PART IIA 2005
3C7: Mechanics of solids
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Datasheet: Elasticity & Plasticity

Answers to 3C7: Mechanics of Solids (2004-2005)

1. (a) $\dfrac{\Delta a}{a} = \dfrac{1+\nu}{E}\sigma$

   (c) $\tau = G\gamma$

   (d) $\gamma = 2\dfrac{\Delta a}{a}$

   (e) 2 independent parameters

2. (b) $p_c = \dfrac{2\nu p_o (1+\nu)a^2}{b^2[1+(1-2\nu)(1-\nu)]+\nu a^2}$

   (c) $\dfrac{A(1-\nu)}{E}(b-a) + \dfrac{B(1+\nu)}{E}\left(\dfrac{1}{b}-\dfrac{1}{a}\right)$

   where

$$A = \frac{p_o \dfrac{a^2}{b^2} - \dfrac{p_e}{1+\nu}}{(1-2\nu)+\dfrac{a^2}{b^2}}, \qquad B = \frac{p_o(1-2\nu) - \dfrac{p_e}{1+\nu}}{\dfrac{(1-2\nu)}{a^2}+\dfrac{1}{b^2}}$$

3. (a)

$$\sigma_{rr} = \frac{C}{\tan\alpha - \alpha}\left(2\alpha - 2\theta - \sin 2\theta - 2\tan\alpha \sin^2\theta\right)$$

$$\sigma_{\theta\theta} = \frac{C}{\tan\alpha - \alpha}\left(2\alpha - 2\theta + \sin 2\theta - 2\tan\alpha \cos^2\theta\right)$$

$$\sigma_{r\theta} = \frac{C}{\tan\alpha - \alpha}\left(1 - \cos 2\theta - \tan\alpha \sin 2\theta\right)$$

   (b) $C = p/2$

4. (a) $p = 6k$

   (b) $p = \dfrac{4k}{xl}\left[l^2 + \dfrac{x^2}{4}\right]$

   (c) $x = 3+\sqrt{5}$