C(L,M),A
      DO 10 I=1,L
       DO 20 J=1,M
        C(I,J)=0
 20    CONTINUE
 10   CONTINUE
      DO 30 I=1,L
       DO 40 J=1,M
        C(I,J)=A*B(I,J)
 40    CONTINUE
 30   CONTINUE
      RETURN
      END
*************************************************************************
*************************************************************************
      FUNCTION RAND(KK)
       INTEGER KK,M,CONST1
       REAL RAND,CONST2
       PARAMETER(CONST1=2147483647,CONST2=.4656613E-9)
       SAVE
       DATA M /0/
       IF(M.EQ.0) M=KK
       M=M*65539
       IF(M.LT.0) M=(M+1)+CONST1
       RAND=M*CONST2
       RETURN
       END
*************************************************************************
```

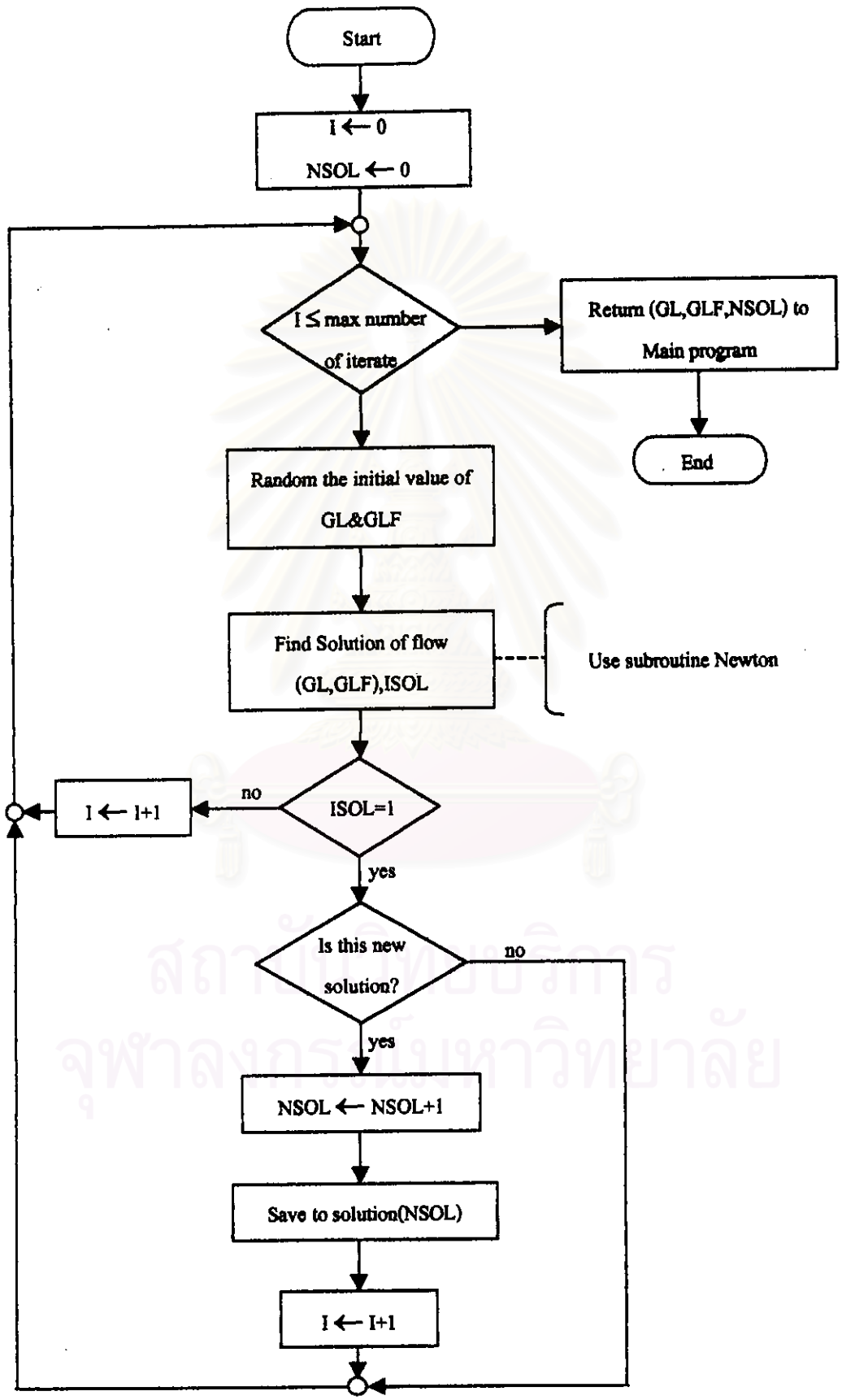
ภาคผนวก ข

แผนผังแสดงการคำนวณของโปรแกรม MRVENT

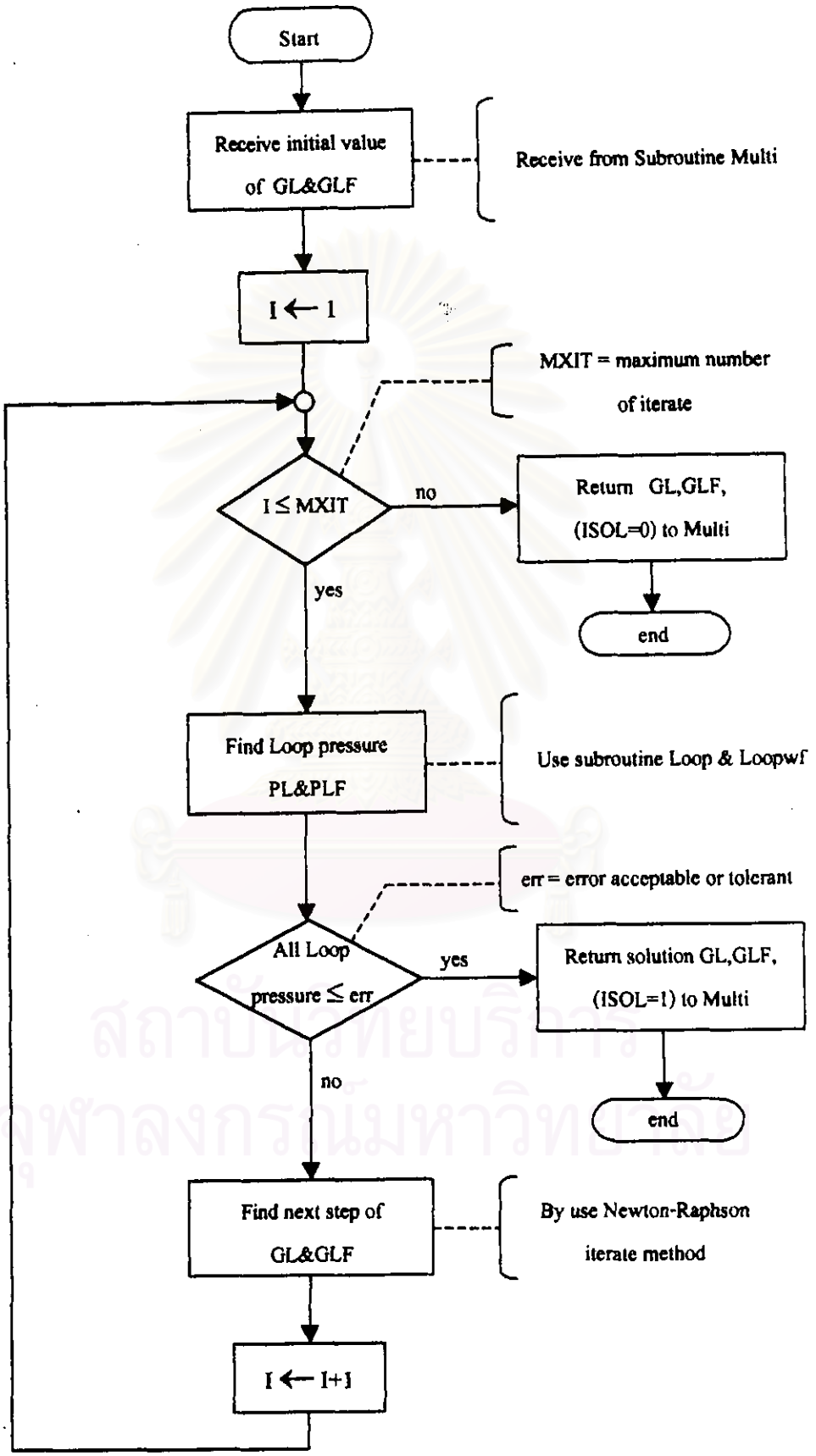
รูปที่ 89. ผังแสดงการคำนวณของโปรแกรม MRVENT (Main program)



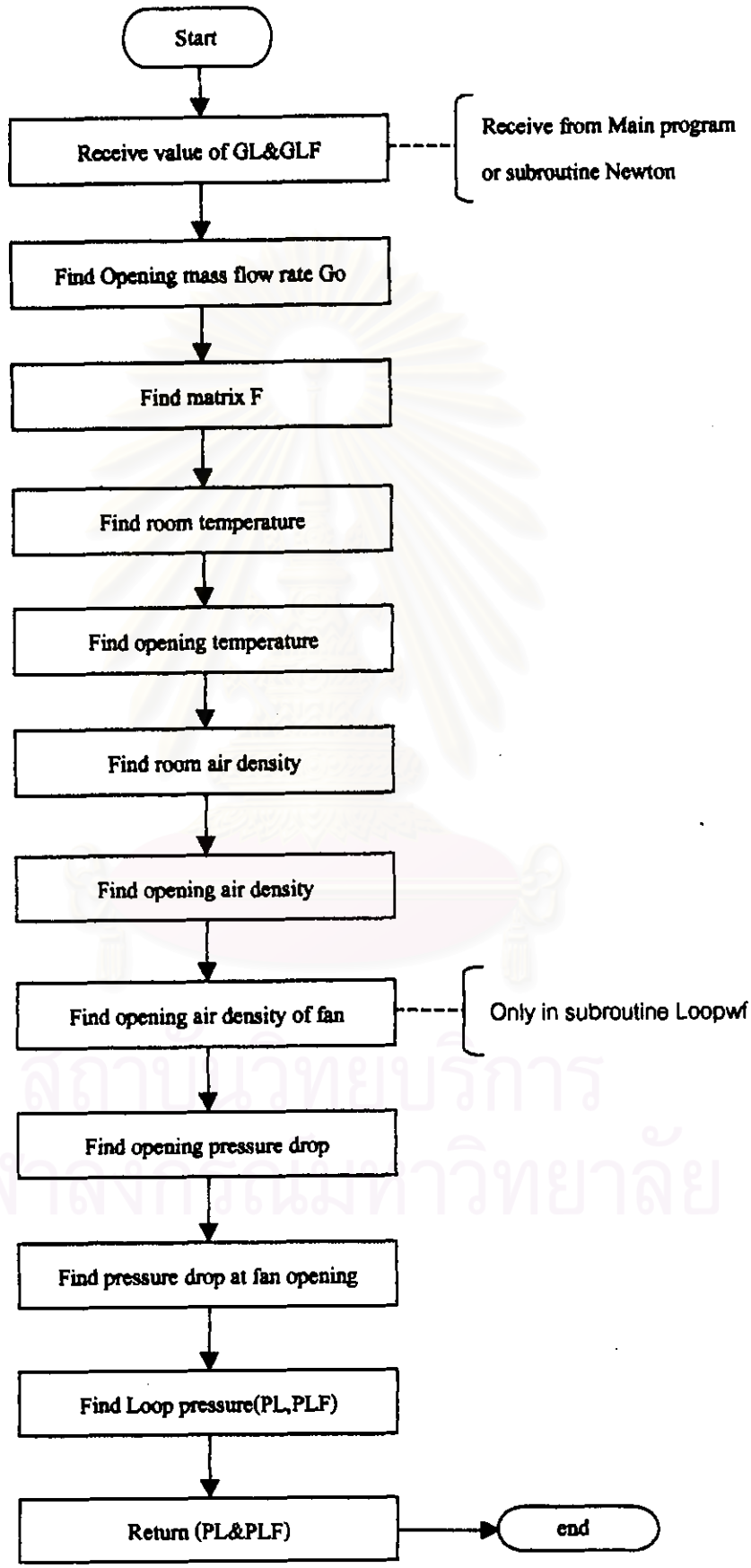
รูปที่ 90. ผังแสดงการคำนวณของโปรแกรม MRVENT (Subroutine Multi)



รูปที่ 91. ผังแสดงการคำนวณของโปรแกรม MRVENT (Subroutine Newton)



รูปที่ 92. ผังแสดงการคำนวณของโปรแกรม MRVENT (Subroutine Loop&Loopwf)



ภาคผนวก ค

ตัวอย่าง Input file สำหรับโปรแกรม MRVENT และ Output ที่คำนวณได้

ตัวอย่าง input file สำหรับอาคาร 3 ชั้น 3 วงรอบการไหล
เมื่อมีความร้อนที่ห้อง 3.(Wr3=1,000 kW) และ ความเร็วลมเท่ากับ 0 m/s ดังนี้

```
3 Loop Building
PLEASE ENTER OUTSIDE TEMPERATURE (K)
   300.000000
PLEASE ENTER OUTSIDE AIR DENSITY (kg/m**3)
    1.1614
PLEASE ENTER OUTSIDE ABSOLUTE PRESSURE (PASCAL)
 101325.000000
PLEASE ENTER SPECIFIC HEAT OF AIR (J/kg.K)
   1007.000000
PLEASE ENTER GRAVITY ACCELATION (m/s**2)
    9.810000
PLEASE ENTER WALL THERMAL CONDUCTIVITY (W/m**2)
    1.000000
PLEASE ENTER RANGE OF ITERATE:RMIN?,RMAX?(kg/min)
  -500.000000    500.000000
PLEASE ENTER NUMBER OF
ROOM?,OPENING?,LOOP?,FAN?
