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C###################################################################################
c                                                                                  #
c                    SUBROUTINE PROGRAM                                            #
C                  VERSION 1.0 (25/05/2009)                                        #
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c----------------------------------------------------------------------------------#
c              TVD scheme for surface variants                                     #
c                                                                                  #
c###################################################################################
      Subroutine TVDSCHEMEH(QSUR,Q,GRADX,GRADY,LIMTER)
      Include './Include/OCERM_INF'
    Integer LIMTER
C   Parameter(LIMTER = 8)
    Dimension QSUR(IJE,KB),Q(IJM,KB),GRADX(IJM,KB),GRADY(IJM,KB)
C   Dimension TVDCOE(IJM,KBM,2)
c----------------------------------------------------------------------------------
!$OMP PARALLEL DEFAULT(SHARED) PRIVATE(I,J,K,RF,I_UP,I_EDGE)
    If(LIMTER .GT. 0) Then
      Do K = 1, KBM
!$OMP DO
        Do I = 1, IJE

         If(CFM(I) .EQ. 1.0) Then

          RF = 2.0 * GRADX(INDEX_EDGE(I,K,1),K) *
     &          (CXY(INDEX_EDGE(I,K,2),1) - CXY(INDEX_EDGE(I,K,1),1))+
     &            2.0 * GRADY(INDEX_EDGE(I,K,1),K) *
     &           (CXY(INDEX_EDGE(I,K,2),2) - CXY(INDEX_EDGE(I,K,1),2))

            RF = RF / (Q(INDEX_EDGE(I,K,2),K) -
     &           Q(INDEX_EDGE(I,K,1),K) + Sign(1.E-15,Q(INDEX_EDGE(I,K,2),K)-
     &           Q(INDEX_EDGE(I,K,1),K))) - 1.0

            QSUR(I,K) = Q(INDEX_EDGE(I,K,1),K) +
     &           0.5 * FUNLIMTER(LIMTER,RF) *
     &           (Q(INDEX_EDGE(I,K,2),K) - Q(INDEX_EDGE(I,K,1),K))

         Endif
        Enddo
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!$OMP END DO
      Enddo
    Endif
    If(LIMTER .EQ. 0) Then                                  ! Higher WENO order
          Do K = 1, KBM
!$OMP DO
          Do I = 1, IJE
            If(CFM(I) .EQ. 1.0) Then
              I_UP = INDEX_EDGE(I,K,1)
              I_EDGE = 0
              Do J = 1, CELL_POLYGEN(I_UP)
                 If(CELL_SIDE(I_UP,J,1) .EQ. I) I_EDGE = J
              Enddo

                QSUR(I,K) = 0.0
                Do J = 1, NUM_STENCIL(I_UP)
                   If(I_STENCIL(I_UP,J) .GT. 0) Then
                      QSUR(I,K) = QSUR(I,K) + A_ENO(I_UP,I_EDGE,J) *
     &                            Q(I_STENCIL(I_UP,J),K)
                   Else
                      QSUR(I,K) = QSUR(I,K) + A_ENO(I_UP,I_EDGE,J) *
     &                            QGHOST(I_STENCIL(I_UP,J),K)
                   Endif
                Enddo
                QSUR(I,K) = QSUR(I,K) + A_ENO(I_UP,I_EDGE,0) * Q(I_UP,K)

            Endif
          Enddo
!$OMP END DO
       Enddo
    Endif
!$OMP END PARALLEL
    Return
    End

    Function FUNLIMTER(LIMTER,RF)
    Double precision FUNLIMTER, RF
    Integer LIMTER
      Goto (1,2,3,4,5,6,7,8,9,10,11) LIMTER
1   Continue                        ! SUPERBEE
      FUNLIMTER = Dmax1(0.0,Dmin1(1.0,2.*RF), Dmin1(2.0,RF))
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      Goto 100
2     Continue                    ! Van Leer
        FUNLIMTER = (RF + DAbs(RF)) / (1.0 + RF + 1.E-10)
      Goto 100
3     Continue                    ! Van Albada
        FUNLIMTER = (RF + RF ** 2.) / (1.  + RF ** 2.)
      Goto 100
4     Continue                    ! Min-Mod
        If(RF .GT.  0.0) Then
          FUNLIMTER = Dmin1(RF,1.0)
        Else
          FUNLIMTER = 0.0
        Endif
      Goto 100
5     Continue                    ! Sweby
          FUNLIMTER = Dmax1(0.0,  Dmin1(1.0,1.5*RF),  Dmin1(1.5,RF))
      Goto 100
6       Continue                    ! QUICK
        FUNLIMTER = Dmax1(0.0,  Dmin1(2.0*RF,(3.+RF)/4.,2.))
      Goto 100
7     Continue                    ! UMIST
        FUNLIMTER = Dmax1(0.0,  Dmin1(2.0*RF,(1.+3.*RF)/4.,
       &                  (3.+RF)/4.,2.))
      Goto 100
8     Continue                    ! OSHER
        FUNLIMTER = Dmax1(0.0,  Dmin1(2.,RF))
      Goto 100
9       Continue                    ! MUSCL
        FUNLIMTER = (RF + DAbs(RF)) / (1.  + DAbs(RF))
      Goto 100
10    Continue                    ! 1ST UNWIND
          FUNLIMTER = 0.0
      Goto 100
11    Continue                    ! MC
        FUNLIMTER = Dmax1(0.0,  Dmin1((1.+RF)/2.,2.,2.*RF))
      Goto 100
100   Continue
      Return
      End
```