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Techniques of Water-Resources Investigations
of the United States Geological Survey

Chapter A5

A MODULAR FINITE-ELEMENT MODEL (MODFE) FOR AREAL AND AXISYMMETRIC GROUND-WATER-FLOW PROBLEMS, PART 3: DESIGN PHILOSOPHY AND PROGRAMMING DETAILS

By Lynn J. Torak

Book 6
MODELING TECHNIQUES

List of Main Programs

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C         *** LMFE1 ***
C         MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C         IN TWO DIMENSIONS.
C         SIMULATES THE FOLLOWING CONDITIONS:
C         (1) CONFINED FLOW
C         USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C         TO SOLVE MATRIX EQUATIONS.
       DIMENSION TITLE(20)
       COMMON/PRIME/G(5000)
       COMMON/GDIM/ISUM
       COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
      1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
       COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,MBW
       COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
       COMMON/ITP/IIN,IOUT,ITA,ITB
       COMMON/IPRN/IPND
       COMMON/IND/IRAD,IUNIT,ISTD
       COMMON/SCLE/SCALE
       COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
       COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
      1,THBQO,TER
       COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
       COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
       OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
      1,FORM='FORMATTED')
       OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
      1,FORM='FORMATTED')
       OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
       OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
     6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
       CALL INITB(TITLE,G,TIME,NBCZ)
       CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
      1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
      2,G(IDZA),G(IDSA),NBCZ)
       CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
      1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
       CALL SETB(G(IAA),G(INA),G(INDA),IBND)
       DO 20 JP=1,NPER
       JPER=JP
       CALL NXTPD(G(IDTA),JPER)
       DO 10 I=1,NSTEPS
       ISTP=I
       DT=G(IDTA+I-1)
       CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
      1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
      2,ISTP)
       CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
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     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
     2,G(INA),G(IKA),G(ILA))
      IF(ISTD.LT.1) CALL EXTRAP(G(IHA),G(IHBA),G(IBA),G(INA))
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
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C       *** LMFE2 ***
C       MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C       IN TWO DIMENSIONS.
C       SIMULATES THE FOLLOWING CONDITIONS:
C       (1) CONFINED FLOW
C       USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C       TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)  +++
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETCG(G(IAA))
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
     2,G(INA),G(IKA),G(ILA))
      IF(ISTD.LT.1) CALL EXTRAP(G(IHA),G(IHBA),G(IBA),G(INA))
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      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
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C         *** LMFE3 ***
C         MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C         IN TWO DIMENSIONS.
C         SIMULATES THE FOLLOWING CONDITIONS:
C         (1) CONFINED FLOW
C         (2) TRANSIENT LEAKAGE
C         USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C         TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,MBW
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL CBINIT(G,ICHA,ICQA,IDHRA,ICTQA,IGMA,IALFA,IACA,IBTA,IBCA
     1,NCBZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL CBFMCO(G(IAA),G(IARA),G(IGMA),G(IALFA),G(IACA),G(IBTA)
     1,G(IBCA),G(IYGA),G(INDA),NCBZ)
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NCBCH.EQ.ISTP) CALL CBCHG(G(IHRA),G(IDHRA),TIME,ISTP)
      CALL CBFMEQ(G(IAA),G(ICHA),G(ICQA),G(IDHRA),G(ICTQA),G(IGMA)
     1,G(IALFA),G(IACA),G(IBTA),G(IBCA),DT,G(INA))
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
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      CALL CBADEQ(G(IAA),G(IBA),G(ICHA),G(ICQA),G(IGMA),G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALCB(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),G(ICHA)
     2,G(ICQA),G(IGMA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL CBTQC(G(IBA),G(IHBA),G(ICTQA),G(IGMA),G(IALFA),G(IACA)
     1,DT,G(INA))
      IF(ISTD.LT.1) CALL EXTRAP(G(IHA),G(IHBA),G(IBA),G(INA))
      CALL CBHRXT(G(IHRA),G(IDHRA))
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
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C        *** LMFE4 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) CONFINED FLOW
C        (2) TRANSIENT LEAKAGE
C        USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL CBINIT(G,ICHA,ICQA,IDHRA,ICTQA,IGMA,IALFA,IACA,IBTA,IBCA
     1,NCBZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL CBFMCO(G(IAA),G(IARA),G(IGMA),G(IALFA),G(IACA),G(IBTA)
     1,G(IBCA),G(IYGA),G(INDA),NCBZ)
      CALL SETCG(G(IAA))
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NCBCH.EQ.ISTP) CALL CBCHG(G(IHRA),G(IDHRA),TIME,ISTP)
      CALL CBFMEQ(G(IAA),G(ICHA),G(ICQA),G(IDHRA),G(ICTQA),G(IGMA)
     1,G(IALFA),G(IACA),G(IBTA),G(IBCA),DT,G(INA))
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
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      CALL CBADEQ(G(IAA),G(IBA),G(ICHA),G(ICQA),G(IGMA),G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALCB(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),G(ICHA)
     2,G(ICQA),G(IGMA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL CBTQC(G(IBA),G(IHBA),G(ICTQA),G(IGMA),G(IALFA),G(IACA)
     1,DT,G(INA))
      IF(ISTD.LT.1) CALL EXTRAP(G(IHA),G(IHBA),G(IBA),G(INA))
      CALL CBHRXT(G(IHRA),G(IDHRA))
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
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C        *** NLMFE1 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED FLOW
C        (2) AQUIFER STORAGE CONVERSIONS
C        USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,MBW
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      CALL RDTP(G(IAA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
     2,G(IKA),G(ILA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
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      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
```

