Chapter 6, Problem 4

A two-member pin-connected structure supports a concentrated load *P* at joint *B* as shown in Figure P6.4. Calculate the largest load *P* that may be applied with a factor of safety *n*.

Given: $n = 2.5$, $E = 210$ GPa .
Assumption: Buckling occurs in the plane of the structure.

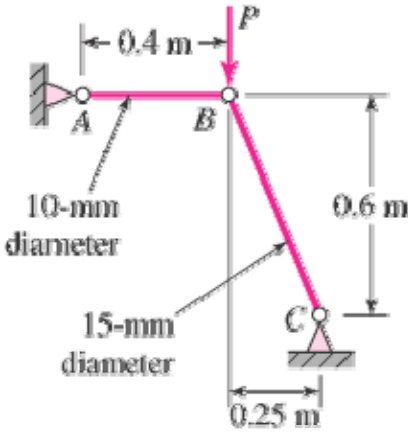
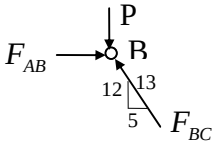


Figure P6.4

Chapter 6, Solution 4

$L_{BC} = 0.65\ m \qquad F_{AB} = \frac{5}{12}P, \qquad F_{BC} = \frac{13}{12}P$



Bar AB

$$(F_{AB})_{cr} = \frac{\pi^2 EI}{L_e^2} = \frac{\pi^2(210\times10^9)[\frac{\pi}{4}(5\times10^{-3})^4]}{(0.4)^2} = 6.359kN = \frac{5}{12}P_{cr}, \qquad P_{cr} = 15.26kN$$

Bar BC

$$(F_{BC})_{cr} = \frac{\pi^2(210\times10^9)[\frac{\pi}{4}(7.5\times10^{-3})^4]}{(0.65)^2} = 12.19kN = \frac{13}{12}P_{cr}, \qquad P_{cr} = 11.25kN$$

Choose the small value, $P_{cr} = 11.25$ with $n = 2.5$. Thus

$$P_{all} = \frac{P_{cr}}{n} = \frac{11.25}{2.5} = 4.5\ kN$$