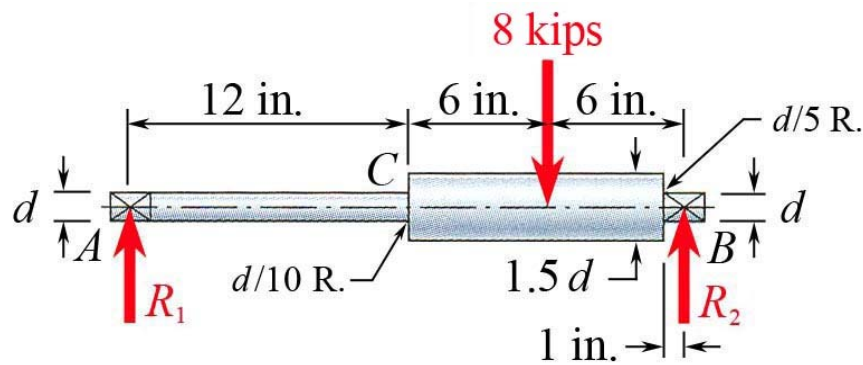


MEEG 4103 Quiz 6.2b.081

(Open book, closed notes)

- ② Estimate S'_e for the following materials: (a) AISI 4130 Q&T steel with $S_{ut} = 217$ kpsi, (b) 5052 H36 aluminum.
- ⑧ A shaft made of a 1050 HR steel with machined surfaces rotates at a speed of 1200 rev/min and supports an 8-kip bending force as shown, where \mathbf{R}_1 and \mathbf{R}_2 are bearing forces. Specify a diameter d using a design factor $n_d = 1.6$ for a life of 3 min. (Hint. Let $d = 2$ in. in the first trial.)



- (a) $S'_e = 100$ kpsi. ① (b) No S'_e (for nonferrous metals). ①

$$2. S_{ut} = 90 \text{ kpsi} \quad S'_e = 45 \text{ kpsi} \quad \sqrt{a} = 0.0715269\sqrt{\text{in.}} \quad r = d/10$$

$$K_t = 1.68 \quad K_f = 1 + q(K_t - 1) \quad N = 3600 \text{ cycles} \quad k_a = 0.8194$$

$$S_f = aN^b \quad f = 0.859 \quad R_1 = 2 \text{ kips} \quad M_C = 24000 \text{ lb}\cdot\text{in.} \quad ①$$

Trial #1: Let $d = 2$ in. $q = 0.862 \quad K_f = 1.586 \quad k_b = 0.816$

$$S_e = 30.09 \text{ kpsi} \quad b = -0.136611 \quad a = 198.66 \quad S_f = 64.91 \text{ kpsi}$$

$$\sigma_C = K_f(M_C c/I) = 48.46 \text{ kpsi} \quad n = S_f/\sigma_C = 1.34 < 1.6 \quad \therefore \text{N.G.} \quad ③$$

Trial #2: Let $d = 2.25$ in. $q = 0.869 \quad K_f = 1.591 \quad k_b = 0.8012$

$$S_e = 29.54 \text{ kpsi} \quad b = -0.13926 \quad a = 202.29 \quad S_f = 64.67 \text{ kpsi}$$

$$\sigma_C = K_f(M_C c/I) = 34.15 \text{ kpsi} \quad n = S_f/\sigma_C = 1.89 > 1.6 \quad \therefore \text{O.K.} \quad ③$$

Choose $d = 2.25$ in. ①