       9       12        3        0
PLEASE ENTER THE CHARACTER OF ROOM        1:
HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
       4
       1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
       0    180.000000
       2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
       2    100.000000
       3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
       4     38.000000
       4: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
       7     38.000000
PLEASE ENTER FLOOR LEVEL OF ROOM        1:
  0.000000E+00
PLEASE ENTER THE CHARACTER OF ROOM        2:
HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
       5
       1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
```

```
      0     80.000000
      2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      1     100.000000
      3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      3     100.000000
      4: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      5     38.000000
      5: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      8     38.000000
PLEASE ENTER FLOOR LEVEL OF ROOM        2:
    4.000000
PLEASE ENTER THE CHARACTER OF ROOM      3:
HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
      4
      1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      0     180.000000
      2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      2     100.000000
      3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      6     38.000000
      4: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      9     38.000000
PLEASE ENTER FLOOR LEVEL OF ROOM        3:
    8.000000
PLEASE ENTER THE CHARACTER OF ROOM      4:
HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
      3
      1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      0     76.000000
      2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      1     38.000000
      3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      5  0.000000E+00
PLEASE ENTER FLOOR LEVEL OF ROOM        4:
  0.000000E+00
PLEASE ENTER THE CHARACTER OF ROOM      5:
HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
      4
```

```
      1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      0     56.000000
      2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      2     38.000000
      3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      4   0.000000E+00
      4: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      6   0.000000E+00
PLEASE ENTER FLOOR LEVEL OF ROOM        5:
    4.000000
PLEASE ENTER THE CHARACTER OF ROOM      6:
HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
      3
      1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      0     74.000000
      2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      3     38.000000
      3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      5   0.000000E+00
PLEASE ENTER FLOOR LEVEL OF ROOM        6:
    8.000000
PLEASE ENTER THE CHARACTER OF ROOM      7:
HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
      3
      1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      0     76.000000
      2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      1     38.000000
      3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      8   0.000000E+00
PLEASE ENTER FLOOR LEVEL OF ROOM        7:
  0.000000E+00
PLEASE ENTER THE CHARACTER OF ROOM      8:
HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
      4
      1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      0     56.000000
      2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
```

```
      2     38.000000
      3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      7   0.000000E+00
      4: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      9   0.000000E+00
 PLEASE ENTER FLOOR LEVEL OF ROOM        8:
    4.000000
 PLEASE ENTER THE CHARACTER OF ROOM       9:
 HOW MANY ROOMS NEAR THIS ROOM (INCLUDE ROOM 0)
      3
      1: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      0     74.000000
      2: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      3     38.000000
      3: ROOM NUMBER?,WALL AREA BETWEEN?(m**2)
      8   0.000000E+00
 PLEASE ENTER FLOOR LEVEL OF ROOM         9:
    8.000000
 PLEASE ENTER DATA OF INCIDENT MATRIX
 PLEASE ENTER CHARACTER OF OPENING        1:
 FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      0        6     12.000000      2.000000
 PLEASE ENTER CHARACTER OF OPENING        2:
 FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      9        0     12.000000      2.000000
 PLEASE ENTER CHARACTER OF OPENING        3:
 FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      4        1      2.000000      2.000000
 PLEASE ENTER CHARACTER OF OPENING        4:
 FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      1        7      2.000000      2.000000
 PLEASE ENTER CHARACTER OF OPENING        5:
 FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      5        2      6.000000      2.000000
 PLEASE ENTER CHARACTER OF OPENING        6:
 FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      2        8      6.000000      2.000000
 PLEASE ENTER CHARACTER OF OPENING        7:
```

```
FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      6       3     10.000000      2.000000
PLEASE ENTER CHARACTER OF OPENING       8:
FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      3       9     10.000000      2.000000
PLEASE ENTER CHARACTER OF OPENING       9:
FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      5       4      4.000000     20.000000
PLEASE ENTER CHARACTER OF OPENING      10:
FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      7       8      4.000000     20.000000
PLEASE ENTER CHARACTER OF OPENING      11:
FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      6       5      8.000000     20.000000
PLEASE ENTER CHARACTER OF OPENING      12:
FROM ROOM?,TO ROOM?,HEIGHT(m)?,NET AREA?
      8       9      8.000000     20.000000
PLEASE ENTER DATA OF LOOP
HOW MANY OPENINGS THAT LOOP       1PASS :
      8
      1: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      1       0       6
      2: OPENING NUMBER?,FROM ROOM?,TO ROOM?
     11       6       5
      3: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      9       5       4
      4: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      3       4       1
      5: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      4       1       7
      6: OPENING NUMBER?,FROM ROOM?,TO ROOM?
     10       7       8
      7: OPENING NUMBER?,FROM ROOM?,TO ROOM?
     12       8       9
      8: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      2       9       0
PLEASE ENTER WIND PRESSURE DATA OF LOOP       1:
PWIN?,PWOUT?
```

```
    0.000000   0.000000E+00
HOW MANY OPENINGS THAT LOOP       2PASS :
      6
      1: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      1       0       6
      2: OPENING NUMBER?,FROM ROOM?,TO ROOM?
     11       6       5
      3: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      5       5       2
      4: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      6       2       8
      5: OPENING NUMBER?,FROM ROOM?,TO ROOM?
