

4.11

One Voigt element (from prob. 4.8a)

$$\bar{\gamma}_i = \frac{J_i \bar{\sigma}}{\tau_i \left(s + \frac{1}{\tau_i} \right)}$$

Summing over all elements:

$$\bar{\gamma} = \bar{\gamma}_u + \sum_i \bar{\gamma}_i = \left\{ J_u + \sum_i \frac{J_i}{\tau_i \left(s + \frac{1}{\tau_i} \right)} \right\} \bar{\sigma}$$

Creep: $\bar{\sigma} = \sigma_0 / s$

$$\frac{\bar{\gamma}}{\sigma_0} \equiv \bar{J}_{\text{creep}} = \frac{J_u}{s} + \sum_i \frac{J_i}{\tau_i s \left(s + \frac{1}{\tau_i} \right)}$$

$$J_{\text{creep}}(t) = J_u + \sum_i J_i \left(1 - e^{-t/\tau_i} \right)$$