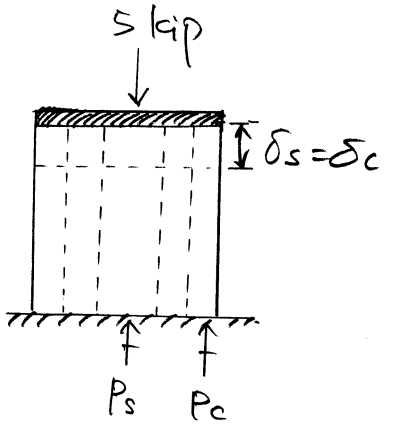
# 12-331 Solid Mechanics

**HW #5 Due: 10/3/2000**

## 4-42




- Equilibrium; $P_s + P_c = 5$ ..... ①
- Compatibility; $\delta_s = \delta_c$

$$\frac{P_s(8)}{\frac{\pi}{4}(2^2)(28.0)(10^3)} = \frac{P_c(8)}{\frac{\pi}{4}(6^2-5^2)(14.6)(10^3)}$$

$$P_s = 0.69138\,P_c \quad \cdots ②$$

using ① & ②

$P_s = 2.0543$ kip $\quad P_c = 2.9457$ kip

- Average Normal stress

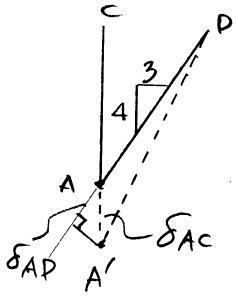
$$\sigma_s = \frac{P_s}{A_s} = \frac{2.0543}{\frac{\pi}{4}(2^2)} = \underline{0.654\ \text{ksi}}$$

$$\sigma_c = \frac{P_c}{A_c} = \frac{2.9457}{\frac{\pi}{4}(6^2-5^2)} = \underline{0.341\ \text{ksi}}$$

## 4-52

- Equilibrium;

$F_{AB} = F_{AC} = F_{AD} = F$




- Compatibility;

$$\delta_{AC} \cdot \frac{4}{5} = \delta_{AD}$$

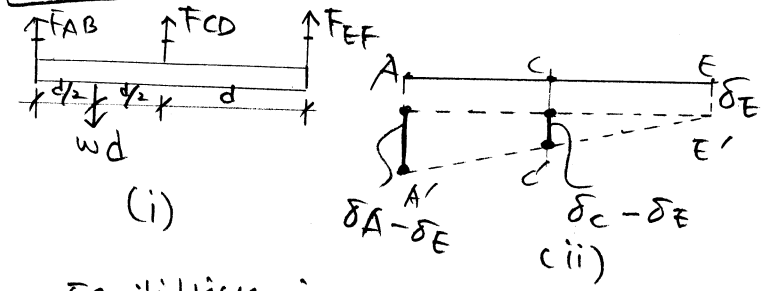
$$\boxed{\delta = \frac{PL}{AE}}$$

$$\frac{F(1.6)}{\frac{\pi}{4} d_{AC}^2 E} \cdot \frac{4}{5} = \frac{F(2)}{\frac{\pi}{4}(0.002^2)E}$$

$$\therefore\ d_{AC} = \sqrt{\frac{(1.6)(0.002^2)(4)}{(2)(5)}} = 0.0016$$

$$= \underline{1.6\ (\text{mm})}$$

## 4-57




- Equilibrium;

$\uparrow \Sigma F = 0$; $F_{AB} + F_{CD} + F_{EF} = wd$ ..... ①

$\Sigma M_A = 0$; $F_{CD}(d) + F_{EF}(2d) = wd\left(\frac{d}{2}\right)$

$$F_{CD} + 2F_{EF} = \frac{wd}{2} \quad \cdots ②$$

- Compatibility;

$$\frac{\delta_C - \delta_E}{d} = \frac{\delta_A - \delta_E}{2d}$$

$$2\delta_C - \delta_E = \delta_A$$

$$\frac{2F_{CD}L}{AE} - \frac{F_{EF}L}{AE} = \frac{F_{AB}L}{AE}$$

$$2F_{CD} - F_{EF} = F_{AB}$$

$$F_{AB} - 2F_{CD} + F_{EF} = 0 \quad \cdots ③$$

From eq. ① ② & ③, we have 3 unknowns 3 equations, So

$$F_{AB} = \frac{2wd}{12},\ F_{CD} = \frac{wd}{3},\ F_{EF} = \frac{wd}{12}$$

$$\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ 1 & -2 & 1 \end{bmatrix} \begin{Bmatrix} F_{AB} \\ F_{CD} \\ F_{EF} \end{Bmatrix} = \begin{Bmatrix} wd \\ wd/2 \\ 0 \end{Bmatrix}$$