     12       8       9
      6: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      2       9       0
PLEASE ENTER WIND PRESSURE DATA OF LOOP       2:
PWIN?,PWOUT?
    0.000000   0.000000E+00
HOW MANY OPENINGS THAT LOOP       3PASS :
      4
      1: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      1       0       6
      2: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      7       6       3
      3: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      8       3       9
      4: OPENING NUMBER?,FROM ROOM?,TO ROOM?
      2       9       0
PLEASE ENTER WIND PRESSURE DATA OF LOOP       3:
PWIN?,PWOUT?
    0.000000   0.000000E+00
PLEASE ENTER PROPERTY OF ROOM       1:
ST?,SW?,TR?,WR?
      0       1   0.000000E+00   0.000000E+00
PLEASE ENTER PROPERTY OF ROOM       2:
ST?,SW?,TR?,WR?
      0       1   0.000000E+00   0.000000E+00
PLEASE ENTER PROPERTY OF ROOM       3:
```

ST?,SW?,TR?,WR?

0 1 0.000000E+00 1000000.000000

PLEASE ENTER PROPERTY OF ROOM 4:

ST?,SW?,TR?,WR?

0 1 0.000000E+00 0.000000E+00

PLEASE ENTER PROPERTY OF ROOM 5:

ST?,SW?,TR?,WR?

0 1 0.000000E+00 0.000000E+00

PLEASE ENTER PROPERTY OF ROOM 6:

ST?,SW?,TR?,WR?

0 1 0.000000E+00 0.000000E+00

PLEASE ENTER PROPERTY OF ROOM 7:

ST?,SW?,TR?,WR?

0 1 0.000000E+00 0.000000E+00

PLEASE ENTER PROPERTY OF ROOM 8:

ST?,SW?,TR?,WR?

0 1 0.000000E+00 0.000000E+00

PLEASE ENTER PROPERTY OF ROOM 9:

ST?,SW?,TR?,WR?

0 1 0.000000E+00 0.000000E+00

ตัวอย่าง output file ที่คำนวณได้ ของอาคาร 3 ชั้น 3 วงรอบการไหล

number of solution 4

solution no. 1

-------GL-------

gl 1 = 0.000000E+00 kg/min

gl 2 = 0.000000E+00 kg/min

gl 3 = 0.000000E+00 kg/min

-------GO-------

go 1 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 2 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 3 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 4 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 5 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 6 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 7 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 8 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 9 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 10 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 11 = 0.000000E+00 kg/min 0.000000E+00 l/s

go 12 = 0.000000E+00 kg/min 0.000000E+00 l/s

-------PO-------

PO 1 = 0.000000E+00 pascal

PO 2 = 0.000000E+00 pascal

PO 3 = 0.000000E+00 pascal

PO 4 = 0.000000E+00 pascal

PO 5 = 0.000000E+00 pascal

PO 6 = 0.000000E+00 pascal

PO 7 = 0.000000E+00 pascal

PO 8 = 0.000000E+00 pascal

PO 9 = 0.000000E+00 pascal

PO 10 = 0.000000E+00 pascal

PO 11 = 0.000000E+00 pascal

PO 12 = 0.000000E+00 pascal

-------TR-------

TR 1 = 345.920000 K

TR 2 = 1143.842000 K

TR 3 = 3374.730000 K

TR 4 = 115.306700 K

TR 5 = 462.404200 K

