# Modulus of elasticity:

For small deformation, i.e, elastic limit is not exceeded, stress in a body is directly proportional to the corresponding strain

$$\text{Modulus of elasticity} = \frac{\text{Stress}}{\text{Strain}}$$

Young's modulus: For materials whose length is much greater than the thickness or width, we are concerned with the longitudinal modulus of elasticity or Young's modulus.

$$\text{Young's modulus } (Y) = \frac{\text{longitudinal stress}}{\text{longitudinal strain}}$$

If a rod is stretched by equal and opposite forces, then Y is given by

$$Y = \frac{\text{Tensile stress}}{\text{Tensile strain}}$$

$$Y = \frac{F/A}{\Delta l/l} = \frac{Fl}{A\Delta l}$$

(see previous notes for problems etc.)

~~For compressive~~

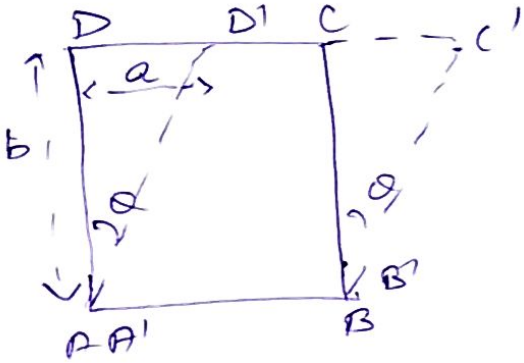
If rod is compressed,

$$Y = \frac{\text{Compressive stress}}{\text{Compressive strain}}$$

## Shear modulus / modulus of rigidity / Torsional modulus

Shear modulus is given by ratio of shearing stress ($F/A$) to the shearing strain ($\theta = \frac{a}{b}$).

$$\theta = \frac{a}{b}$$




$$\text{Shear modulus } (\eta) = \frac{\text{Shearing stress}}{\text{Shearing strain}} = \frac{F/A}{\theta}$$

$$\boxed{\eta = \frac{F/A}{a/b} = \frac{Fb}{Aa}}$$