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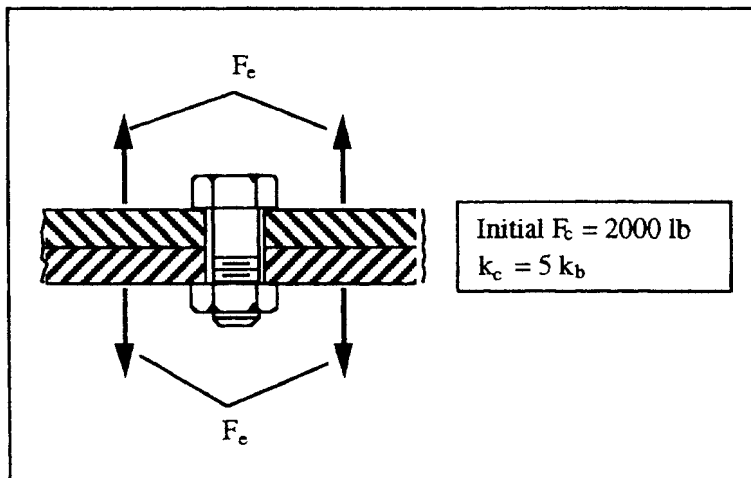
**SOLUTION (10.24)**

**Known:** Two parts of a machine are held together by bolts that are initially tightened to provide a total initial clamping force of 2000 lb. The elasticities are such that  $k_c = 5k_b$ .

**Find:**

- (a) Determine the external separating force that would cause the clamping force to be reduced to 500 lb.
- (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),

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

$$500 = 2000 - \left( \frac{5}{5 + 1} \right) F_e : 1500 = \frac{5}{6} F_e$$

Hence,  $F_e = 1800$  lb

(b) Load off;  $F_b = F_i = 2000$  lb

Load on;  $F_b = 2000 + \frac{1}{6} (1800) = 2300$  lb

$$F_m = \frac{2000 + 2300}{2} = 2150 \text{ lb}$$

$$F_a = \frac{2300 - 2000}{2} = 150 \text{ lb}$$