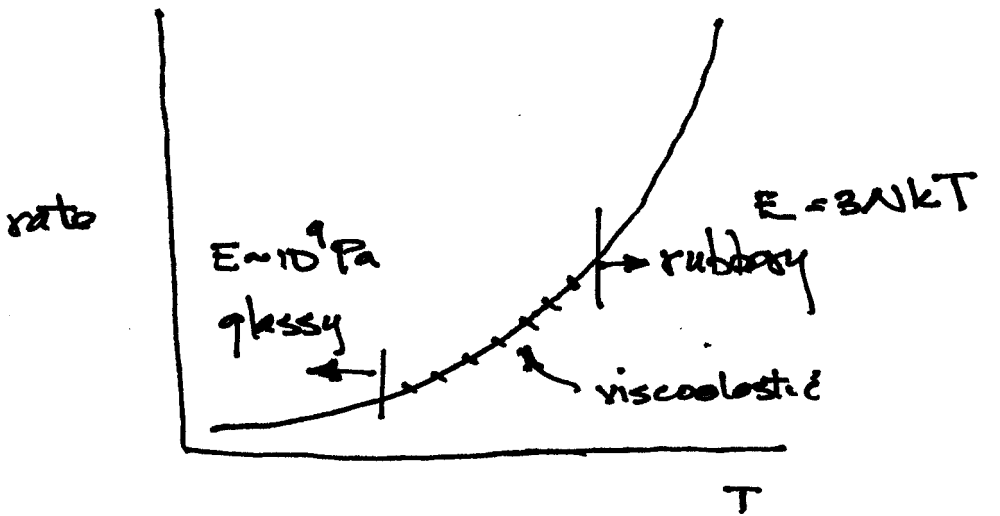
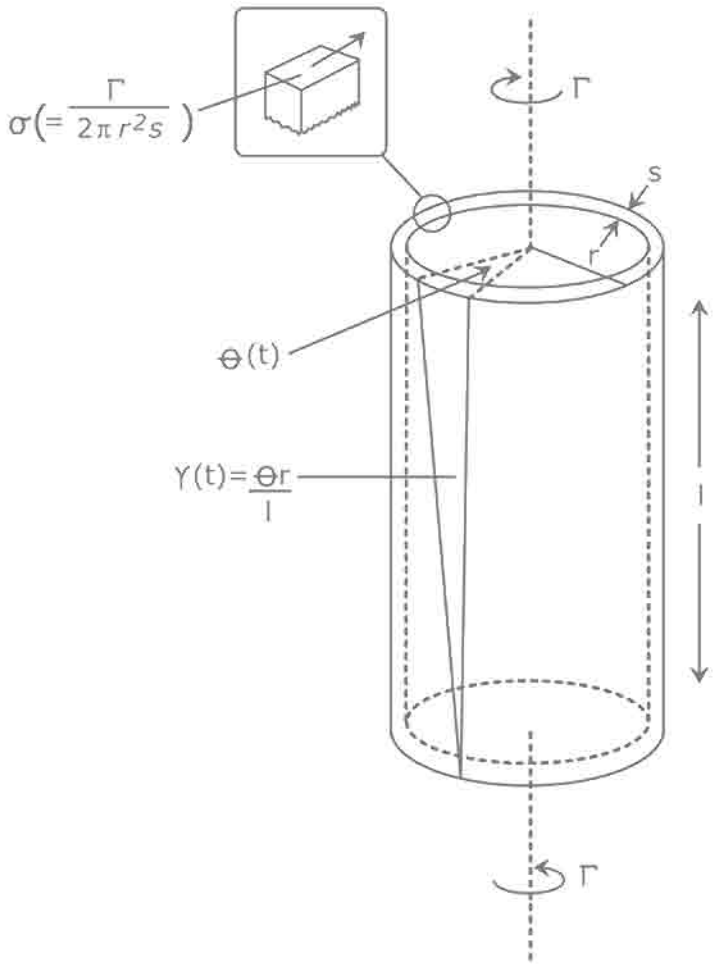
Viscoelasticity

