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PROGRAM LID DRIVEN CAVITY

IMPLICIT NONE

INTEGER, PARAMETER N = 50 GRID SIZE NXN GRID

REAL DX, DY, DT, RE GRID SPACING, TIME STEP, REYNOLDS NUMBER

REAL U(N, N), V(N, N), P(N, N) VELOCITY AND PRESSURE FIELDS

INTEGER I, J, STEP

REAL START TIME, END TIME, ELAPSED TIME

PARAMETERS

DX = 1.0 / N-1 GRID SPACING IN X DIRECTION

DY = 1.0 / N-1 GRID SPACING IN Y DIRECTION

DT = 0.001 TIME STEP SIZE

RE = 100 REYNOLDS NUMBER

INITIALIZE ARRAYS

U = 0.0

V = 0.0

P = 0.0

INITIALIZE THE TOP BOUNDARY LID VELOCITY

U(N, 1) = 1.0

START TIMING

CALL CPU TIME START TIME

MAIN LOOP FOR TIME STEPPING

DO STEP = 1, 1000

CALL COMPUTE VELOCITY U, V, P, DX, DY, DT, RE

CALL UPDATE PRESSURE P, DX, DY

OUTPUT OR CHECK CONVERGENCE

IF MOD STEP, 100 = 0 THEN

PRINT *, STEP, STEP

END IF

END DO

STOP TIMING

CALL CPU TIME END TIME

ELAPSED TIME = END TIME - START TIME

PRINT *, ELAPSED TIME FOR CFD SIMULATION, ELAPSED TIME, SECONDS

CONTAINS

FUNCTION TO UPDATE THE VELOCITY AND PRESSURE FIELDS SIMPLIFIED

SUBROUTINE COMPUTE VELOCITY U, V, P, DX, DY, DT, RE

REAL, DIMENSION(1:N, 1:N), INTENT(INOUT) U, V, P

REAL, INTENT(IN) DX, DY, DT, RE

INTEGER I, J

SIMPLE EXPLICIT METHOD FOR VELOCITY SIMPLIFIED

DO I = 2, N-1

DO J = 2, N-1

U(I, J) = U(I, J) - DT * (U(I, J) * U(I+1, J) - U(I-1, J)) / 2*DX

V(I, J) = V(I, J) - DT * (V(I, J) * V(I, J+1) - V(I, J-1)) / 2*DY

END DO

END DO

SIMPLE VELOCITY UPDATE FOR V SIMILAR

DO I = 2, N-1

DO J = 2, N-1

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V I, J V I, J - DT * U I, J * V I+1, J - V I-1, J / 2*DX
V I, J * V I, J+1 - V I, J-1 / 2*DY

END DO

END DO

END SUBROUTINE COMPUTE VELOCITY

FUNCTION TO SOLVE FOR PRESSURE SIMPLIFIED POISSON EQUATION SOLVER

SUBROUTINE UPDATE PRESSURE P, DX, DY

REAL, DIMENSION , , INTENT INOUT P

REAL, INTENT IN DX, DY

INTEGER I, J

SIMPLE PRESSURE POISSON EQUATION JACOBI ITERATION

DO I 2, N-1

DO J 2, N-1

P I, J 0.25 * P I+1, J + P I-1, J + P I, J+1 + P I, J-1

END DO

END DO

END SUBROUTINE UPDATE PRESSURE

END PROGRAM LID DRIVEN CAVITY