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Research Project Overview

1 Concept overview

Given

$$\sigma(z,t) = H_A \int_0^t G(t-s)\frac{d\epsilon}{ds}(z,s)ds = H_A G * \frac{d\epsilon}{dt}$$

where

$$G(t) = 1 + c\int_{\tau_1}^{\tau_2} g(t,\tau)dF(\tau) = G_\infty + G_d \mathbb{E}_F[g]$$

In other words, $G_\infty \equiv 1, G_d \equiv c$ with

$$g(t,\tau) = \frac{e^{-t/\tau}}{\tau}, \quad \tau = \text{"relaxation time"}$$

Note that

$$\hat{g} = \frac{1}{1+i\omega\tau}$$

Then, $\sigma(z,t)$ can be expressed as

$$\sigma(z,t) = H_A G_\infty \, \epsilon\big|_0^t + H_A G_d P$$

where $P := \mathbb{E}_F[g] * d\epsilon/dt$, giving

$$\hat{P} = \mathbb{E}_F[\hat{g}]\cdot\frac{d\epsilon}{dt} = \underbrace{\int_{\tau_1}^{\tau_2} \frac{1}{1+i\omega\tau}dF(\tau)\cdot}_{\text{“}\mathbb{E}(\omega)\text{”}}\frac{d\hat{\epsilon}}{dt}$$

“Can show that” $\mathcal{P}$ satisfies an (auxiliary) ODE:

$$\tau\dot{\mathcal{P}} + \mathcal{P} = G_d\frac{d\epsilon}{dt}, \text{ where } \tau \sim F(\tau)$$

Where $P = \mathbb{E}_F[\mathcal{P}]$.

2 Project overview

Weeks	Planned Activities
1, 2	Show problems are analogous (auxiliary ODE same, although PDEs differ)
3, 4	Implement polynomial chaos
5...	Rigorously prove approach is valid; recover Gauss-Legendre as special case