FAQ's

1. What is Bulk modulus?

When a body is subjected to three mutually perpendicular stresses the ratio of direct stress to the volumetric strain is known as the bulk modulus.

The bulk modulus is given by: K = direct stress / volumetric strain

2. A tensile test was conducted in a mild steel bar. The following data were obtained from the test

a. Diameter of the steel bar=3cm

b. Gauge length of the bar=20cm

c. Extension at a load of 150kN is 0.21mm

Determine Young's Modulus

Solution:

Young's Modulus =stress/strain

Stress=load/area

$= 150/((\pi \times 30^2)/4)$

$= 150 \times 1000/706.858$

$=212.206\ N/mm^2$

Strain =change in length/original length

=0.21/200

=0.00105

Young's Modulus = 212.206/0.00105

$=2.02 \times 10^5\ N/mm^2$

3. When a metal tube of eternal diameter 25mm and internal diameter 20mm is subjected to an axial load of 30 kN, the extension on a gauge length of 75mm is 0.06mm. The decrease in the outer diameter is 0.006mm. Find the values of E, Poisson's ratio and change in volume if the length of the tube is 0.5m.

Area of cross section of the tube = $\Pi/4(25^2 - 20^2)$
$= 176.6\ mm^2$

Stress = Load/Area
$= (30 \times 1000)/(176.6 \times 10^{-6})$
$= 169.8\ MN/m^2$

Longitudinal Strain, e = dl/l
$= (0.06/75) = 0.0008$

Young's Moudulus = Stress/Strain
$= (169.8 \times 10^6)/ 0.0008$
$= 212.25\ GN/m^2$

Lateral Strain = $\delta D/D$
$= 0.006/25 = 0.00024$

Poisson's ratio = 1/m = Lateral strain/Longitudinal Strain
$= 0.00024/0.0008$
$= 0.3$

Volumetric Strain = e(1-2/m)
$= 0.0008(1-2 \times 0.3)$
$= 0.00032$
dV/V = 0.00032

Therefore, change in volume dV = 0.00032 x 176.6 x 500
$= 28.256\ mm^3$