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18 BNCHMRK FRTRN90 PRT1403 VERSION 1.5.PRE-RELEASE
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1 PROGRAM LID DRIVEN CAVITY
2 IMPLICIT NONE
3 INTEGER, PARAMETER N = 50      GRID SIZE NXN GRID
4 REAL DX, DY, DT, RE           GRID SPACING, TIME STEP, REYNOLDS NUMBER
5 REAL U(N, N), V(N, N), P(N, N) VELOCITY AND PRESSURE FIELDS
6 INTEGER I, J, STEP
7 REAL START TIME, END TIME, ELAPSED TIME
8
9     PARAMETERS
10    DX 1.0 / N-1             GRID SPACING IN X DIRECTION
11    DY 1.0 / N-1             GRID SPACING IN Y DIRECTION
12    DT 0.001                 TIME STEP SIZE
13    RE 100                   REYNOLDS NUMBER
14
15     INITIALIZE ARRAYS
16    U 0.0
17    V 0.0
18    P 0.0
19
20     INITIALIZE THE TOP BOUNDARY LID VELOCITY
21    U(N, 1) = 1.0
22
23     START TIMING
24     CALL CPU TIME START TIME
25
26     MAIN LOOP FOR TIME STEPPING
27     DO STEP 1, 1000
28         CALL COMPUTE VELOCITY U, V, P, DX, DY, DT, RE
29         CALL UPDATE PRESSURE P, DX, DY
30
31         OUTPUT OR CHECK CONVERGENCE
32         IF MOD STEP, 100 = 0 THEN
33             PRINT *, STEP, STEP
34         END IF
35     END DO
36
37     STOP TIMING
38     CALL CPU TIME END TIME
39     ELAPSED TIME = END TIME - START TIME
40     PRINT *, ELAPSED TIME FOR CFD SIMULATION, ELAPSED TIME, SECONDS
41
42     CONTAINS
43
44         FUNCTION TO UPDATE THE VELOCITY AND PRESSURE FIELDS SIMPLIFIED
45         SUBROUTINE COMPUTE VELOCITY U, V, P, DX, DY, DT, RE
46             REAL, DIMENSION( , ), INTENT INOUT U, V, P
47             REAL, INTENT IN DX, DY, DT, RE
48             INTEGER I, J
49
50             SIMPLE EXPLICIT METHOD FOR VELOCITY SIMPLIFIED
51             DO I = 2, N-1
52                 DO J = 2, N-1
53                     U(I, J) = U(I, J) - DT * (U(I, J) * U(I+1, J) - U(I-1, J)) / (2*DX)
54                                         + (V(I, J) * U(I, J+1) - U(I, J-1)) / (2*DY)
55                 END DO
56             END DO
57
58             SIMPLE VELOCITY UPDATE FOR V SIMILAR
59             DO I = 2, N-1
60                 DO J = 2, N-1
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```
1      V I, J    V I, J - DT *    U I, J * V I+1, J - V I-1, J / 2*DX
2      V I, J * V I, J+1 - V I, J-1 / 2*DY
3      END DO
4      END DO
5      END SUBROUTINE COMPUTE VELOCITY
6
7      FUNCTION TO SOLVE FOR PRESSURE SIMPLIFIED POISSON EQUATION SOLVER
8      SUBROUTINE UPDATE PRESSURE P, DX, DY
9      REAL, DIMENSION , , INTENT INOUT      P
10     REAL, INTENT IN      DX, DY
11     INTEGER      I, J
12
13     SIMPLE PRESSURE POISSON EQUATION JACOBI ITERATION
14     DO I      2, N-1
15       DO J      2, N-1
16         P I, J = 0.25 * P I+1, J + P I-1, J + P I, J+1 + P I, J-1
17       END DO
18     END DO
19     END SUBROUTINE UPDATE PRESSURE
20
21 END PROGRAM LID DRIVEN CAVITY
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