ADAS Subroutine b8splt

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C
      SUBROUTINE B8SPLT( NTDIM , NDDIM ,
     &                   ITA    , IDA    , ITVAL   , IDVAL  ,
     &                   TETA   , TEDA   , TOUT    , DOUT   ,
     &                   CINA   ,          COUTA   ,
     &                                     LTRNG   , LDRNG
     &                 )
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: B8SPLT *********************
C
C  PURPOSE:
C          PERFORMS CUBIC SPLINE ON LOG(TEMPERATURE AND DENSITY)
C          VERSUS LOG(COLLISIONAL-RADIATIVE MATRIX COEFFICIENTS)
C          INPUT DATA
C
C          USING  TWO-WAY SPLINES IT CALCULATES  THE  INTERPOL. COEFFTS.
C          FOR  'ITVAL' ELECTRON TEMPERATURES  AND  'IDVAL' DENSITIES
C          FROM THE TWO-DIMENSIONAL TABLE OF TEMPERATURES/DENSITIES READ
C          IN FROM THE INPUT FILE. IF A  VALUE  CANNOT  BE  INTERPOLATED
C          USING SPLINES IT IS EXTRAPOLATED VIA 'XXSPLE'.
C
C          This is a special version of B8SPLN which examines the input
C          data for zeros (effective zeros of 1.0D-72) and eliminates
C          these from the spline. This is to avoid NaNQ propagating
C          throughout the population calculation. So far only one
C          array is affected - PCRMAT in B8GETP. Only do a spline
C          fit if at least half of the points are present.
C
C  CALLING PROGRAM: ADAS208/B8GETP
C
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  NTDIM   = MAX NUMBER OF ELECTRON TEMPERATURES ALLOWED
C  INPUT : (I*4)  NDDIM   = MAX NUMBER OF ELECTRON DENSITIES    ALLOWED
C
C  INPUT : (I*4)  ITA     = INPUT DATA  : NUMBER OF ELECTRON TEMPERA-
C                           TURES
C  INPUT : (I*4)  IDA     = INPUT DATA  : NUMBER OF ELECTRON DENSIT-
C                           IES
C  INPUT : (I*4)  ITVAL   = OUTPUT DATA : NUMBER OF TEMPERATURES
C  INPUT : (I*4)  IDVAL   = OUTPUT DATA : NUMBER OF DENSITIES
C
C  INPUT : (R*8)  TETA()  = INPUT DATA  : ELECTRON TEMPERATURES (K)
C  INPUT : (R*8)  TEDA()  = INPUT DATA  : ELECTRON DENSITIES (CM-3)
C  INPUT : (R*8)  TOUT()  = OUTPUT DATA : ELECTRON TEMPERATURES (K)
C  INPUT : (R*8)  DOUT()  = OUTPUT DATA : ELECTRON DENSITIES (CM-3)
C
C
C  INPUT : (R*8)  CINA(,)  =INPUT DATA FILE: FULL SET OF COLL. RAD.
C                           COEFFICIENTS FOR THE DATA-BLOCK BEING
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C                              ANALYSED.
C                              1ST DIMENSION: ELECTRON TEMPERATURE INDEX
C                              2ND DIMENSION: ELECTRON DENSITY     INDEX
C  OUTPUT: (R*8)  COUTA(,)= SPLINE INTERPOLATED COLL. RAD. CEOFFICIENTS
C                              THE USER ENTERED TEMPERATURES AND DENSITIES
C                              1ST DIMENSION: ELECTRON TEMPERATURE INDEX
C                              2ND DIMENSION: ELECTRON DENSITY     INDEX
C
C  OUTPUT: (L*4)  LTRNG()=  .TRUE.  => OUTPUT 'COUTA()' VALUE WAS INTER-
C                                      POLATED  FOR  THE  USER  ENTERED
C                                      ELECTRON TEMPERATURE 'TOUT'()'.
C                           .FALSE. => OUTPUT 'COUTA()' VALUE WAS EXTRA-
C                                      POLATED  FOR  THE  USER  ENTERED
C                                      ELECTRON TEMPERATURE 'TOUT'()'.
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C
C  OUTPUT: (L*4)  LDRNG()=  .TRUE.  => OUTPUT 'COUTA()' VALUE WAS INTER-
C                                      POLATED  FOR  THE  USER  ENTERED
C                                      ELECTRON DENSITY 'DOUT()'.
