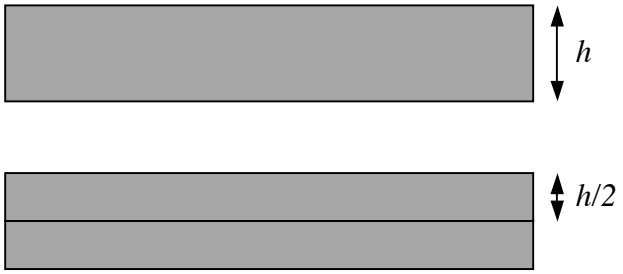
HOMEWORK 5 - Due March 03

1) Convert λ and μ to E and ν. Young's modulus is the ratio of stress to strain for the case of uniaxial stress $\sigma_1 = E\varepsilon_1$ and Poisson's ratio is the ratio of cross-sectional strain to longitudinal strain $\varepsilon_2 = -\nu\varepsilon_1$. Derive formulas for E and ν in terms of the Lame parameters λ and μ by setting up a uniaxial stress experiment where $\sigma_2 = \sigma_3 = 0$ and $\varepsilon_2 = \varepsilon_3$. The stress-strain relation in the principal-stress co-ordinate system is.

$$\begin{pmatrix}\sigma_1\\ \sigma_2\\ \sigma_3\end{pmatrix} = \begin{pmatrix}\lambda+2\mu & \lambda & \lambda\\ \lambda & \lambda+2\mu & \lambda\\ \lambda & \lambda & \lambda+2\mu\end{pmatrix}\begin{pmatrix}\varepsilon_1\\ \varepsilon_2\\ \varepsilon_3\end{pmatrix}$$

2) Continental yield strength envelope model. The continental yield strength has been described as a jelly sandwich consisting of a weak layer (jelly) between two strong layers (bread). The flexural rigidity of a single strong later is.

$$D_o = \frac{Eh^3}{12\left(1-\nu^2\right)}$$



(a) What is the flexural rigidity of two strong layers, each of thickness *h/2*, that are not bonded along their common interface?

(b) What is the effective elastic thickness for the layered case?

3) T&S problem 3-19

4) T&S problem 3-22