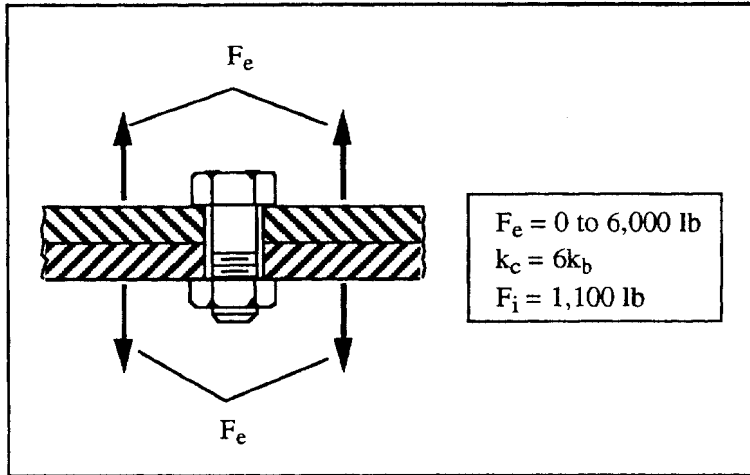


**SOLUTION (10.19)**

**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. The total bolt load when an external load is applied is, from Eq. (10.13),

$$F_b = F_i + \left( \frac{k_b}{k_b + k_c} \right) F_e = 1100 + \frac{1}{1 + 6} (6000)$$
$$= 1957 \text{ lb}$$

$$F_c = F_i - \left( \frac{k_c}{k_c + k_b} \right) F_e = 1100 - \frac{6}{7} (6000)$$

$$= -4043 \text{ lb, since } -4043 < 0, F_c = 0 \text{ lb and } F_b = 6000 \text{ lb}$$

2. When  $F_c = 0$ , separation takes place:  $1100 - \frac{6}{7} F_e = F_c = 0$  and thus

$$F_e = \frac{7}{6} (1100) = 1283 \text{ lb}$$

3. With no external load:  $F_b = F_c = F_i$

4.

