

## PeGn624 Homework # 7

- Assigned: 2009-01-29
- Due: 2009-02-09

Please derive the effective horizontal stress equation Eq. 1.

$$\sigma'_h = \frac{\nu}{1-\nu} (\sigma_v - \alpha_P P - 3\beta_T K (T - T_R)) \quad (1)$$

For both derivations, use the following assumptions, Eqs. 2-4.

$$\sigma_h = \sigma_{xx} = \sigma_{yy} \quad (2)$$

$$\sigma_v = \sigma_{zz} \quad (3)$$

$$\epsilon_{xx} = \epsilon_{yy} = 0 \quad (4)$$

The following relationships may be useful, Eqs. 5-7.

$$G = \frac{E}{2(1+\nu)} \quad (5)$$

$$\lambda = \frac{\nu E}{(1+\nu)(1-2\nu)} \quad (6)$$

$$K = \frac{E}{3(1-2\nu)} \quad (7)$$

1. Start with Hooke's Law, Eqs. 8-9.

$$\epsilon_{xx} = \frac{1}{E} (\sigma_x - \nu(\sigma_y + \sigma_z)) \quad (8)$$

$$\epsilon_{yy} = \frac{1}{E} (\sigma_y - \nu(\sigma_x + \sigma_z)) \quad (9)$$

2. Start with the general stress-strain relationship, Eq. 10.

$$\sigma_{ij} = 2G\epsilon_{ij} + \lambda\epsilon_b\delta_{ij} + \alpha_P P\delta_{ij} + 3\beta_T K_b(T - T_R)\delta_{ij} \quad (10)$$