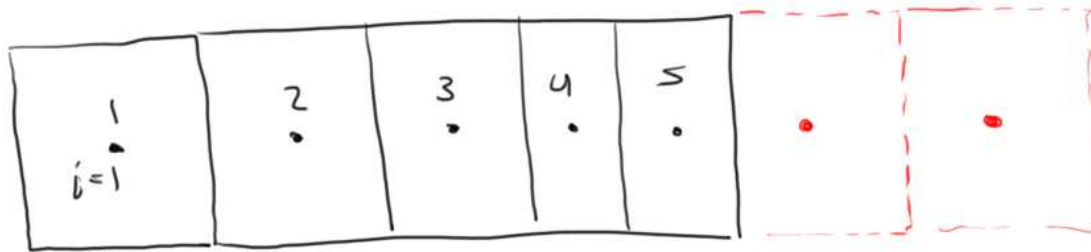


$$-\frac{1}{12\mu} \left[\frac{\omega_{i+1}^3 - \omega_i^3}{\Delta x} \cdot \frac{A_{(i+1)k} \omega_k^{N+1} - A_{(i)k} \omega_k^{N+1}}{\Delta x} + \omega_i^3 \left[\frac{A_{i+2} \omega_k^{N+1} - 2 A_{i+1} \omega_k^{N+1} + A_i \omega_k^{N+1}}{\Delta x^2} \right] \right] + \frac{\omega_i^{N+1} - \omega_i^N}{\Delta t} + q_i = 0$$



Well

Reservoir

$$\vec{K}(\vec{w}) \vec{w} = \vec{Q}$$

$$\vec{w} = \vec{K}^{-1} \vec{Q}$$

Newton - Raphson

$$\vec{R} = \vec{K}(\vec{w}) \vec{w} - \vec{Q} = \vec{0}$$

$$\vec{R} \approx \vec{R}^n + \left(\frac{\partial \vec{R}}{\partial \vec{w}} \right)_n (\vec{w}^{n+1} - \vec{w}^n) + \frac{1}{2!} \left(\frac{\partial^2 \vec{R}}{\partial \vec{w}^2} \right)_n (\vec{w}^{n+1} - \vec{w}^n)^2 + \dots$$

$$\vec{0} \approx \vec{R}^n + K_T^n \Delta \vec{w} + O(\Delta \vec{w}^2)$$

K_T is tangent stiffness $\Rightarrow K_T = \frac{\partial \vec{R}}{\partial \vec{w}}$ evaluated at $w = w^n$

$$\Delta \vec{w} = -(K_T)^{-1} \vec{R}^n$$

$$\vec{w}^{n+1} = \vec{w}^n + \Delta \vec{w}$$

$$\frac{\vec{w}^{n+1} - \vec{w}^n}{N^{n+1}} < 1 \sim 10^{-6}$$