OPTIONAL PROJECT: AE 625 CFD

Simulate a lid driven cavity problem using the below information.

Consider the system of differential equations: two equations for the velocity components u,v and one equation for pressure to simulate a 2D Channel flow.

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = -\frac{1}{\rho}\frac{\partial p}{\partial x} + \nu\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$$
$$\frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} = -\frac{1}{\rho}\frac{\partial p}{\partial y} + \nu\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}\right)$$
$$\frac{\partial^2 p}{\partial x^2} + \frac{\partial^2 p}{\partial y^2} = -\rho\left(\frac{\partial u}{\partial x}\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y}\frac{\partial v}{\partial x} + \frac{\partial v}{\partial y}\frac{\partial v}{\partial y}\right)$$

The initial condition is *u,v,p=0* everywhere, and the boundary conditions are:

$u = 1$ at $y = 2$ (the "lid");

$u, v = 0$ on the other boundaries;

$\frac{\partial p}{\partial y} = 0$ at $y = 0$;

$p = 0$ at $y = 2$

$\frac{\partial p}{\partial x} = 0$ at $x = 0, 2$

Plot the results of the cavity flow solver for different lengths of time.