KELVIN MODEL

$$\sigma = k\varepsilon + \mu\dot{\varepsilon}$$

CREEP: constant stress σ_0

$$\sigma_0 = k\varepsilon + \mu\dot{\varepsilon} \leftarrow \text{Differential EQN}$$

Solution $\varepsilon = \frac{\sigma_0}{k}\left[1 - e^{-\left(\frac{kt}{\mu}\right)}\right]$

$t=0 \quad e^{-\frac{k0}{\mu}} = 1 \Rightarrow \varepsilon = 0$

$t \to \infty \quad e^{-\frac{kt}{\mu}} \to 0 \quad \varepsilon \Rightarrow \frac{\sigma_0}{k}$ strain you'd get with spring alone

ε goes from 0 to $\frac{\sigma_0}{k}$ asymptotically

RELAXATION: constant STRAIN $\Rightarrow \dot{\varepsilon} = 0$

$\varepsilon = \varepsilon'$

$\dot{\varepsilon} = \frac{d\varepsilon}{dt}$

$$\sigma = k\varepsilon' + \cancel{\mu(0)}^{\,0} \Rightarrow \sigma = k\varepsilon'$$

σ is constant too.

RECOVERY REMOVE STRESS WHILE @ strain level ε' $\quad \sigma = 0$

$$0 = k\varepsilon + \mu\dot{\varepsilon}$$

$\varepsilon = \varepsilon' e^{-\left[\frac{kt}{\mu}\right]}$ i.e. another asymptote.

$[t=0, \varepsilon=\varepsilon'] \quad [t\to\infty, \varepsilon\to 0]$

17 FEB