2D Coupled Convection

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = 0 \qquad \frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} = 0$$

After Discretization

$$u_{i,j}^{n+1} = u_{i,j}^{n} - u_{i,j}^{n}\frac{\Delta t}{\Delta x}\left(u_{i,j}^{n} - u_{i-1,j}^{n}\right) - v_{i,j}^{n}\frac{\Delta t}{\Delta y}\left(u_{i,j}^{n} - u_{i,j-1}^{n}\right)$$

$$v_{i,j}^{n+1} = v_{i,j}^{n} - u_{i,j}^{n}\frac{\Delta t}{\Delta x}\left(v_{i,j}^{n} - v_{i-1,j}^{n}\right) - v_{i,j}^{n}\frac{\Delta t}{\Delta y}\left(v_{i,j}^{n} - v_{i,j-1}^{n}\right)$$

Solved with following Initial Conditions:

$$u\,,\ v = 2\ (0.5 \le x, y \le 1)\ \&\ 1\ \text{elsewhere}$$

and Boundary condtions

$$u, v = 1\ \text{for}\ \{x,\ y\} = (0, 2)$$