TR 6 = 1144.998000 K

TR 7 = 115.306700 K

TR 8 = 462.404200 K

TR 9 = 1144.998000 K

-------RHOR-------

rhor 1 = 5.394167E-01 kg/m**3

rhor 2 = 2.413145E-01 kg/m**3

rhor 3 = 9.481512E-02 kg/m**3

rhor 4 = 8.389463E-01 kg/m**3

rhor 5 = 4.570017E-01 kg/m**3

rhor 6 = 2.411215E-01 kg/m**3

rhor 7 = 8.389463E-01 kg/m**3

rhor 8 = 4.570017E-01 kg/m**3

rhor 9 = 2.411215E-01 kg/m**3

-------PR---------

PR 1 = -82.282170 pascal

PR 2 = -113.557400 pascal

PR 3 = -130.128900 pascal

PR 4 = -76.405400 pascal

PR 5 = -109.325700 pascal

PR 6 = -127.258400 pascal

PR 7 = -76.405400 pascal

PR 8 = -109.325700 pascal

PR 9 = -127.258400 pascal

-------windex-------

windex 1 = 0.000000E+00 W

---

solution no. 2

-------GL-------

gl 1 = 3.774760 kg/min

gl 2 = 119.505800 kg/min

gl 3 = -16.281060 kg/min

-------GO-------

go 1 = 106.999500 kg/min 1535.496000 l/s

go 2 = 106.999500 kg/min 3095.402000 l/s

go 3 = 3.774760 kg/min 74.450400 l/s

go 4 = 3.774760 kg/min 73.103160 l/s

go 5 = 119.505800 kg/min 3152.866000 l/s

go 6 = 119.505800 kg/min 3447.718000 l/s

go 7 = -16.281060 kg/min -1638.337000 l/s

go 8 = -16.281060 kg/min -470.996800 l/s

go 9 = 3.774760 kg/min 99.587770 l/s

go 10 = 3.774760 kg/min 64.989720 l/s

go 11 = 123.280600 kg/min 3287.015000 l/s

go 12 = 123.280600 kg/min 3468.340000 l/s

-------PO-------

PO 1 = 3.422660E-01 pascal

PO 2 = 6.900133E-01 pascal

PO 3 = 5.854842E-04 pascal

PO 4 = 5.748895E-04 pascal

PO 5 = 7.849704E-01 pascal

PO 6 = 8.583798E-01 pascal

PO 7 = -5.557054E-02 pascal

PO 8 = -1.597568E-02 pascal

PO 9 = 7.831666E-06 pascal

PO 10 = 5.110846E-06 pascal

PO 11 = 8.442187E-03 pascal

PO 12 = 8.907892E-03 pascal

--------TR--------

TR 1 = 104.656500 K

TR 2 = 303.110800 K

TR 3 = 1803.656000 K

TR 4 = 112.317700 K

TR 5 = 251.532300 K

TR 6 = 257.392800 K

TR 7 = 59.923010 K

TR 8 = 288.140900 K

TR 9 = 304.769100 K

--------RHOR--------

rhor 1 = 8.606012E-01 kg/m**3

rhor 2 = 5.777047E-01 kg/m**3

rhor 3 = 1.656259E-01 kg/m**3

rhor 4 = 8.450280E-01 kg/m**3

rhor 5 = 6.317309E-01 kg/m**3

rhor 6 = 6.250888E-01 kg/m**3

rhor 7 = 9.680403E-01 kg/m**3

rhor 8 = 5.924091E-01 kg/m**3

rhor 9 = 5.761207E-01 kg/m**3

--------PR--------

PR 1 = -54.269280 pascal

PR 2 = -89.598100 pascal

PR 3 = -121.492900 pascal

PR 4 = -54.594240 pascal

PR 5 = -87.753130 pascal

PR 6 = -112.533800 pascal

PR 7 = -52.182070 pascal

PR 8 = -90.167980 pascal

PR 9 = -113.423000 pascal

--------windex--------

windex 2 = -211.134500 W

---

solution no. 3

---------GL ---------

gl 1 = -3.775190 kg/min

gl 2 = -119.504500 kg/min

gl 3 = 16.281070 kg/min

---------GO---------

go 1 = -106.998600 kg/min -3095.364000 l/s

go 2 = -106.998600 kg/min -1535.483000 l/s

go 3 = -3.775190 kg/min -73.111960 l/s

go 4 = -3.775190 kg/min -74.460110 l/s

