
FORMULAE - LECTURE 14

Time dependent behaviour of geomaterials

$$C_{\alpha} = -\frac{\Delta e}{\Delta \log t} \quad C_{\alpha\varepsilon} = \frac{\Delta \varepsilon}{\Delta \log t} = \frac{C_{\alpha}}{1 + e_0}$$

$$\varepsilon_z^v(t) = C_{\alpha\varepsilon} \log \left(1 + \frac{t}{t_i} \right)$$

$$d\varepsilon_i^e = \frac{d\sigma}{E_i} \quad d\varepsilon_v = \frac{\sigma}{\eta} dt$$

Viscoelastic model

$$\sigma = E_i \varepsilon_i^e = \sigma = E_v \varepsilon_v^e + \eta \dot{\varepsilon}_v^e$$

$$\varepsilon = \varepsilon_i^e + \varepsilon_v^e = \frac{\sigma}{E_i} + \frac{\sigma}{E_v} (1 - e^{-t/t_r}) \quad t_r = \frac{\eta}{E_v}$$

Elastic visco-plastic model

$$\varepsilon = \varepsilon_i^e + \varepsilon_v^p$$

Maxwell model

$$\varepsilon = \frac{\sigma}{E_i} + \frac{\sigma}{\eta} t$$

Bingham model

$$\text{if } \sigma < \sigma_{pc} \rightarrow \varepsilon = \varepsilon_i^e = \frac{\sigma}{E_i}$$

$$\text{if } \sigma > \sigma_{pc} \rightarrow \varepsilon = \frac{\sigma}{E_i} + \frac{\sigma - \sigma_{pc}}{\eta} t$$
