ADAS Subroutine d5mfsp

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      SUBROUTINE D5MFSP( NDSTAT , NDMET  , NDONE  ,
     &                   NSTATE , NMET   , ID     , NMSUM  ,
     &                   CFREC  , CFION  , CFMET  , CPOPN  ,
     &                   POPN   , POPNMO , POPNPO ,
     &                   CPOPND , CPOPNZ ,
     &                   POPF   ,
     &                   XTEMP  , YTEMP  ,
     &                   RHS    , RDUM   , SOLVE  , LSOLVE , LAGAIN
     &                 )
C----------------------------------------------------------------------
C****************** FORTRAN77 SUBROUTINE: D5MFSP ******************** ********
C
C PURPOSE: TO PERFORM THE MAIN MATRIX ALGEBRA WHICH CALCULATES THE
C          LEVEL POPULATIONS-INCLUDING METASTABLE STATES
C
C CALLING PROGRAM: D5MPOP
C
C INPUT: (R*8) CFREC( , , ) = RECOMBINATION RATE COEFFICIENTS TO ALL
C          METASTABLE NDMET;STARTING FROM FIRST TO
C          GROUND LEVEL,WITH CFREC(NDMET,NDMET,1)
C          SET TO ZERO
C          DIMENSIONS = (NDMET,NDMET,NDSTAT)
C
C        (R*8) CFION( , , ) = IONISATION RATE COEFFICIENTS TO ALL
C          METASTABLE NDMET;STARTING FROM GROUND TO
C          FIRST LEVEL,WITH
C                CFION(NDMET,NDMET,NSTATE) SET TO ZERO
C          DIMENSIONS = (NDMET,NDMET,NDSTAT)
C
C        (I*4) NSTATE        = PARAMETER = NO OF NDMET
C
C        (I*4) NDMET         = PARAMETER = MAXIMUM SIZE OF MATRICES
C          HOLDING METASTABLE TRANSITIONS
C
C        (R*8) NMET( )       = NO  OF METASTABLES IN EACH ENERGY LEVEL
C          DETERMINES ACTUAL SIZE OF MINI MATRICES
C          DIMENSION = NDSTAT
C
C        (I*4) NDONE         = 1 0;MODIFYING MATRICES IN ORDER TO USE
C          SUBROUTINES
C
C        (I*4) ID            = POSITION OF DOMINANT TERM
C
C        (R*8) CFMET( , , ) = CROSS COUPLING COEFFICIENTS BETWEEN
C          METASTABLE NDMET WITH LEADING DIAGONAL
C          CALCULATED
C          DIMENSIONS = (NDMET,NDMET,NDSTAT)
C
C        (L*4) LSOLVE        =  TRUE  => XXMINV SOLVES SET OF 'N' LINEAR
C          EQUATIONS A X = B WHERE A,X,B ARE
C          MATRICES/VECTORS AND:
C          A = 'A(,)' ON INPUT
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C              X = 'B()' ON OUTPUT
C              B = 'B()' ON INPUT
C              FALSE  => ONLY MATRIX INVERSION,
C              A INVERSE REPLACES A
C
C          (R*8) DINT           = + OR - 1 DEPENDING ON THE NUMBER OF ROW
C           INTERCHANGES IN THE MATRIX INVERSION
C
C
C          (R*8) NMETZ     = ACTUAL DIMENSION OF NORMALIZATION MATRIX
C           ONCE FIRST ROW & COLUMN IS ELIMINATED
C        = NMET(ID)+NMET(ID+1)-1
C
C          (I*4) NDSTAT    = PARAMETER = MAXIMUM NUMBER OF NDMET
C
C          (I*4) NPOSX     = NMET(ID)
C
C          (I*4) NPOSY     = NMET(ID+1)
C
C
C OUTPUT:(R*8) CPOPN( , , )  = ARRAY HOLDING COEFFICIENTS OF POPULATION
C           STATE EQUATIONS
C           DIMENSIONS = (NDMET,NDMET,NDSTAT+1)
C
C          (R*8) POPN( , , )   = ARRAY HOLDING POPULATION STATE VALUES WITH
C           THIRD DIMENSION SET TO 1
C           DIMENSIONS = (NDMET,NDONE,NDSTAT+1)
C
C          (R*8) CPOPND( , , ) = TEMPORARY NAME OF MATRIX TO BE SUBSTITUTED
C           INTO NEXT EQUATION IN UPWARD LOOP
C           DIMENSIONS = (NDMET,NDMET,NDSTAT+1)
C
C          (R*8) CPOPNZ( , , ) = TEMPORARY NAME OF MATRIX TO BE SUBSTITUTED
C           INTO NEXT EQUATION  IN DOWNWARD LOOP
C           DIMENSIONS = (NDMET,NDMET,NDSTAT+1)
C
C          (R*8) POPNPO( , , ) = TEMPORARY NAME OF MATRIX HOLDING POPULATION
C           STATE VALUES AFTER NORMALIZATION,TO BE
C           SUBSTITUTED INTO NEXT EQUATION IN UPWARD
C           LOOP
C           DIMENSIONS = (NDMET,NDONE,NDSTAT+1)
C
C          (R*8) POPNMO( , , ) = TEMPORARY NAME OF MATRIX HOLDING POPULATION
C           STATE VALUES AFTER NORMALIZATION,TO BE
C           SUBSTITUTED INTO NEXT EQUATION IN DOWNWARD
C           LOOP
C           DIMENSIONS = (NDMET,NDONE,NDSTAT+1)
C
C          (R*8) SUM           = SUM OF ALL LEVEL POPULATION VALUES
C           INCLUDING METASTABLES
C
C          (R*8) XTEMP( , )    = TEMPORARY MATRIX FOR DURING SUBROUTINE
C           CALCULATIONS
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C          DIMENSIONS = (NDMET,NDMET)
C
C        (R*8) YTEMP( , )   = TEMPORARY MATRIX FOR DURING SUBROUTINE
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDMET)
C
