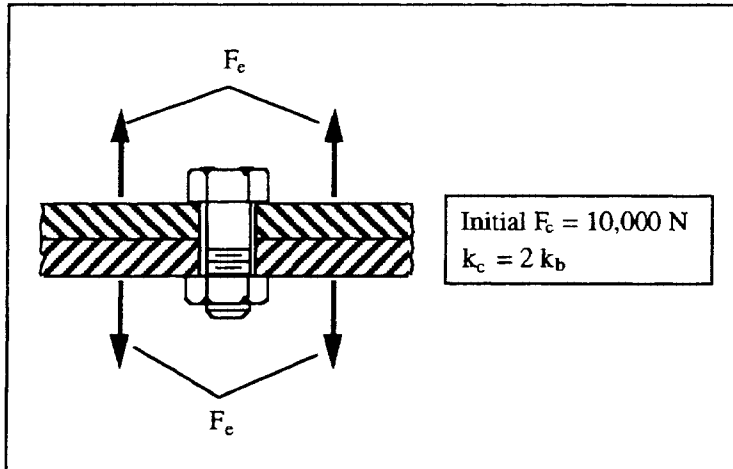

SOLUTION (10.23)

Known: Two parts of a machine are held together by bolts that are initially tightened to provide a total initial clamping force of 10,000 N. The elasticities are such that $k_c = 2k_b$.

Find:

- (a) Determine the external separating force that would cause the clamping force to be reduced to 1000 N.
- (b) If this separating force is repeatedly applied and removed, determine values of mean and alternating force acting on the bolts.

Schematic and Given Data:



Assumption: The stress on the bolt is within the elastic limit.

Analysis:

(a) From Eq. (10.13),

$$F_c = F_i - \left(\frac{k_c}{k_c + k_b} \right) F_e :$$

$$1000 = 10,000 - \left(\frac{2}{2+1} \right) F_e : 9000 = \frac{2}{3} F_e$$

Hence, $F_e = 13,500 \text{ N}$ ■

(b) Load off; $F_b = F_i = 10,000 \text{ N}$

Load on; $F_b = 10,000 + \frac{1}{3} (13,500) = 14,500 \text{ N}$

$$F_m = \frac{10,000 + 14,500}{2} = 12,250 \text{ N} \quad \blacksquare$$

$$F_a = \frac{14,500 - 10,000}{2} = 2250 \text{ N} \quad \blacksquare$$