A load of $10N$ extends a wire of the length $5m$ by $5mm$. The cross-sectional area of the wire is $2.5mm^2$. Calculate its young's modulus.

Solution.

$$S = 2.5mm^2 = 2.5 \cdot 10^{-6}m^2, l_0 = 5m, \Delta l = 5mm = 5 \cdot 10^{-3}m, F = 10N$$

$$E-?$$

Young's modulus, E, may be calculated by dividing the tensile stress by the tensile strain:

$$E = \frac{\sigma}{\varepsilon}.$$

$\sigma = \frac{F}{S}$ - the tensile stress;

$\varepsilon = \frac{\Delta l}{l_0}$ - the tensile strain.

$$E = \frac{Fl_0}{S\Delta l}.$$

$$E = \frac{10 \cdot 5}{2.5 \cdot 10^{-6} \cdot 5 \cdot 10^{-3}} = 4 \cdot 10^9 \left(\frac{N}{m^2}\right).$$

Answer: $E = 4 \cdot 10^9 \frac{N}{m^2}$.