

DATE 15-11-2025 22 00 05 USER FRTRN90 JOB BNCHMRK PAGE 0001

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 (N, 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

 SIMPLE VELOCITY UPDATE FOR V SIMILAR

 DO I = 2, N-1

 DO J = 2, N-1

DATE 15-11-2025 22 00 05 USER FRTRN90 JOB BNCHMRK PAGE 0002

$V_{I,J} - DT * U_{I,J} * V_{I,J} * V_{I,J+1} - V_{I-1,J} / 2*DX$
 $V_{I,J} * V_{I,J+1} - V_{I,J-1} / 2*DY$

 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