C        (R*8) PTEMP( , , ) = TEMPORARY MATRIX FOR DURING ERROR CHECK
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C        (R*8) QTEMP( , , ) = TEMPORARY MATRIX FOR DURING ERROR CHECK
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C        (R*8) RTEMP( , , ) = TEMPORARY MATRIX FOR DURING ERROR CHECK
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C        (R*8) STEMP( , , ) = TEMPORARY MATRIX FOR DURING ERROR CHECK
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C        (R*8) TEMP( , , )  = MATRIX HOLDING RESULTS OF ERROR CHECK
C          ALL OF WHICH SHOULD BE ZERO
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C        (R*8) SOLVE( , )   = NORMALIZATION MATRIX AT CRITICAL STAGE
C          DIMENSIONS = (2*NDMET-1,2*NDMET-1)
C
C        (R*8) CTEMP( , , ) = HOLDS VALUES OF CFMET FOR ERROR CHECK,IS
C          NECCESSARY SINCE CFMET IS ALTERED DURING
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDMET,NDSTAT)
C
C        (R*8) RHS( )    = SIPHONED OFF COLUMN OF NORMALIZATION
C          MATRIX,USED TO CALCULATE METASTABLE
C          NDMET OF DOMINANT STAGE THROUGH XXMINV
C          DIMENSIONS = (2*NDMET-1)
C
C        (R*8) RDUM( )    = DUMMY ARRAY USED IN XXMINV AS RHS WHEN
C          LSOLVE =  FALSE
C
C
C ROUTINES :
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          _____
C          DXMADD    ADAS      MATRIX ADDITION/SUBTRACTION
C          DXMMUL    ADAS      MATRIX MULTIPLICATION
C          XXMINV    ADAS      MATRIX INVERSION
C
C
C AUTHOR:  D. BROOKS, H. P. SUMMERS, JET
C          K1/1/57
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C           JET EXT. 4941
C
C DATE:   02/06/94
C
C UPDATE:  14/02/95  HPS - INTRODUCED IAGAIN TO IMPROVE DOMINANT STAGE
C                            IDENTIFICATION.
C UPDATE:  06/07/95  HPS - MODIFIED LOOP TO PREVENT IAGAIN AND HENCE ID
C                            BEING SET GREATER THAN NSTATE-1.
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                       DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C             - FIRST RELEASE
C
C VERSION: 1.2                       DATE: 01-12-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C             - COPIED FOLLOWING UPDATES MADE BY DAVID BROOKS:
C
C UPDATE:  29/11/95  DHB - INTRODUCED A CHECK TO MAKE SURE THAT THE
C                            POPULATION EQUATIONS ARE SOLVED FOR THE BEST
C                            POSSIBLE CHOICE OF DOMINANT STAGE. NB: THIS
C                            IS NOT THE DOMINANT STAGE ITSELF BUT THE
C                            NEAREST STAGE TO IT THAT CAN SUPPORT THE
C                            CALCULATION I.E. THERE IS A CHECK TO MAKE
C                            SURE THE DOMINANT STAGE IDENTIFICATION DOES
C                            NOT PUSH THE SOLUTION LOOP TOO CLOSE TO ANY
C                            REGION OF RAPID POPULATION DROP OFF. THE
C                            PARAMETER ACC HAS BEEN INTRODUCED TO MEASURE
C                            THIS DROP OFF AND CAN BE ADJUSTED IF IT IS TOO
C                            STRINGENT.
C UPDATE:  29/11/95  DHB - ADDED CHECK TO AVOID UNNECCESARY LOOPING IN
C                            UNRESOLVED CASE.
C
C VERSION: 1.3                       DATE: 01-12-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C             - SWAPPED ORDER OF DECLARATION OF PARAMETER ACC.
C
C-----------------------------------------------------------------------
      INTEGER           ID,          NDMET,       NDONE,       NDSTAT
      INTEGER           NMET(NDSTAT),             NMSUM,       NSTATE
      LOGICAL           LAGAIN,      LSOLVE
      REAL*8            CFION(NDMET,NDMET,NDSTAT)
      REAL*8            CFMET(NDMET,NDMET,NDSTAT)
      REAL*8            CFREC(NDMET,NDMET,NDSTAT)
      REAL*8            CPOPN(NDMET,NDMET,NDSTAT+1)
      REAL*8            CPOPND(NDMET,NDMET,NDSTAT+1)
      REAL*8            CPOPNZ(NDMET,NDMET,NDSTAT+1)
      REAL*8            POPF(NMSUM), POPN(NDMET,NDONE,NDSTAT+1)
      REAL*8            POPNMO(NDMET,NDONE,NDSTAT+1)
      REAL*8            POPNPO(NDMET,NDONE,NDSTAT+1)
      REAL*8            RDUM(NDMET), RHS(2*NDMET-1)
      REAL*8            SOLVE(2*NDMET-1,2*NDMET-1)
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      REAL*8              XTEMP(NDMET,NDMET),        YTEMP(NDMET,NDMET)
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