```
C         *** NLMFE2 ***
C         MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C         IN TWO DIMENSIONS.
C         SIMULATES THE FOLLOWING CONDITIONS:
C         (1) UNCONFINED FLOW
C         (2) AQUIFER STORAGE CONVERSIONS
C         USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C         TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL SETCG(G(IAA))
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      CALL RDTP(G(IAA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
     2,G(IKA),G(ILA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
```

```
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
```

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C        *** NLMFE3 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED FLOW
C        (2) AQUIFER STORAGE CONVERSIONS
C        (3) TRANSIENT LEAKAGE
C        USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,MBW
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL CBINIT(G,ICHA,ICQA,IDHRA,ICTQA,IGMA,IALFA,IACA,IBTA,IBCA
     1,NCBZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL CBFMCO(G(IAA),G(IARA),G(IGMA),G(IALFA),G(IACA),G(IBTA)
     1,G(IBCA),G(IYGA),G(INDA),NCBZ)
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NCBCH.EQ.ISTP) CALL CBCHG(G(IHRA),G(IDHRA),TIME,ISTP)
      CALL RDTP(G(IAA))
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```
      CALL CBFMEQ(G(IAA),G(ICHA),G(ICQA),G(IDHRA),G(ICTQA),G(IGMA)
     1,G(IALFA),G(IACA),G(IBTA),G(IBCA),DT,G(INA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
     2,G(IKA),G(ILA))
      CALL CBADEQ(G(IAA),G(IBA),G(ICHA),G(ICQA),G(IGMA),G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL CBADWT(G(IDHA),G(IAA),G(IBA),G(ICHA),G(ICQA),G(IGMA),G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL CBADWT(G(IDHA),G(IAA),G(IBA),G(ICHA),G(ICQA),G(IGMA),G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBWTCB(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),G(ICHA),G(ICQA),G(IGMA),DT,G(IJPA)
     3,G(INA),G(IKA),G(ILA))
      CALL CBTQC(G(IDHA),G(IHBA),G(ICTQA),G(IGMA),G(IALFA),G(IACA)
     1,DT,G(INA))
      IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL CBHRXT(G(IHRA),G(IDHRA))
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
```