go 5 = -119.504500 kg/min -3447.694000 l/s

go 6 = -119.504500 kg/min -3152.843000 l/s

go 7 = 16.281070 kg/min 470.998300 l/s

go 8 = 16.281070 kg/min 1638.339000 l/s

go 9 = -3.775190 kg/min -64.997710 l/s

go 10 = -3.775190 kg/min -99.599430 l/s

go 11 = -123.279700 kg/min -3468.323000 l/s

go 12 = -123.279700 kg/min -3287.003000 l/s

---------PO---------

PO 1 = -6.900037E-01 pascal

PO 2 = -3.422804E-01 pascal

PO 3 = -5.750240E-04 pascal

PO 4 = -5.856272E-04 pascal

PO 5 = -6.583646E-01 pascal

PO 6 = -7.849582E-01 pascal

PO 7 = 1.597575E-02 pascal

PO 8 = 5.557065E-02 pascal

PO 9 = -5.112056E-06 pascal

PO 10 = -7.833474E-06 pascal

PO 11 = -8.907788E-03 pascal

PO 12 = -8.442100E-03 pascal

---------TR---------

TR 1 = 104.859200 K

TR 2 = 303.113100 K

TR 3 = 1803.657000 K

TR 4 = 59.926340 K

TR 5 = 288.142200 K

TR 6 = 304.770500 K

TR 7 = 112.324600 K

TR 8 = 251.534200 K

TR 9 = 257.394800 K

---------RHOR---------

rhor 1 = 8.605956E-01 kg/m**3

rhor 2 = 5.777026E-01 kg/m**3

rhor 3 = 1.656259E-01 kg/m**3

rhor 4 = 9.680314E-01 kg/m**3

rhor 5 = 5.924078E-01 kg/m**3

rhor 6 = 5.761194E-01 kg/m**3

rhor 7 = 8.450139E-01 kg/m**3

rhor 8 = 6.317268E-01 kg/m**3

rhor 9 = 6.250865E-01 kg/m**3

---------PR---------

PR 1 = -54.289850 pascal

PR 2 = -89.598240 pascal

PR 3 = -121.492900 pascal

PR 4 = -52.182530 pascal

PR 5 = -90.168090 pascal

PR 6 = -113.423100 pascal

PR 7 = -54.594960 pascal

PR 8 = -87.753300 pascal

PR 9 = -112.533900 pascal

-------windex-------

windex 3 = -211.133700 W

---

solution no. 4

---------GL---------

gl 1 = 2.029323E-01 kg/min

gl 2 = 38.647620 kg/min

gl 3 = -10.397720 kg/min

---------GO---------

go 1 = 28.452840 kg/min 408.312400 l/s

go 2 = 28.452840 kg/min 1298.793000 l/s

go 3 = 2.029323E-01 kg/min 3.735397 l/s

go 4 = 2.029323E-01 kg/min 4.934009 l/s

go 5 = 38.647620 kg/min 1662.942000 l/s

go 6 = 38.647620 kg/min 1821.984000 l/s

go 7 = -10.397720 kg/min -1304.396000 l/s

go 8 = -10.397720 kg/min -474.626800 l/s

go 9 = 2.029323E-01 kg/min 8.731834 l/s

go 10 = 2.029323E-01 kg/min 3.625224 l/s

go 11 = 38.850560 kg/min 1758.044000 l/s

go 12 = 38.850560 kg/min 1730.726000 l/s

---------PO---------

PO 1 = 2.420344E-02 pascal

PO 2 = 7.698826E-02 pascal

PO 3 = 1.579235E-06 pascal

PO 4 = 2.085979E-06 pascal

PO 5 = 1.338932E-01 pascal

PO 6 = 1.466986E-01 pascal

PO 7 = -2.825570E-02 pascal

PO 8 = -1.028132E-02 pascal

PO 9 = 3.691607E-08 pascal

PO 10 = 1.532657E-08 pascal

PO 11 = 1.422937E-03 pascal

PO 12 = 1.400826E-03 pascal

-------TR-------

TR 1 = 208.260000 K

TR 2 = 685.543900 K

TR 3 = 2322.562000 K

TR 4 = 84.804260 K

TR 5 = 599.515300 K

TR 6 = 645.990500 K

TR 7 = 73.454730 K

TR 8 = 631.290700 K

TR 9 = 654.264300 K

-------RHOR-------

rhor 1 = 6.854883E-01 kg/m**3

