Answer on Question #54206-Engineering-Mechanical Engineering

Two struts (strut-1 and strut-2) have the same length L and the same end support conditions. The modulus of elasticity E1 for strut-1 is twice the modulus of elasticity E2 for strut-2. The moment of inertia I2 for strut-2 is twice the moment of inertia I1 for strut-1. If P1 and P2 are the critical buckling loads for strut-1 and strut-2, respectively, how are P1 and P2 related?

Solution

The critical buckling load is directly proportional to moment of inertia and modulus of elasticity:

$$P \sim IE.$$

Thus,

$$\frac{P_2}{P_1} = \frac{I_2}{I_1}\frac{E_2}{E_1} = 2 \cdot \frac{1}{2} = 1.$$

So, the critical buckling loads for strut-1 and strut-2 are equal.