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 \) lb

\[ F_a = \frac{2300 - 2000}{2} = 150 \) lb