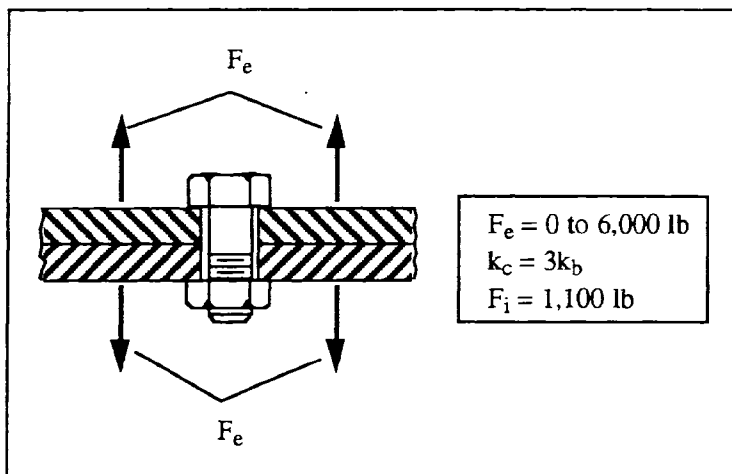

SOLUTION (10.20)

Known: In a given assembly, two parts are clamped together by a bolt. The ratio of the clamped member stiffness and the bolt stiffness is given. the initial bolt tension and the range of the fluctuating external load are also given.

Find: Draw a graph (plotting force vs. time) showing three or four external load fluctuations, and corresponding curves showing the fluctuations in total bolt load and total joint clamping force.

Schematic and Given Data:



Assumption: The bolt size and material are such that the bolt load remains within the elastic range.

Analysis:

1. Using Eq. (10.13) for $F_e = 6000 \text{ lb}$,

$$F_b = F_i + \left(\frac{k_b}{k_b + k_c} \right) F_e = 1100 + \frac{1}{1 + 3} (6000)$$

$$= 2600 \text{ lb}$$

$$F_c = F_i - \left(\frac{k_c}{k_c + k_b} \right) F_e = 1100 - \frac{3}{4} (6000)$$

$$= -3400 \text{ lb}$$

Since $-3400 < 0$, $F_c = 0$ and $F_b = 6000 \text{ lb}$

2. When $F_c = 0$, separation takes place: $1100 - \frac{3}{4} F_e = F_c = 0$ and thus
 $F_e = \frac{4}{3} (1100) = 1467 \text{ lb}$
3. For $F_e = 0 \text{ lb}$, $F_b = F_c = F_i$
- 4.