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C         *** NLMFE4 ***
C         MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C         IN TWO DIMENSIONS.
C         SIMULATES THE FOLLOWING CONDITIONS:
C         (1) UNCONFINED FLOW
C         (2) AQUIFER STORAGE CONVERSIONS
C         (3) TRANSIENT LEAKAGE
C         USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C         TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,MBW
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL CBINIT(G,ICHA,ICQA,IDHRA,ICTQA,IGMA,IALFA,IACA,IBTA,IBCA
     1,NCBZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL CBFMCO(G(IAA),G(IARA),G(IGMA),G(IALFA),G(IACA),G(IBTA)
     1,G(IBCA),G(IYGA),G(INDA),NCBZ)
      CALL SETCG(G(IAA))
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NCBCH.EQ.ISTP) CALL CBCHG(G(IHRA),G(IDHRA),TIME,ISTP)
      CALL RDTP(G(IAA))
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      CALL CBFMEQ(G(IAA),G(ICHA),G(ICQA),G(IDHRA),G(ICTQA),G(IGMA)
     1,G(IALFA),G(IACA),G(IBTA),G(IBCA),DT,G(INA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
     2,G(IKA),G(ILA))
      CALL CBADEQ(G(IAA),G(IBA),G(ICHA),G(ICQA),G(IGMA),G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL CBADWT(G(IDHA),G(IAA),G(IBA),G(ICHA),G(ICQA),G(IGMA),G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL CBADWT(G(IDHA),G(IAA),G(IBA),G(ICHA),G(ICQA),G(IGMA),G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBWTCB(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),G(ICHA),G(ICQA),G(IGMA),DT,G(IJPA)
     3,G(INA),G(IKA),G(ILA))
      CALL CBTQC(G(IDHA),G(IHBA),G(ICTQA),G(IGMA),G(IALFA),G(IACA)
     1,DT,G(INA))
      IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL CBHRXT(G(IHRA),G(IDHRA))
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
```

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C       *** NLMFE5 ***
C       MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C       IN TWO DIMENSIONS.
C       SIMULATES THE FOLLOWING CONDITIONS:
C       (1) UNCONFINED FLOW
C       (2) AQUIFER STORAGE CONVERSIONS
C       (3) NONLINEAR STEADY LEAKAGE
C       USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C       TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL VNINIT(G,IECA,IHSA,NVNZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL VNFMCO(G(IHA),G(IARA),G(IECA),G(IHSA),G(INDA),NVNZ)
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NVNCH.EQ.ISTP) CALL VNCHG(G(IHSA),TIME,ISTP)
      CALL RDTP(G(IAA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
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     2,G(IKA),G(ILA))
      CALL VNPRED(G(IHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA),G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL VNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA)
     1,G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL VNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA)
     1,G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL VNBAL(G(IHA),G(IDHA),G(IHBA),G(IYGA),G(ITPA),G(IECA),G(IHSA)
     1,DT,G(INA))
      IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
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C        *** NLMFE6 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED FLOW
C        (2) AQUIFER STORAGE CONVERSIONS
C        (3) NONLINEAR STEADY LEAKAGE
C        USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL VNINIT(G,IECA,IHSA,NVNZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL VNFMCO(G(IHA),G(IARA),G(IECA),G(IHSA),G(INDA),NVNZ)
      CALL SETCG(G(IAA))
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NVNCH.EQ.ISTP) CALL VNCHG(G(IHSA),TIME,ISTP)
      CALL RDTP(G(IAA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
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     2,G(IKA),G(ILA))
      CALL VNPRED(G(IHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA),G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL VNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA)
     1,G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL VNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA)
     1,G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL VNBAL(G(IHA),G(IDHA),G(IHBA),G(IYGA),G(ITPA),G(IECA),G(IHSA)
     1,DT,G(INA))
      IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
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C        *** NLMFE7 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED FLOW
C        (2) AQUIFER STORAGE CONVERSIONS
C        (3) NONLINEAR CAUCHY-TYPE BOUNDARIES AND (OR) NONLINEAR POINT
C            SINKS
C        USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
    7 FORMAT(/4X,59HSUMMARY OF FLOW AT NONLINEAR CAUCHY-TYPE BOUNDARIES
     1BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL GNINIT(G,IGCA,IHRK,IHRL,IZRK,IZRL,IZPA,IKRA,ILRA,IKPA,INZA
     1,INSA,NBNC,NPNB,NLCZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL GNFMCO(G(IXGA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(IKRA),G(ILRA),G(IKPA),G(INZA),G(INSA),NBNC
     2,NPNB,NLCZ)
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
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     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NGNCH.EQ.ISTP) CALL GNCHG(G(IHRK),G(IHRL),TIME,G(IKRA),G(ILRA)
     1,ISTP)
      CALL RDTP(G(IAA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
     2,G(IKA),G(ILA))
      CALL GNPRED(G(IHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYCA),G(IXCA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL GNBAL(G(IHA),G(IDHA),G(IHBA),G(IYGA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(IARA),G(IXGA),DT,G(INA),G(IKRA),G(ILRA)
     2,G(IKPA),NBNC,NPNB)
      IF(NLCZ.LT.1) GO TO 9
      WRITE(IOUT,7)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKRA),G(ILRA),G(INZA),G(INSA)
     1,NLCZ)
    9 IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
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C         *** NLMFE8 ***
C         MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C         IN TWO DIMENSIONS.
C         SIMULATES THE FOLLOWING CONDITIONS:
C         (1) UNCONFINED FLOW
C         (2) AQUIFER STORAGE CONVERSIONS
C         (3) NONLINEAR CAUCHY-TYPE BOUNDARIES AND (OR) NONLINEAR POINT
C             SINKS
C         USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C         TO SOLVE MATRIX EQUATIONS.
       DIMENSION TITLE(20)
       COMMON/PRIME/G(5000)
       COMMON/GDIM/ISUM
       COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
      1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
       COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
       COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
       COMMON/ITP/IIN,IOUT,ITA,ITB
       COMMON/IPRN/IPND
       COMMON/IND/IRAD,IUNIT,ISTD
       COMMON/SCLE/SCALE
       COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
       COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
      1,THBQO,TER
       COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
       COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
       OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
      1,FORM='FORMATTED')
       OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
      1,FORM='FORMATTED')
       OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
       OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
     6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
     7 FORMAT(/4X,59HSUMMARY OF FLOW AT NONLINEAR CAUCHY-TYPE BOUNDARIES
      1BY ZONE)
       CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
       CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
       CALL GNINIT(G,IGCA,IHRK,IHRL,IZRK,IZRL,IZPA,IKRA,ILRA,IKPA,INZA
      1,INSA,NBNC,NPNB,NLCZ)
       CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
      1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
      2,G(IDZA),G(IDSA),NBCZ)
       CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
      1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
       CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
       CALL GNFMCO(G(IXGA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
      1,G(IZRL),G(IZPA),G(IKRA),G(ILRA),G(IKPA),G(INZA),G(INSA),NBNC
      2,NPNB,NLCZ)
       CALL SETCG(G(IAA))
       DO 20 JP=1,NPER
       JPER=JP
       CALL NXTPD(G(IDTA),JPER)
       DO 10 I=1,NSTEPS
       ISTP=I
       DT=G(IDTA+I-1)
       CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
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```
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NGNCH.EQ.ISTP) CALL GNCHG(G(IHRK),G(IHRL),TIME,G(IKRA),G(ILRA)
     1,ISTP)
      CALL RDTP(G(IAA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
     2,G(IKA),G(ILA))
      CALL GNPRED(G(IHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL GNBAL(G(IHA),G(IDHA),G(IHBA),G(IYGA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(IARA),G(IXGA),DT,G(INA),G(IKRA),G(ILRA)
     2,G(IKPA),NBNC,NPNB)
      IF(NLCZ.LT.1) GO TO 9
      WRITE(IOUT,7)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKRA),G(ILRA),G(INZA),G(INSA)
     1,NLCZ)
    9 IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
```

