TOBB EKONOMİ VE TEKNOLOJİ ÜNİVERSİTESİ

**MAK506 THEORY OF ELASTICITY**
**FALL 2010**
**Due date: 20.12.2010**
**HOMEWORK 6**

**1.** The following state of strain has been measured at a point on the surface of a crane hook: $\varepsilon_a = 1000\,\mu$, $\varepsilon_b = -250\,\mu$ and $\varepsilon_c = 200\,\mu$ for $\theta_a = -15^0$, $\theta_b = 30^0$ and $\theta_c = 75^0$ (Figure 1) . Determine strain components $\varepsilon_x$, $\varepsilon_y$ and $\gamma_{xy}$.

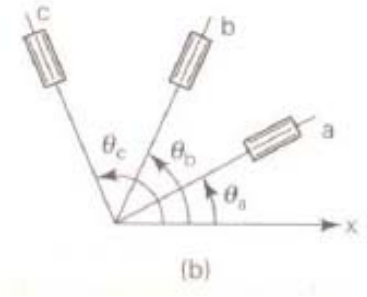


Figure 1

**2.** A copper tube of 800 mm$^2$ cross-sectional area is held at both ends as in Figure 2. If at $20\,^0C$ no axial force $P_x$ exists in the tube, what will $P_x$ be when the temperature rises to $120\,^0C$ ? Let $E = 120\ GPa$ and $\alpha = 16.8x10^{-6}\ per\,^0C$.

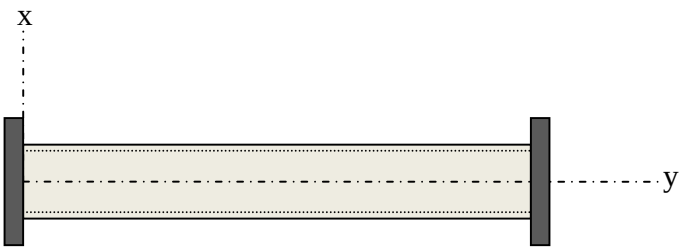


Figure 2

Problem #1: Advanced Strength and Applied Elasticity, Ansel C. Ugural, Saul K. Fenster, Third Edition, Exercise 2.24. Problem #2: Advanced Strength and Applied Elasticity, Ansel C. Ugural, Saul K. Fenster, Third Edition, Exercise 3.17. Problem #3: Applied Elasticity, CHI-TEH WANG, Sc.D., Page75.

**3.** A thin uniform disk of radius b is enclosed in a heavy ring of the same material into which it just fits when the disk and ring are at a uniform temperature. If the heat is supplied over the faces of the disk and it is rejected at the circumference, the temperature rise at a distance r from the center is given by

$$T = (T_1 - T_0) - (T_1 - T_0)\frac{r^2}{b^2}$$

Assume that the ring takes up a uniform temperature $T_0$ but undergoes no appreciable strain due to the stresses set up. Show that the radial compressive stress in the disk at a radius *r* is,

$$\frac{1}{4}E\alpha(T_1 - T_0)\left(\frac{3-\nu}{1-\nu} - \frac{r^2}{b^2}\right)$$

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