$$f\,dx = dU - T\,dS$$

$$\text{rate} \sim \exp\frac{-E^*}{RT}$$



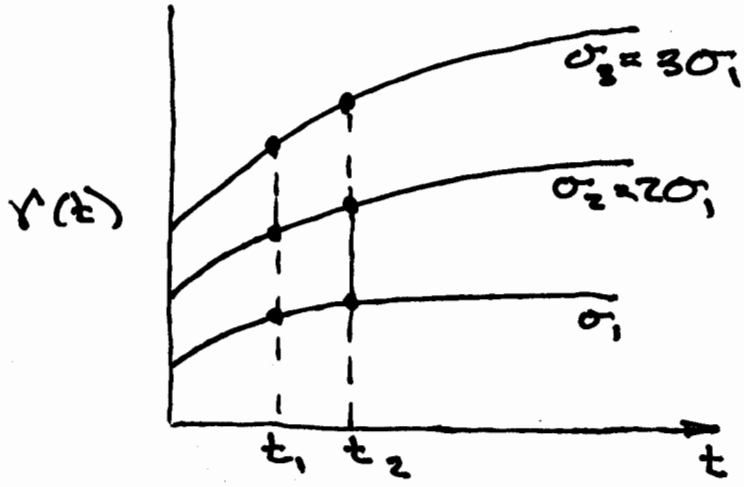
Simple Shear -
torsion of thin-walled cylinder

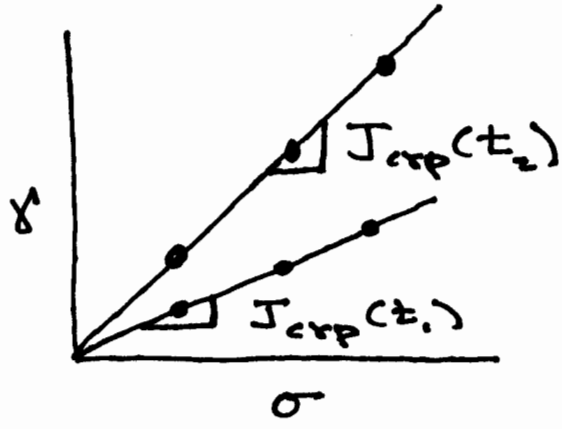


shear compliance:

$$J = \frac{\gamma}{\sigma} = \frac{(\theta r/l)}{(\Gamma/2\pi r^2 s)} = \left[\frac{2\pi r^3 s}{l}\right]\frac{\theta}{\Gamma}$$

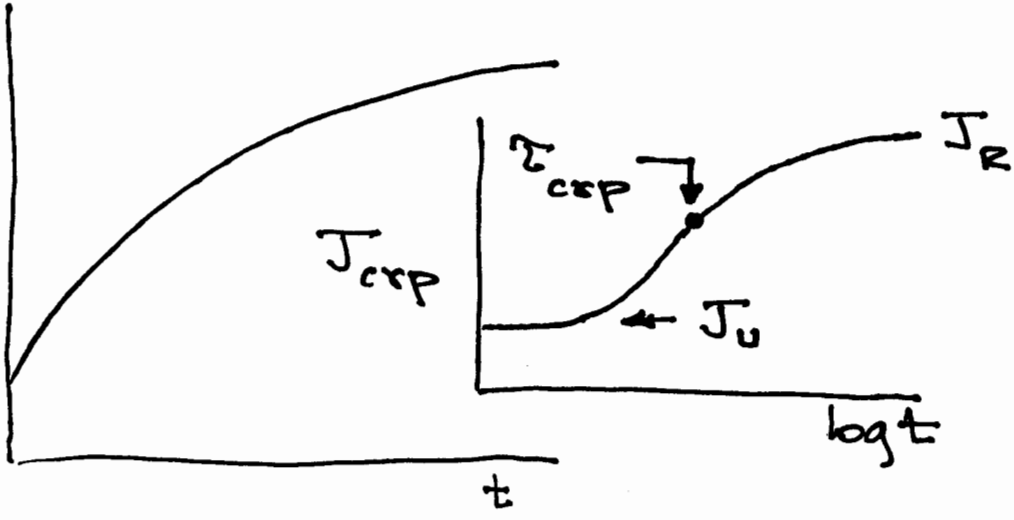
Creep: $\sigma = \text{const}$, $\gamma = \gamma(t)$