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C        *** NLMFE5 COMBINED WITH NLMFE7 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED FLOW
C        (2) AQUIFER STORAGE CONVERSIONS
C        (3) NONLINEAR CAUCHY-TYPE BOUNDARIES AND (OR) NONLINEAR POINT
C            SINKS
C        (4) NONLINEAR STEADY LEAKAGE
C        USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/IPRN/IPND
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
    7 FORMAT(/4X,59HSUMMARY OF FLOW AT NONLINEAR CAUCHY-TYPE BOUNDARIES
     1BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL GNINIT(G,IGCA,IHRK,IHRL,IZRK,IZRL,IZPA,IKRA,ILRA,IKPA,INZA
     1,INSA,NBNC,NPNB,NLCZ)
      CALL VNINIT(G,IECA,IHSA,NVNZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL GNFMCO(G(IXGA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(IKRA),G(ILRA),G(IKPA),G(INZA),G(INSA),NBNC
     2,NPNB,NLCZ)
      CALL VNFMCO(G(IHA),G(IARA),G(IECA),G(IHSA),G(INDA),NVNZ)
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
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      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NGNCH.EQ.ISTP) CALL GNCHG(G(IHRK),G(IHRL),TIME,G(IKRA),G(ILRA)
     1,ISTP)
      IF(NVNCH.EQ.ISTP) CALL VNCHG(G(IHSA),TIME,ISTP)
      CALL RDTP(G(IAA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
     2,G(IKA),G(ILA))
      CALL GNPRED(G(IHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL VNPRED(G(IHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA),G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL VNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA)
     1,G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL VNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA)
     1,G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
    5 CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL GNBAL(G(IHA),G(IDHA),G(IHBA),G(IYGA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(IARA),G(IXGA),DT,G(INA),G(IKRA),G(ILRA)
     2,G(IKPA),NBNC,NPNB)
      IF(NLCZ.LT.1) GO TO 9
      WRITE(IOUT,7)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKRA),G(ILRA),G(INZA),G(INSA)
     1,NLCZ)
    9 CALL VNBAL(G(IHA),G(IDHA),G(IHBA),G(IYGA),G(ITPA),G(IECA),G(IHSA)
     1,DT,G(INA))
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      IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
     1,G(INA),ISTP)
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL MASOUT(G(IYGA),DT,ISTP)
   10 CONTINUE
   20 CONTINUE
      STOP
      END
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C        *** NLMFE6 COMBINED WITH NLMFE8 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED FLOW
C        (2) AQUIFER STORAGE CONVERSIONS
C        (3) NONLINEAR CAUCHY-TYPE BOUNDARIES AND (OR) NONLINEAR POINT
C            SINKS
C        (4) NONLINEAR STEADY LEAKAGE
C        USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
    6 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
    7 FORMAT(/4X,59HSUMMARY OF FLOW AT NONLINEAR CAUCHY-TYPE BOUNDARIES
     1BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL WTINIT(G,IDHA,ITKA,ITPA,ISYA)
      CALL GNINIT(G,IGCA,IHRK,IHRL,IZRK,IZRL,IZPA,IKRA,ILRA,IKPA,INZA
     1,INSA,NBNC,NPNB,NLCZ)
      CALL VNINIT(G,IECA,IHSA,NVNZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL WTFMCO(G(IARA),G(ITKA),G(ITPA),G(ISYA),G(INDA))
      CALL GNFMCO(G(IXGA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(IKRA),G(ILRA),G(IKPA),G(INZA),G(INSA),NBNC
     2,NPNB,NLCZ)
      CALL VNFMCO(G(IHA),G(IARA),G(IECA),G(IHSA),G(INDA),NVNZ)
      CALL SETCG(G(IAA))
      DO 20 JP=1,NPER
      JPER=JP
      CALL NXTPD(G(IDTA),JPER)
      DO 10 I=1,NSTEPS
```

```
      ISTP=I
      DT=G(IDTA+I-1)
      CALL COCHG(G(IQA),G(IARA),G(IHA),G(IHRA),G(IHBA),G(IHKA),G(IHLA)
     1,G(IALA),G(IQBA),G(ICKA),G(ICLA),TIME,G(IKA),G(ILA),G(INDA),G(INA)
     2,ISTP)
      IF(NGNCH.EQ.ISTP) CALL GNCHG(G(IHRK),G(IHRL),TIME,G(IKRA),G(ILRA)
     1,ISTP)
      IF(NVNCH.EQ.ISTP) CALL VNCHG(G(IHSA),TIME,ISTP)
      CALL RDTP(G(IAA))
      CALL FMEPWT(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA),G(IAA)
     1,G(IARA),G(IQA),G(IBA),G(ITKA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA)
     2,G(IKA),G(ILA))
      CALL GNPRED(G(IHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL VNPRED(G(IHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA),G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL VNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA)
     1,G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL WTCCHK(G(IHA),G(IDHA),G(IBA),G(ITPA),G(INA),ISC)
      IF(ISC.EQ.0) GO TO 5
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL FMECWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(ICKA)
     1,G(ICLA),G(IAA),G(IARA),G(IQA),G(IBA),G(ITKA),G(IYGA),G(ITPA)
     2,G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL VNCORR(G(IHA),G(IDHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA)
     1,G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL HCALWT(G(IHA),G(IDHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL MBALWT(G(IHA),G(IDHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA)
     1,G(IQBA),G(ICKA),G(ICLA),G(IAA),G(IQA),G(IYGA),G(IXGA),G(ITKA)
     2,G(IARA),G(ITPA),G(ISYA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      IF(NQBND.LT.1) GO TO 8
      WRITE(IOUT,6)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    8 CALL GNBAL(G(IHA),G(IDHA),G(IHBA),G(IYGA),G(IGCA),G(IHRK),G(IHRL)
     1,G(IZRK),G(IZRL),G(IZPA),G(IARA),G(IXGA),DT,G(INA),G(IKRA),G(ILRA)
     2,G(IKPA),NBNC,NPNB)
      IF(NLCZ.LT.1) GO TO 9
      WRITE(IOUT,7)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKRA),G(ILRA),G(INZA),G(INSA)
     1,NLCZ)
```

```
 9 CALL VNBAL(G(IHA),G(IDHA),G(IHBA),G(IYGA),G(ITPA),G(IECA),G(IHSA)
  1,DT,G(INA))
    IF(ISTD.LT.1) CALL XTRPWT(G(IHA),G(IDHA),G(IHBA),G(ITKA),G(ITPA)
  1,G(INA),ISTP)
    CALL DATOUT(G(IHA),DT,TIME,ISTP)
    CALL MASOUT(G(IYGA),DT,ISTP)
10 CONTINUE
20 CONTINUE
    STOP
    END
```

