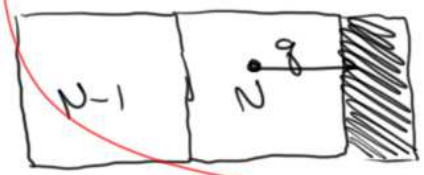
$$T_{i-1/2}\left(P_{i-1}-P_i\right)+T_{i+1/2}\left(P_{i+1}-P_i\right)=\frac{V_i\,\phi\,C_t}{B_w\,\Delta t}\left(P_i^{n+1}-P_i^{n}\right)-Q^{sc}$$

$$T=\begin{bmatrix} T_{1/2}+T_{3/2} & -T_{3/2} & 0 & 0 \\ -T_{3/2} & T_{3/2}+T_{5/2} & -T_{5/2} & 0 \\ 0 & -T_{5/2} & T_{5/2}+T_{7/2} & -T_{7/2} \\ 0 & 0 & -T_{7/2} & T_{7/2}+T_{9/2} \end{bmatrix}$$

$2T_1$

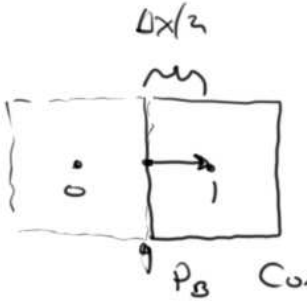
$T_{9/2}=0$

"Neumann"



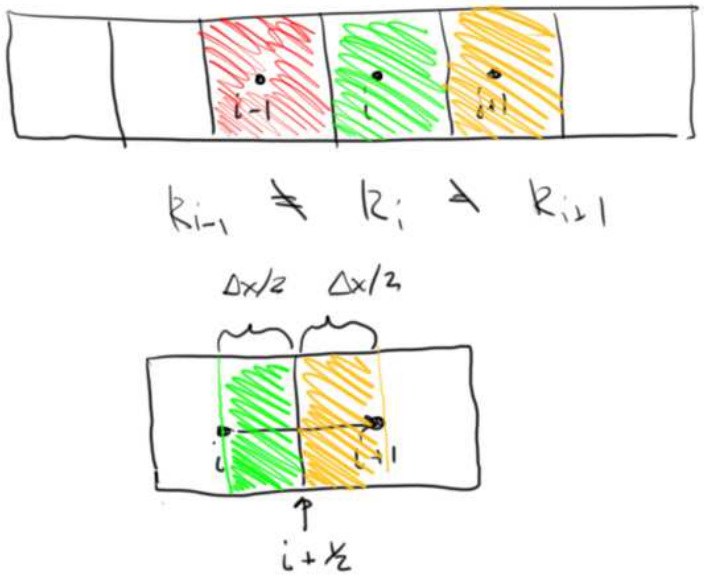
No flux on right

$$q_{N+1/2}=T_{N+1/2}\left(P_N-P_{N+1}\right)=0$$



$$q_{1/2}=T_{1/2}\left(P_0-P_1\right)=2T_1\left(P_B-P_1\right)$$

Constant Pressure "Dirichlet"



$$q = \frac{k_{i+1/2}\, A}{\mu B_w \Delta x}\left(P_{i+1} - P_i\right) \quad \Rightarrow \quad \left(P_{i+1} - P_i\right) = \frac{q \mu B_w \Delta x}{k_{i+1/2}\, A}$$

For green

$$\left(P_{i+1/2} - P_i\right) = \frac{q \mu B_w \Delta x}{2 k_i A}$$

For yellow

$$\left(P_{i+1} - P_{i+1/2}\right) = \frac{q \mu B_w \Delta x}{2 k_{i+1} A}$$

green + yellow

$$(P_{i+1/2} - P_i) + (P_{i+1} - P_{i+1/2}) = \frac{q \mu B_w \Delta x}{2 k_i A} + \frac{q \mu B_w \Delta x}{2 k_{i+1} A}$$

$$(P_{i+1} - P_i) = \frac{q \mu B_w \Delta x}{A} \frac{1}{2}\left(\frac{1}{k_i} + \frac{1}{k_{i+1}}\right) \Rightarrow q = \frac{A}{\mu B_w \Delta x} 2 \left(\frac{1}{k_i} + \frac{1}{k_{i+1}}\right)^{-1} (P_{i+1} - P_i)$$

