

Answer on Question #69066 - Physics / Other

A composite system consists of parallel rods XY and PQ, calculate the extension of the system if each rod has a length of in crosssectional areas of XY and PQ are 0.1cm^2 and 0.2 cm^2 respectively, the young moduli of XY and PQ are 1×10^{11} and $2\times 10^{11}\text{Nm}^{-2}$ respectively and the applied force is 10000N .

Solution:

Using the Hooke's law

$$F = k\Delta l$$

and expression for the coefficient k

$$k = \frac{E_1 A_1}{l} + \frac{E_2 A_2}{l}$$

we find the extension of the system

$$\begin{aligned} \frac{\Delta l}{l} &= \frac{F}{kl} = \frac{F}{\left(\frac{E_1 A_1}{l} + \frac{E_2 A_2}{l}\right)l} = \frac{F}{E_1 A_1 + E_2 A_2} \\ &= \frac{10000}{1\times 10^{11}\times 0.1\times 10^{-4} + 2\times 10^{11}\times 0.2\times 10^{-4}} = \frac{10000}{5\times 10^6} = 0.002\text{ m} = 2\text{ mm}. \end{aligned}$$

Answer: 2 mm.