

2D Linear Convection

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

After Discretization

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

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

Solved with following Initial Conditions:

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

and Boundary condtns

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