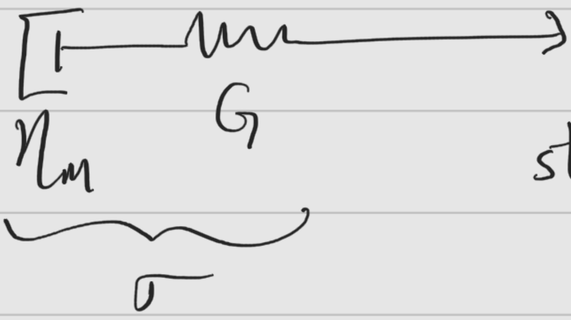
Maxwell material



strain is additive

$$\varepsilon_M + \varepsilon_e = \varepsilon_T$$

$$\dot{\varepsilon}_M + \dot{\varepsilon}_e = \varepsilon_T$$

$$\sigma_e = \sigma_M$$

$$G\varepsilon_e = \eta\,\dot{\varepsilon}_M$$

$$G(\varepsilon_T - \varepsilon_M) = \eta\,\dot{\varepsilon}_M$$

$$\Rightarrow \underbrace{G\varepsilon_T - G\varepsilon_M}_{\text{elastic stress}} = \underbrace{\eta\,\dot{\varepsilon}_M}_{\text{resistive stress}}$$

or $$\underbrace{G\dot{\varepsilon}_T}_{\text{total applied stressing rate}} - G\dot{\varepsilon}_M = \eta\,\ddot{\varepsilon}_M$$

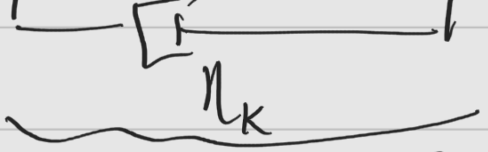
→ for earthquake cycle, $\dot{\varepsilon}_T$ is time invariant.

$$\Rightarrow \boxed{\dot{\sigma}^{\infty} - G\dot{\varepsilon}_M = \eta\,\ddot{\varepsilon}_M}$$

Kelvin-Voigt body

stress is additive

$$\sigma_e + \sigma_K = \sigma_T$$



common ε_K

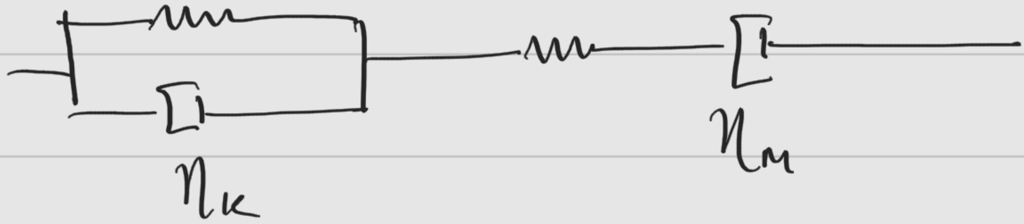
$$\dot\sigma_e + \dot\sigma_K = \dot\sigma_T$$

$$\Rightarrow \sigma_T = G\varepsilon_K + \eta\dot\varepsilon_K$$

$$\sigma_T - G\varepsilon_K = \eta\dot\varepsilon_K$$

or $$\boxed{\dot\sigma_T - G\dot\varepsilon_K = \eta\ddot\varepsilon_K}$$ → identical to governing equation for viscous strain-rate in Maxwell.

Burger's body



$$\left[\sigma_e^K + \sigma_K = G\varepsilon_e^m = \eta_m\dot\varepsilon_M\right] = \sigma$$

$$G\varepsilon_K + \eta_K\dot\varepsilon_K = G\varepsilon_e = \eta_m\dot\varepsilon_M \rightarrow \text{stress}$$

$$\varepsilon_T = \varepsilon_e + \varepsilon_M + \varepsilon_K$$

$$\dot\varepsilon_T = \dot\varepsilon_e + \dot\varepsilon_M + \dot\varepsilon_K$$

$$G\varepsilon_K + \eta_K\dot\varepsilon_K = G\underbrace{\left(\varepsilon_T - (\varepsilon_M + \varepsilon_K)\right)} = \eta_m\dot\varepsilon_M$$

$$G\,\varepsilon_K + \eta_K \dot{\varepsilon}_K = \sigma \qquad \text{— (1)}$$

$$\underbrace{G\,\dot{\varepsilon}_T}_{\dot{J}\infty} - G\left(\dot{\varepsilon}_M + \dot{\varepsilon}_K\right) = \eta_M \ddot{\varepsilon}_M \qquad \text{— (2)}$$

$$\dot{\varepsilon}_K = \frac{\sigma - G\,\varepsilon_K}{\eta_K}$$

This is almost a Maxwell body except for $\dot{\varepsilon}_K$