

Chapter 8, Problem 22

A cantilever spring is subjected to a concentrated load P varying continuously from 0 to P_o (Figure P8.22). What is the greatest allowable load P_o for $n = 4$?

Given: $S_y = 850 \text{ MPa}$, $S_e = 175 \text{ MPa}$, $b = 5 \text{ mm}$, $h = 10 \text{ mm}$, $K_f = 2$

Assumption: Failure occurs due to bending stress at the fillet.

Design Decision: Use the Soderberg criterion.

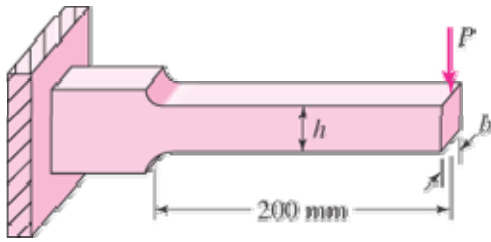


Figure P8.22

Chapter 8, Solution 22

$$P_m = P_a = \frac{P_0}{2}, \quad M_m = 0.2P_m = 0.1P_0, \quad P_a/P_m = 1 \quad \sigma_a/\sigma_m = 1$$

Eq.(8.20):
$$\sigma_m = \frac{850/4}{(1) \frac{85}{17.5} + 1} = 36.28 \text{ MPa}$$

Also
$$\sigma_m = \frac{6M_m}{bh^2} = \frac{6(0.1)P_0}{0.005 \times 100(10^{-6})} = 1.2(10^6)P_0$$

Thus

$$1.2P_0 = 36.28, \quad P_0 = 30.23 \text{ N}$$