

## 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, 1.0

## 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, , 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

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

END DO

END DO

## SIMPLE VELOCITY UPDATE FOR V SIMILAR

DO I 2, N-1

DO J 2, N-1

```
      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
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```
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
```