

Answer on Question #52118-Engineering-Other

What is the change in volume of a circular bar 1m in length with a radius of 5cm loaded axially by a 50kN tensile load ($E = 206\text{GPa}$ and $\nu = 0.3$).

Solution

The strain is

$$e = \frac{F}{EA} = \frac{50\text{kN}}{\pi \cdot (0.05\text{ m})^2 \cdot 206\text{GPa}} = 0.0309.$$

The new length is

$$l' = (1 + e)l = (1 + 0.0309)1\text{ m} = 1.0309\text{ m}.$$

The new radius is

$$r' = r(1 - \nu e) = 0.05\text{ m}(1 - 0.0309 \cdot 0.3) = 0.0495365\text{ m}.$$

The change in volume of a circular bar is

$$V' - V = \pi(r'^2 l' - r^2 l) = 9.33 \cdot 10^{-5}\text{ m}^3.$$

Answer: $9.33 \cdot 10^{-5}\text{ m}^3$.