

6-17

FBD

Reactions:

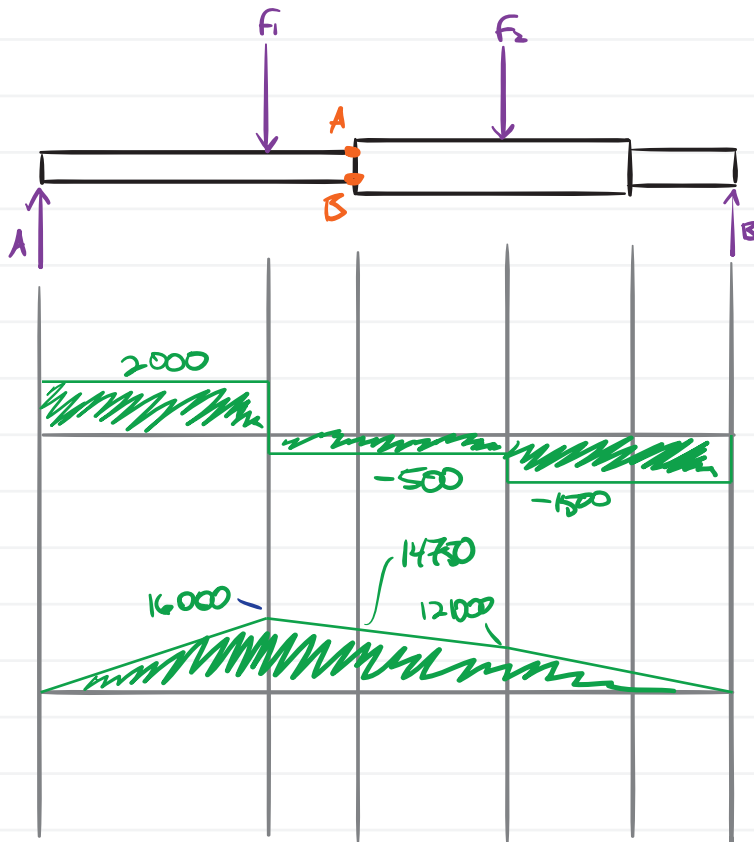
$$A + B = F_1 + F_2$$

$$-8 \cdot F_1 - 16 \cdot F_2 + 24B = 0$$

$$\Rightarrow B = \frac{F_1 + 2F_2}{3}$$

$$= 1500 \text{ lbf.}$$

$$A = 2000 \text{ lbf.}$$



A: compression $\sigma_A = \frac{-M_{AC}}{I} = \frac{-14750 \cdot (1.5/2)}{\frac{\pi}{64} (1.5/2)^4} = -35000 \text{ psi} = -35.0 \text{ kpsi}$

B: tension $\sigma_B = 35.0 \text{ kpsi}$

$$S_y = 71 \text{ kpsi}$$

Stress concentration

$K_t = 1.95$ notch sensitivity: $q = 0.76$

$K_f = 1 + q(K_t - 1) = 1.72$ fatigue stress concentration factor

Endurance limit

$$S_e' = 0.5 \cdot 85 = 42.5 \text{ kpsi}$$

Marin Factors surface finish $k_a = (2.70)(85)^{-0.245} = 0.83$

size factor $k_b = 0.879 \cdot (1.75)^{-0.107} = 0.8345$

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should use most conservative, so,

$$k_b = 0.879 (1.75)^{-0.107} = 0.8218$$

loading factor $k_c = 1$

assuming room temp. $k_d = 1$

for 50% reliability $k_e = 1$

assuming no miscellaneous effects $k_f = 1$

$$S_e = k_a k_b k_c k_d k_e k_f S'_e$$
$$= 29.0 \text{ Kpsi}$$

$$n_f = \frac{S_e}{K_f \sigma_{rev}} = 0.48 \longrightarrow \frac{no}{no \text{ infinite life.}}$$

Finite life