```
C        *** NSSFE1 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED, STEADY-STATE FLOW
C        USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/IPRN/IPND
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
   10 FORMAT (1H1,18X,30HSUMMARY OF CLOSURE INFORMATION/
     $56H NO. OF ITERATIONS TO CLOSE (ITER) ..................  = ,I4/
     $56H MAXIMUM ABSOLUTE DISPLACEMENT (DSPA) ...............  = ,G11.5)
   20 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL SWINIT(G,TOLSW,DSMX,DSP,RP,NITSW,ITKA,ITPA)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETCG(G(IAA))
      CALL SWFMCO(G(IAA),G(ITKA),G(ITPA),G(IJPA),G(INA))
      ISTP=1
      DT=1.
      DO 50 IT=1,NITSW
      ITER=IT
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL SWBDMP(G(IBA),DSMX,DSP,DSPO,DSPA,RP,ITER)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL SWTHK(G(IHA),G(IAA),G(IBA),G(IQA),G(ITKA),G(ITPA),DSPA,TOLSW
     1,G(IJPA),G(INA),ITER)
      IF(DSPA.LT.TOLSW) GO TO 60
```

```
 50 CONTINUE
 60 CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
   1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
   2,G(INA),G(IKA),G(ILA))
    WRITE(IOUT,10) ITER,DSPA
    CALL DATOUT(G(IHA),DT,TIME,ISTP)
    CALL TKOUT(G(ITKA))
    IF(NQBND.LT.1) GO TO 62
    WRITE(IOUT,20)
    CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
 62 CALL MASOUT(G(IYGA),DT,ISTP)
    STOP
    END
```

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C         *** NSSFE2 ***
C         MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C         IN TWO DIMENSIONS.
C         SIMULATES THE FOLLOWING CONDITIONS:
C         (1) UNCONFINED, STEADY-STATE FLOW
C         USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C         TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
   10 FORMAT (1H1,18X,30HSUMMARY OF CLOSURE INFORMATION/
     $56H NO. OF ITERATIONS TO CLOSE (ITER) ..................... = ,I4/
     $56H MAXIMUM ABSOLUTE DISPLACEMENT (DSPA) ................. = ,G11.5)
   20 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL SWINIT(G,TOLSW,DSMX,DSP,RP,NITSW,ITKA,ITPA)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      CALL SWFMCO(G(IAA),G(ITKA),G(ITPA),G(IJPA),G(INA))
      ISTP=1
      DT=1.
      DO 50 IT=1,NITSW
      ITER=IT
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL SWBDMP(G(IBA),DSMX,DSP,DSPO,DSPA,RP,ITER)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL SWTHK(G(IHA),G(IAA),G(IBA),G(IQA),G(ITKA),G(ITPA),DSPA,TOLSW
     1,G(IJPA),G(INA),ITER)
      IF(DSPA.LT.TOLSW) GO TO 60
   50 CONTINUE
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```
60 CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
  1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
  2,G(INA),G(IKA),G(ILA))
   WRITE(IOUT,10) ITER,DSPA
   CALL DATOUT(G(IHA),DT,TIME,ISTP)
   CALL TKOUT(G(ITKA))
   IF(NQBND.LT.1) GO TO 62
   WRITE(IOUT,20)
   CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
62 CALL MASOUT(G(IYGA),DT,ISTP)
   STOP
   END
```

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C        *** NSSFE3 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED, STEADY-STATE FLOW
C        (2) NONLINEAR STEADY VERTICAL LEAKAGE
C        USES MODIFIED, INCOMPLETE-CHOLESKY, CONJUGATE GRADIENT METHOD
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/IPRN/IPND
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
   10 FORMAT (1H1,18X,30HSUMMARY OF CLOSURE INFORMATION/
     $56H NO. OF ITERATIONS TO CLOSE (ITER) ..................... = ,I4/
     $56H MAXIMUM ABSOLUTE DISPLACEMENT (DSPA) ................. = ,G11.5)
   20 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL SWINIT(G,TOLSW,DSMX,DSP,RP,NITSW,ITKA,ITPA)
      CALL VNINIT(G,IECA,IHSA,NVNZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETCG(G(IAA))
      CALL SWFMCO(G(IAA),G(ITKA),G(ITPA),G(IJPA),G(INA))
      CALL VNFMCO(G(IHA),G(IARA),G(IECA),G(IHSA),G(INDA),NVNZ)
      ISTP=1
      DT=1.
      DO 50 IT=1,NITSW
      ITER=IT
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL VNPRED(G(IHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA),G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL SWBDMP(G(IBA),DSMX,DSP,DSPO,DSPA,RP,ITER)
      CALL HCALC(G(IHA),G(IBA),G(INA))
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```
      CALL RDTP(G(IAA))
      CALL SWTHK(G(IHA),G(IAA),G(IBA),G(IQA),G(ITKA),G(ITPA),DSPA,TOLSW
     1,G(IJPA),G(INA),ITER)
      IF(DSPA.LT.TOLSW) GO TO 60
   50 CONTINUE
   60 CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
     2,G(INA),G(IKA),G(ILA))
      CALL VNBLSS(G(IHA),G(IYGA),G(ITPA),G(IECA),G(IHSA),DT,G(INA))
      WRITE(IOUT,10) ITER,DSPA
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL TKOUT(G(ITKA))
      IF(NQBND.LT.1) GO TO 62
      WRITE(IOUT,20)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
   62 CALL MASOUT(G(IYGA),DT,ISTP)
      STOP
      END
```

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C       *** NSSFE4 ***
C       MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C       IN TWO DIMENSIONS.
C       SIMULATES THE FOLLOWING CONDITIONS:
C       (1) UNCONFINED, STEADY-STATE FLOW
C       (2) NONLINEAR STEADY LEAKAGE
C       USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C       TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
   10 FORMAT (1H1,18X,30HSUMMARY OF CLOSURE INFORMATION/
     $56H NO. OF ITERATIONS TO CLOSE (ITER) ..... = ,I4/
     $56H MAXIMUM ABSOLUTE DISPLACEMENT (DSPA) ..... = ,G11.5)
   20 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL SWINIT(G,TOLSW,DSMX,DSP,RP,NITSW,ITKA,ITPA)
      CALL VNINIT(G,IECA,IHSA,NVNZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      CALL SWFMCO(G(IAA),G(ITKA),G(ITPA),G(IJPA),G(INA))
      CALL VNFMCO(G(IHA),G(IARA),G(IECA),G(IHSA),G(INDA),NVNZ)
      ISTP=1
      DT=1.
      DO 50 IT=1,NITSW
      ITER=IT
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL VNPRED(G(IHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA),G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL SWBDMP(G(IBA),DSMX,DSP,DSPO,DSPA,RP,ITER)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
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      CALL SWTHK(G(IHA),G(IAA),G(IBA),G(IQA),G(ITKA),G(ITPA),DSPA,TOLSW
     1,G(IJPA),G(INA),ITER)
      IF(DSPA.LT.TOLSW) GO TO 60
   50 CONTINUE
   60 CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
     2,G(INA),G(IKA),G(ILA))
      CALL VNBLSS(G(IHA),G(IYGA),G(ITPA),G(IECA),G(IHSA),DT,G(INA))
      WRITE(IOUT,10) ITER,DSPA
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL TKOUT(G(ITKA))
      IF(NQBND.LT.1) GO TO 62
      WRITE(IOUT,20)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
   62 CALL MASOUT(G(IYGA),DT,ISTP)
      STOP
      END
```

