12-331 Solid Mechanics

HW #6 Due: 10/17/2000

5.4

- Internal torque ; $T = 35.0$ lb·ft
- Maximum shear stress

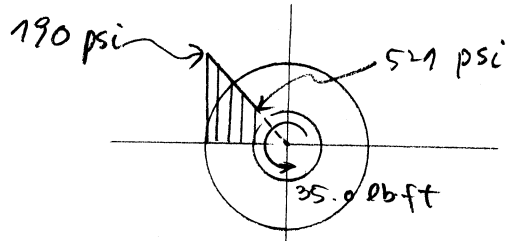
$$\tau_{max} = \frac{Tc}{J} = \frac{35.0(12)(0.75)}{\frac{\pi}{2}(0.75^4 - 0.5^4)}$$

$$= 790 \text{ (psi)}$$

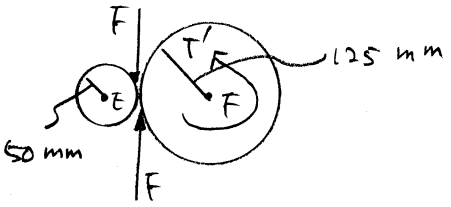
- At $\rho = 0.5$ in

$$\tau_{\rho=0.5} = \frac{35.0(12)(0.5)}{\frac{\pi}{2}(0.75^4 - 0.5^4)}$$

$$= 521 \text{ (psi)}$$



5-9



- Equilibrium ;

$$\Sigma M_E = 0 ; \quad F(0.05) = 50$$

$$F = 1000 \text{ (N)}$$

- $T' = F \cdot \rho = (1000)(0.125)$

$$= 125 \text{ (N·m)}$$

- Maximum shear stress ;

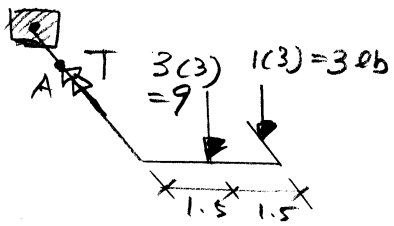
$$\tau_{AB} = \frac{T_{AB} c}{J_{AB}} = \frac{50(0.015)}{\frac{\pi}{2}(0.015^4)}$$

$$= 9.43 \text{ MPa}$$

$$\tau_{CD} = \frac{T_{CD} \cdot c}{J_{CD}} = \frac{125(0.0175)}{\frac{\pi}{2}(0.0175^4)}$$

$$= 14.8 \text{ MPa}$$

5-11



$$T = 9(1.5) + 3(3)$$

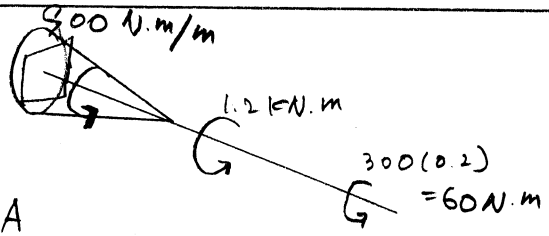
$$= 22.5 \text{ (lb·ft)}$$

- Maximum shear stress at A ;

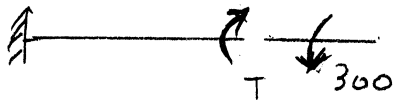
$$(\tau_A)_{max} = \frac{T \cdot c}{J} = \frac{22.5(12)(0.25)}{\frac{\pi}{2}(0.25^4)}$$

$$= 11.0 \text{ (ksi)}$$

5-20

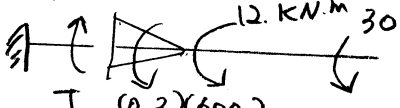


- point A



$$\tau_A = \frac{30(0.02)}{\frac{\pi}{2}(0.02^4)} = 2.39 \text{ MPa}$$

- point B



$$T = 1200 + 60 + 60 = 1320 \text{ N·m}$$

$$\tau_B = \frac{1320(0.02)}{\frac{\pi}{2}(0.02^4)} = 105 \text{ MPa}$$