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BNCHMRK   FRTRN90    FILE NAME/TYPE= TESTIN/TEST4.F90
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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, :) = 1.0

  ! 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
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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
```