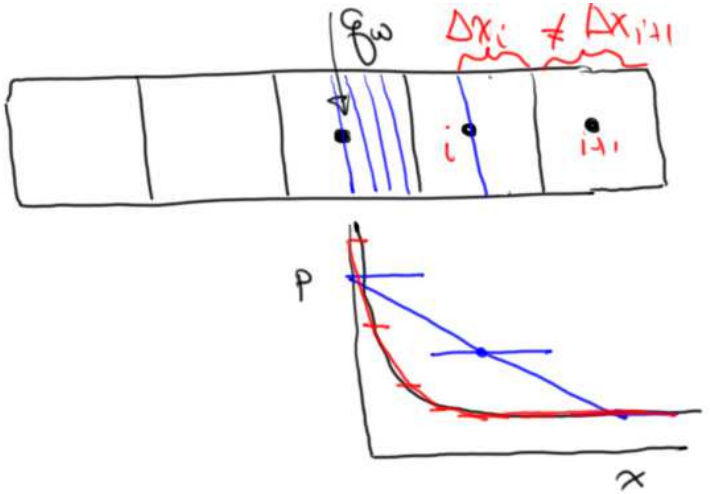
$$= \frac{k_{i+1/2} A}{\mu B_w \Delta x} (P_{i+1} - P_i)$$

$$k_{i+1/2} = 2\left(\frac{1}{k_i} + \frac{1}{k_{i+1}}\right)^{-1}$$

$$= \frac{2 k_i k_{i+1}}{k_i + k_{i+1}}$$

$$T_{i+1/2} = \frac{k_{i+1/2} A}{\mu B_w \Delta x}$$

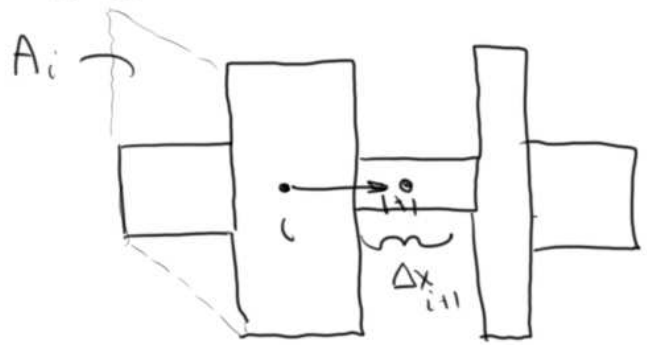
Harmonic Avg.



$$T_{i+1/2} = \frac{k_{i+1/2}\, A}{\mu B_w \Delta x_{i+1/2}}$$

$$\Delta x_{i+1/2} = \frac{\Delta x_i + \Delta x_{i+1}}{2} \quad , \quad k_{i+1/2} = \frac{\frac{\Delta x_i}{2} + \frac{\Delta x_{i+1}}{2}}{\frac{\Delta x_i}{2k_i} + \frac{\Delta x_{i+1}}{2k_{i+1}}} = \frac{\Delta x_i + \Delta x_{i+1}}{\frac{\Delta x_i}{k_i} + \frac{\Delta x_{i+1}}{k_{i+1}}}$$

Changing Area



$$(P_{i+1} - P_i) = \frac{q \mu B_w}{2}\left(\frac{\Delta x_i}{k_i A_i} + \frac{\Delta x_{i+1}}{k_{i+1} A_{i+1}}\right) \Rightarrow q = \frac{1}{\mu B_w \Delta x_{i+1/2}} \underbrace{\left(\frac{\Delta x_i + \Delta x_{i+1}}{\frac{1}{k_i A_i} + \frac{1}{k_{i+1} A_{i+1}}}\right)}_{(kA)_{i+1/2}} (P_{i+1} - P_i)$$

$$T_{i+1/2} = \left(\frac{1}{\mu B_w}\right)_{i+1/2} \left(\frac{kA}{\Delta x}\right)_{i+1/2}$$

where $$\left(\frac{kA}{\Delta x}\right)_{i+1/2} = \frac{2 k_i A_i k_{i+1} A_{i+1}}{k_i A_i \Delta x_{i+1} + k_{i+1} A_{i+1} \Delta x_i}$$