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C         *** NSSFE5 ***
C         MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C         IN TWO DIMENSIONS.
C         SIMULATES THE FOLLOWING CONDITIONS:
C         (1) UNCONFINED, STEADY-STATE FLOW
C         (2) NONLINEAR CAUCHY-TYPE BOUNDARIES AND (OR) NONLINEAR POINT
C             SINKS
C         USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C         TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
   10 FORMAT (1H1,18X,30HSUMMARY OF CLOSURE INFORMATION/
     $56H NO. OF ITERATIONS TO CLOSE (ITER) ..................... = ,I4/
     $56H MAXIMUM ABSOLUTE DISPLACEMENT (DSPA) ................. = ,G11.5)
   20 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
   22 FORMAT(/4X,59HSUMMARY OF FLOW AT NONLINEAR CAUCHY-TYPE BOUNDARIES
     1BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL SWINIT(G,TOLSW,DSMX,DSP,RP,NITSW,ITKA,ITPA)
      CALL GNINIT(G,IGCA,IHRK,IHRL,IZRK,IZRL,IZPA,IKRA,ILRA,IKPA,INZA
     1,INSA,NBNC,NPNB,NLCZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETCG(G(IAA))
      CALL SWFMCO(G(IAA),G(ITKA),G(ITPA),G(IJPA),G(INA))
      CALL GNFMCO(G(IXGA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(IKRA),G(ILRA),G(IKPA),G(INZA),G(INSA),NBNC
     2,NPNB,NLCZ)
      ISTP=1
      DT=1.
      DO 50 IT=1,NITSW
      ITER=IT
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
```

```
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNPRED(G(IHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL SWBDMP(G(IBA),DSMX,DSP,DSPO,DSPA,RP,ITER)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL SWTHK(G(IHA),G(IAA),G(IBA),G(IQA),G(ITKA),G(ITPA),DSPA,TOLSW
     1,G(IJPA),G(INA),ITER)
      IF(DSPA.LT.TOLSW) GO TO 60
   50 CONTINUE
   60 CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
     2,G(INA),G(IKA),G(ILA))
      IF(NQBND.LT.1) GO TO 62
      WRITE(IOUT,20)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
   62 CALL GNBLSS(G(IHA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK),G(IZRL)
     1,G(IZPA),G(IARA),G(IXGA),DT,G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC
     2,NPNB)
      IF(NLCZ.LT.1) GO TO 64
      WRITE(IOUT,22)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKRA),G(ILRA),G(INZA),G(INSA)
     1,NLCZ)
   64 WRITE(IOUT,10) ITER,DSPA
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL TKOUT(G(ITKA))
      CALL MASOUT(G(IYGA),DT,ISTP)
      STOP
      END
```

```
C        *** NSSFE6 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED, STEADY-STATE FLOW
C        (2) NONLINEAR CAUCHY-TYPE BOUNDARIES AND (OR) NONLINEAR POINT
C            SINKS
C        USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
   10 FORMAT (1H1,18X,30HSUMMARY OF CLOSURE INFORMATION/
     $56H NO. OF ITERATIONS TO CLOSE (ITER) ..................... = ,I4/
     $56H MAXIMUM ABSOLUTE DISPLACEMENT (DSPA) ................. = ,G11.5)
   20 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
   22 FORMAT(/4X,59HSUMMARY OF FLOW AT NONLINEAR CAUCHY-TYPE BOUNDARIES
     1BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL SWINIT(G,TOLSW,DSMX,DSP,RP,NITSW,ITKA,ITPA)
      CALL GNINIT(G,IGCA,IHRK,IHRL,IZRK,IZRL,IZPA,IKRA,ILRA,IKPA,INZA
     1,INSA,NBNC,NPNB,NLCZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      CALL SWFMCO(G(IAA),G(ITKA),G(ITPA),G(IJPA),G(INA))
      CALL GNFMCO(G(IXGA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(IKRA),G(ILRA),G(IKPA),G(INZA),G(INSA),NBNC
     2,NPNB,NLCZ)
      ISTP=1
      DT=1.
      DO 50 IT=1,NITSW
      ITER=IT
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
```