rhor 2 = 3.535307E-01 kg/m**3

rhor 3 = 1.328548E-01 kg/m**3

rhor 4 = 9.054474E-01 kg/m**3

rhor 5 = 3.873419E-01 kg/m**3

rhor 6 = 3.683124E-01 kg/m**3

rhor 7 = 9.329644E-01 kg/m**3

rhor 8 = 3.741259E-01 kg/m**3

rhor 9 = 3.651190E-01 kg/m**3

-------PR-------

PR 1 = -75.879610 pascal

PR 2 = -107.891000 pascal

PR 3 = -126.883100 pascal

PR 4 = -71.564000 pascal

PR 5 = -107.093800 pascal

PR 6 = -122.291600 pascal

PR 7 = -71.024120 pascal

PR 8 = -107.633700 pascal

PR 9 = -122.315800 pascal

-------windex-------

windex 4 = -121.646600 W

ภาคผนวก ง

ตัวอย่าง input file สำหรับโปรแกรม ASCOS

ตัวอย่าง input file อาคาร 1 วงรอบการไหล สำหรับโปรแกรม ASCOS

```
1 loop building
21 1 0
2 1
1 2
1
1 1 21
2 1
72 10 0.16
-0.2 0.7
2
1 1 1
0 1 1 0 1
1 1 68
1 1 2
2 2 1
0 0 1 0 1
2 1 2
0
```

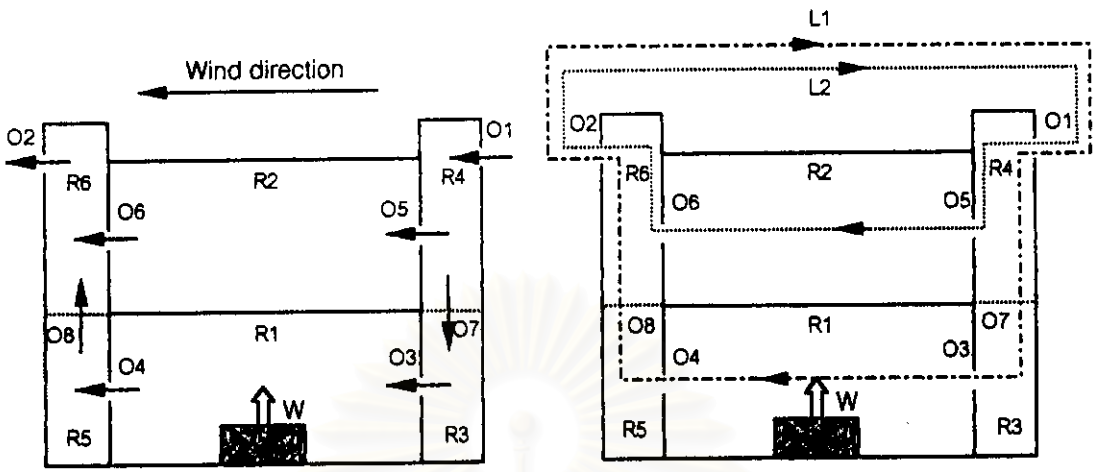
ตัวอย่าง input file อาคาร 2 วงรอบการไหล สำหรับโปรแกรม ASCOS

```
2 Loop building
21 1 0
3 1
2 4
2
1 1 21
1 1 121
2 1
9 10 0.16
0.7 -0.2
2
1 1 1
0 0 0 0 2
2 2 1
0 0 0 0 1
2
shaft room 3,4
260000  1  3  2
0 0
1 1 2
1
2 3
1 1 2
shaft room 5,6
260000  1  3  1
0 0
1 1 2
1
2 3
2 1 2
```

ภาคผนวก จ

ตัวอย่างเมตริกหลักที่ใช้คำนวณในอาคาร 2 วงรอบการไหล

ตัวอย่างการสร้างเมตริกสำหรับคำนวณอาคาร 2 วงรอบการไหลตามรูปที่ 66 ดังนี้



รูปที่ 66. ภาพแสดงอาคารตัวอย่างขนาด 2 ชั้น พร้อมด้วยทิศทางอ้างอิงสำหรับใช้สร้าง Incident matrix และ Loop matrix

1. Incident matrix [I] สร้างโดยการกำหนดทิศทางการไหลของอากาศผ่านช่องเปิด

จากรูปที่ 66 เราสามารถสร้าง Incident matrix ได้ดังนี้

$$[I]_{6,8} = \begin{bmatrix} 0 & 0 & -1 & +1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & +1 & 0 & 0 \\ 0 & 0 & +1 & 0 & 0 & 0 & -1 & 0 \\ -1 & 0 & 0 & 0 & +1 & 0 & +1 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 & 0 & +1 \\ 0 & +1 & 0 & 0 & 0 & -1 & 0 & -1 \end{bmatrix}$$

2. Loop matrix [L] สร้างโดยการกำหนดทิศทางการไหลของวงรอบการไหลผ่านช่องเปิด

จากรูปที่ 66 เราสามารถสร้าง Loop matrix ได้ดังนี้

$$[L]_{2,8} = \begin{bmatrix} +1 & +1 & +1 & +1 & 0 & 0 & +1 & +1 \\ +1 & +1 & 0 & 0 & +1 & +1 & 0 & 0 \end{bmatrix}$$

3. การสร้างเมตริกแสดงทิศทางการไหลของอากาศผ่านช่องเปิดว่ามาจากห้องใด $[F_\pi]$

หากอากาศไหลผ่านช่องเปิดตรงกับทิศทางที่กำหนดใน Incident matrix ตามรูปที่ 66 เราจะสร้างเมตริก $[F_\pi]$ ได้ดังนี้

$$[F_\pi]_{3.6} = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

จะเห็นได้ว่า $F_{\pi 4,1}$ มีค่าเท่ากับ 1 หมายความว่าอากาศที่ช่องเปิด 4 ไหลมาจากห้อง 1 ซึ่งตรงกับรูปที่ 66 ส่วนช่องเปิดอื่นๆก็คิดแบบเดียวกัน

ประวัติผู้เขียน

นายสุเมธ เหมะวัฒนะชัย เกิดเมื่อวันที่ 18 เมษายน พ.ศ. 2518 สำเร็จการศึกษาระดับปริญญาตรีวิศวกรรมศาสตร์บัณฑิต ภาควิชาวิศวกรรมเครื่องกล คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัยในปีการศึกษา 2539 และเข้าศึกษาต่อในหลักสูตรวิศวกรรมศาสตร์มหาบัณฑิต ภาควิชาวิศวกรรมเครื่องกล คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย เมื่อ พ.ศ. 2539