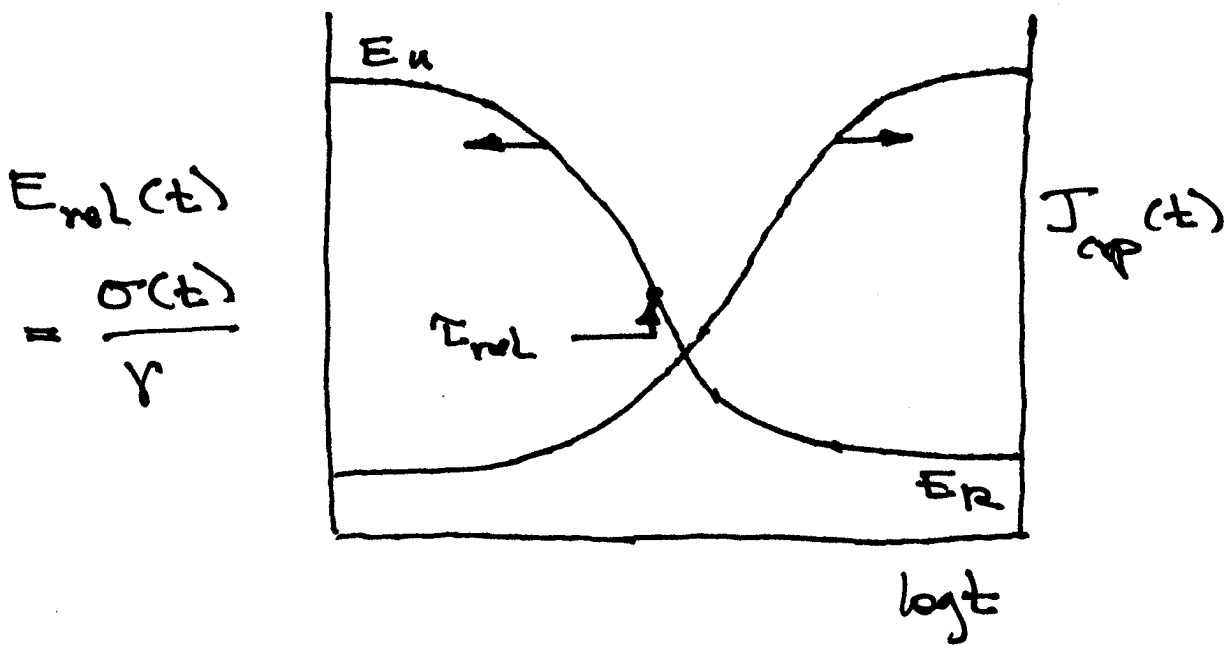


If (not iff) linear: $\gamma(a\sigma) = a\,\gamma(\sigma)$

$$J_{crp}(t) = \frac{\gamma(t)}{\sigma}$$



Relaxation: $\gamma = \text{const.}$, $\sigma = \sigma(t)$



$$E_u = \frac{1}{J_u}, \quad E_R = \frac{1}{J_R}$$

$$E_{rel}(t) \neq 1 / J_{crp}(t)$$

$$\tau_{crp} = \tau_{rel} \cdot \frac{E_u}{E_R}$$