```
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNPRED(G(IHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL SWBDMP(G(IBA),DSMX,DSP,DSPO,DSPA,RP,ITER)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL SWTHK(G(IHA),G(IAA),G(IBA),G(IQA),G(ITKA),G(ITPA),DSPA,TOLSW
     1,G(IJPA),G(INA),ITER)
      IF(DSPA.LT.TOLSW) GO TO 60
    0 CONTINUE
    0 CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
     2,G(INA),G(IKA),G(ILA))
      IF(NQBND.LT.1) GO TO 62
      WRITE(IOUT,20)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
    2 CALL GNBLSS(G(IHA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK),G(IZRL)
     1,G(IZPA),G(IARA),G(IXGA),DT,G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC
     2,NPNB)
      IF(NLCZ.LT.1) GO TO 64
      WRITE(IOUT,22)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKRA),G(ILRA),G(INZA),G(INSA)
     1,NLCZ)
    4 WRITE(IOUT,10) ITER,DSPA
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL TKOUT(G(ITKA))
      CALL MASOUT(G(IYGA),DT,ISTP)
      STOP
      END
```

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C        *** NSSFE3 COMBINED WITH NSSFE5 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED, STEADY-STATE FLOW
C        (2) NONLINEAR STEADY LEAKAGE
C        (3) NONLINEAR CAUCHY-TYPE BOUNDARIES
C        USES MODIFIED, INCOMPLETE CHOLESKY, CONJUGATE GRADIENT METHOD
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
   10 FORMAT (1H1,18X,30HSUMMARY OF CLOSURE INFORMATION/
     $56H NO. OF ITERATIONS TO CLOSE (ITER) ..................... = ,I4/
     $56H MAXIMUM ABSOLUTE DISPLACEMENT (DSPA) ................. = ,G11.5)
   20 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
   22 FORMAT(/4X,59HSUMMARY OF FLOW AT NONLINEAR CAUCHY-TYPE BOUNDARIES
     1BY ZONE)
      CALL INITCG(TITLE,G,TIME,TOL,IAFA,IXA,IPA,IRA,NBCZ)
      CALL SWINIT(G,TOLSW,DSMX,DSP,RP,NITSW,ITKA,ITPA)
      CALL GNINIT(G,IGCA,IHRK,IHRL,IZRK,IZRL,IZPA,IKRA,ILRA,IKPA,INZA
     1,INSA,NBNC,NPNB,NLCZ)
      CALL VNINIT(G,IECA,IHSA,NVNZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETCG(G(IAA))
      CALL SWFMCO(G(IAA),G(ITKA),G(ITPA),G(IJPA),G(INA))
      CALL GNFMCO(G(IXGA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(IKRA),G(ILRA),G(IKPA),G(INZA),G(INSA),NBNC
     2,NPNB,NLCZ)
      CALL VNFMCO(G(IHA),G(IARA),G(IECA),G(IHSA),G(INDA),NVNZ)
      ISTP=1
      DT=1.
      DO 50 IT=1,NITSW
```

```
      ITER=IT
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNPRED(G(IHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL VNPRED(G(IHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA),G(INA))
      CALL MICCG(G(IAA),G(IAFA),G(IXA),G(IPA),G(IRA),G(IBA),TOL,G(IJPA)
     1,G(INA))
      CALL SWBDMP(G(IBA),DSMX,DSP,DSPO,DSPA,RP,ITER)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL SWTHK(G(IHA),G(IAA),G(IBA),G(IQA),G(ITKA),G(ITPA),DSPA,TOLSW
     1,G(IJPA),G(INA),ITER)
      IF(DSPA.LT.TOLSW) GO TO 60
   50 CONTINUE
   60 CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
     2,G(INA),G(IKA),G(ILA))
      IF(NQBND.LT.1) GO TO 62
      WRITE(IOUT,20)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
   62 CALL GNBLSS(G(IHA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK),G(IZRL)
     1,G(IZPA),G(IARA),G(IXGA),DT,G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC
     2,NPNB)
      IF(NLCZ.LT.1) GO TO 64
      WRITE(IOUT,22)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKRA),G(ILRA),G(INZA),G(INSA)
     1,NLCZ)
   64 CALL VNBLSS(G(IHA),G(IYGA),G(ITPA),G(IECA),G(IHSA),DT,G(INA))
      WRITE(IOUT,10) ITER,DSPA
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL TKOUT(G(ITKA))
      CALL MASOUT(G(IYGA),DT,ISTP)
      STOP
      END
```

