KELVIN MODEL

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

CREEP: constant stress σ_0

$$\sigma_0 = k\varepsilon + \mu\dot{\varepsilon}$$ ← 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 $\Rightarrow \dot{\varepsilon} = 0$

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

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

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.

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

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