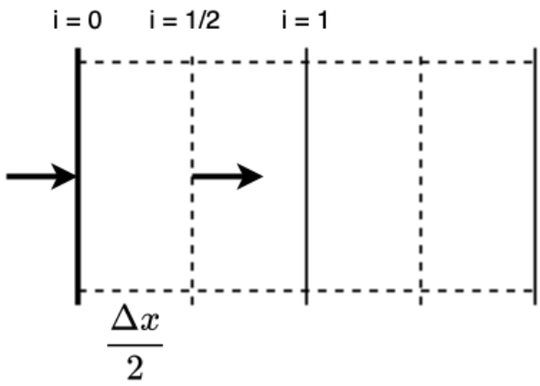
FVM moving shock in 1D with upwind flux.



$$\frac{\partial \mathbf{w} J}{\partial \tau} = F_{in} - F_{out} \tag{1}$$

$$\frac{\partial \mathbf{w} J}{\partial \tau} = (\mathbf{F}(\bar{\mathbf{w}}_u) - x_\tau \bar{\mathbf{w}}_u) - \left(\frac{\mathbf{F}(\mathbf{w}_1) + \mathbf{F}(\mathbf{w}_0)}{2} - |A| \frac{\mathbf{w}_1 - \mathbf{w}_0}{2} \right) \tag{2}$$

Define J as

$$J = \frac{\Delta x}{2} - x' \tag{3}$$

Perturb w

$$\mathbf{w} = \bar{\mathbf{w}} + \mathbf{w}' \tag{4}$$

Substitute and cancel $\bar{\mathbf{F}}$

$$\frac{\partial}{\partial \tau} \left((\bar{\mathbf{w}} + \mathbf{w}') \left(\frac{\Delta x}{2} - x' \right) \right) = \tag{5}$$