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C        *** NSSFE4 COMBINED WITH NSSFE6 ***
C        MODULAR FINITE-ELEMENT MODEL OF GROUND-WATER FLOW
C        IN TWO DIMENSIONS.
C        SIMULATES THE FOLLOWING CONDITIONS:
C        (1) UNCONFINED, STEADY-STATE FLOW
C        (2) NONLINEAR STEADY LEAKAGE
C        (3) NONLINEAR CAUCHY-TYPE BOUNDARIES
C        USES DIRECT METHOD OF TRIANGULAR DECOMPOSITION
C        TO SOLVE MATRIX EQUATIONS.
      DIMENSION TITLE(20)
      COMMON/PRIME/G(5000)
      COMMON/GDIM/ISUM
      COMMON/ADR/IAA,IARA,IXGA,IYGA,IATA,IQA,IBA,IHA,IHRA,IHBA,IALA,IQBA
     1,ICKA,ICLA,IHKA,IHLA,IDTA,IJPA,INA,INDA,IKA,ILA,IDZA,IDSA
      COMMON/NO/NELS,NNDS,NSTEPS,NPER,NZNS,NWELS,NQBND,NHDS,NEQ,MBWC,NIT
      COMMON/CHG/NWCH,NQCH,NHRCH,NBQCH,NHCH,NCBCH,NVNCH,NGNCH
      COMMON/ITP/IIN,IOUT,ITA,ITB
      COMMON/IPRN/IPND
      COMMON/IND/IRAD,IUNIT,ISTD
      COMMON/SCLE/SCALE
      COMMON/BAL/SA,WQI,WQO,DQI,DQO,VLQI,VLQO,BQI,BQO,ER
      COMMON/TBAL/TSA,TWQI,TWQO,TDQI,TDQO,TLQI,TLQO,TBQI,TBQO,THBQI
     1,THBQO,TER
      COMMON/VNLBL/VNLQI,VNLQO,TNLQI,TNLQO
      COMMON/GNBL/BNQI,BNQO,TBNQI,TBNQO,PNQO,TPNQO
      OPEN (50,FILE='MODFE.DAT',STATUS='OLD',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (60,FILE='MODFE.OUT',STATUS='NEW',ACCESS='SEQUENTIAL'
     1,FORM='FORMATTED')
      OPEN (55,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
      OPEN (56,STATUS='SCRATCH',ACCESS='SEQUENTIAL',FORM='UNFORMATTED')
   10 FORMAT (1H1,18X,30HSUMMARY OF CLOSURE INFORMATION/
     $56H NO. OF ITERATIONS TO CLOSE (ITER) ..................... = ,I4/
     $56H MAXIMUM ABSOLUTE DISPLACEMENT (DSPA) ................. = ,G11.5)
   20 FORMAT(/9X,49HSUMMARY OF FLOW AT CAUCHY-TYPE BOUNDARIES BY ZONE)
   22 FORMAT(/4X,59HSUMMARY OF FLOW AT NONLINEAR CAUCHY-TYPE BOUNDARIES
     1BY ZONE)
      CALL INITB(TITLE,G,TIME,NBCZ)
      CALL SWINIT(G,TOLSW,DSMX,DSP,RP,NITSW,ITKA,ITPA)
      CALL GNINIT(G,IGCA,IHRK,IHRL,IZRK,IZRL,IZPA,IKRA,ILRA,IKPA,INZA
     1,INSA,NBNC,NPNB,NLCZ)
      CALL VNINIT(G,IECA,IHSA,NVNZ)
      CALL DATIN(TITLE,G(IXGA),G(IYGA),G(IHA),G(IHBA),G(IHRA)
     1,G(IHKA),G(IHLA),G(IALA),G(IQBA),G(IQA),G(IKA),G(ILA),G(INA)
     2,G(IDZA),G(IDSA),NBCZ)
      CALL FMCO(G(IXGA),G(IYGA),G(IAA),G(IQA),G(IARA),G(IALA),G(IQBA)
     1,G(ICKA),G(ICLA),G(INDA),G(IBA),G(IJPA),G(IKA),G(ILA))
      CALL SETB(G(IAA),G(INA),G(INDA),IBND)
      CALL SWFMCO(G(IAA),G(ITKA),G(ITPA),G(IJPA),G(INA))
      CALL GNFMCO(G(IXGA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(IKRA),G(ILRA),G(IKPA),G(INZA),G(INSA),NBNC
     2,NPNB,NLCZ)
      CALL VNFMCO(G(IHA),G(IARA),G(IECA),G(IHSA),G(INDA),NVNZ)
      ISTP=1
      DT=1.
      DO 50 IT=1,NITSW
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```
      ITER=IT
      CALL FMEQ(G(IHA),G(IHRA),G(IHKA),G(IHLA),G(ICKA),G(ICLA)
     1,G(IAA),G(IARA),G(IQA),G(IBA),DT,G(IJPA),G(INA),G(IKA),G(ILA))
      CALL GNPRED(G(IHA),G(IAA),G(IBA),G(IGCA),G(IHRK),G(IHRL),G(IZRK)
     1,G(IZRL),G(IZPA),G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC,NPNB)
      CALL VNPRED(G(IHA),G(IAA),G(IBA),G(ITPA),G(IECA),G(IHSA),G(INA))
      CALL BAND(G(IAA),G(IATA),G(IBA),G(IJPA),G(INA),IBND)
      CALL SWBDMP(G(IBA),DSMX,DSP,DSPO,DSPA,RP,ITER)
      CALL HCALC(G(IHA),G(IBA),G(INA))
      CALL RDTP(G(IAA))
      CALL SWTHK(G(IHA),G(IAA),G(IBA),G(IQA),G(ITKA),G(ITPA),DSPA,TOLSW
     1,G(IJPA),G(INA),ITER)
      IF(DSPA.LT.TOLSW) GO TO 60
   50 CONTINUE
   60 CALL MASBAL(G(IHA),G(IHBA),G(IHRA),G(IHKA),G(IHLA),G(IQBA),G(ICKA)
     1,G(ICLA),G(IAA),G(IQA),G(IBA),G(IYGA),G(IARA),G(IXGA),DT,G(IJPA)
     2,G(INA),G(IKA),G(ILA))
      IF(NQBND.LT.1) GO TO 62
      WRITE(IOUT,20)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKA),G(ILA),G(IDZA),G(IDSA),NBCZ)
   62 CALL GNBLSS(G(IHA),G(IYGA),G(IGCA),G(IHRK),G(IHRL),G(IZRK),G(IZRL)
     1,G(IZPA),G(IARA),G(IXGA),DT,G(INA),G(IKRA),G(ILRA),G(IKPA),NBNC
     2,NPNB)
      IF(NLCZ.LT.1) GO TO 64
      WRITE(IOUT,22)
      CALL PRTCBV(G(IARA),G(IXGA),DT,G(IKRA),G(ILRA),G(INZA),G(INSA)
     1,NLCZ)
   64 CALL VNBLSS(G(IHA),G(IYGA),G(ITPA),G(IECA),G(IHSA),DT,G(INA))
      WRITE(IOUT,10) ITER,DSPA
      CALL DATOUT(G(IHA),DT,TIME,ISTP)
      CALL TKOUT(G(ITKA))
      CALL MASOUT(G(IYGA),DT,ISTP)
      STOP
      END
```