C                           .FALSE. => OUTPUT 'COUTA()' VALUE WAS EXTRA-
C                                      POLATED  FOR  THE  USER  ENTERED
C                                      ELECTRON DENSITY 'DOUT()'.
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C
C          (I*4)  NIN     = PARAMETER = MAX. NO. OF INPUT  TEMP/DENSITY
C                                       VALUES. MUST BE >= 'ITA'&'IDA'
C          (I*4)  NOUT    = PARAMETER = MAX. NO. OF OUTPUT TEMP/DENSITY
C                                       PAIRS.  MUST BE >= 'ITVAL'
C          (I*4)  IED     = ARRAY SUBSCRIPT USED INPUT  FILE  ELECTRON
C                           DENSITIES.
C          (I*4)  IET     = ARRAY SUBSCRIPT USED INPUT  FILE  ELECTRON
C                           TEMPERATURES.
C          (I*4)  IT      = ARRAY  SUBSCRIPT  USED  FOR  USER  ENTERED
C                           TEMPERATURES.
C          (I*4)  IN      = ARRAY  SUBSCRIPT  USED  FOR  USER  ENTERED
C                           DENSITIES.
C          (I*4)  IOPT    = DEFINES THE BOUNDARY DERIVATIVES FOR THE
C                           SPLINE ROUTOUT'E 'XXSPLE', SEE 'XXSPLE'.
C                           (VALID VALUES = <0, 0, 1, 2, 3, 4)
C
C          (L*4)  LSETX   = .TRUE.  => SET UP SPLINE PARAMETERS RELATOUT'G
C                                      TO 'XIN' AXIS.
C                           .FALSE. => DO NOT SET UP SPLINE PARAMETERS
C                                      RELATOUT'G TO 'XIN' AXIS.
C                                      (I.E. THEY WERE SET IN A PREVIOUS
C                                            CALL )
C                           (VALUE SET TO .FALSE. BY 'XXSPLE')
C
C          (R*8)  R8FUN1  = FUNCTION - (SEE ROUTOUT'ES SECTION BELOW)
C
C          (R*8)  XIN()   = 1) LOG( DATA FILE ELECTRON DENSITIES    )
C                           2) LOG( DATA FILE ELECTRON TEMPERATURES )
C          (R*8)  YIN()   = LOG( INPUT COLL. RAD COEFFTS.)
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C          (R*8)  XOUT()  = 1) LOG( SCALED USER ENTERED ELECTRON DENS. )
C                           2) LOG( SCALED USER ENTERED ELECTRON TEMPS.)
C          (R*8)  YOUT()  = LOG( OUTPUT GENERATED IONIZATIONS/PHOTON )
C          (R*8)  YPASS(,)= LOG( COL. RAD. COEFFTS.) INTERMEDIATE ARRAY
C                           WHICH   STORES   INTERPOLATED/EXTRAPOLATED
C                           VALUES  BETWEEN  THE  TWO  SPLINE SECTIONS.
C                           SECTIONS.
C          (R*8)  DF()    = SPLINE INTERPOLATED DERIVATIVES
C
C
C NOTE:
C
C ROUTOUT'ES:
C          ROUTOUT'E  SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          XXSPLE     ADAS      SPLINE SUBROUTOUT'E (EXTENDED DIAGNOSTICS)
C          R8FUN1     ADAS      REAL*8 FUNCTION: ( X -> X )
C
C AUTHOR:  H.P. SUMMERS
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    15/07/92
C
C
C
C VERSION : 1.1 DATE: 10/05/96
C MODIFIED: Martin O'Mullane
C     - First version
C
C VERSION : 1.2 DATE: 24/09/2004
C MODIFIED: Martin O'Mullane
C     - The check to avoid integrating over zeros in the input
C             can result in no valid points. This causes xxsple an
C             out of bounds error in xxsple. Add a check to avoid
C             the call in this case.
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER             IDA,         IDVAL,       ITA,         ITVAL
      INTEGER             NDDIM,       NTDIM
      LOGICAL             LDRNG(IDVAL),             LTRNG(ITVAL)
      REAL*8              CINA(NTDIM,NDDIM),        COUTA(NTDIM,NDDIM)
      REAL*8              DOUT(IDVAL), TEDA(IDA),   TETA(ITA)
      REAL*8              TOUT(ITVAL)
```