Solution

First, calculate the second moment of area about the neutral axis:

$$I_{NA} = \frac{bd^3}{12} \qquad \text{where } b = 50\,\text{mm and } d = 150\,\text{mm}$$

$$= \frac{50 \times 150^3}{12}\ \text{mm}^4$$

$$= \frac{50 \times 150^3}{12} \times 10^{-12}\ \text{m}^4$$

$$I_{NA} = 1.406 \times 10^{-5}\ \text{m}^4$$

$$y = 75\,\text{mm} = 75 \times 10^{-3}\ \text{m}$$

$$\frac{M}{I} = \frac{\sigma}{y}$$

$$\therefore \quad \sigma = \frac{My}{I}$$

$$\sigma = \frac{720 \times 75 \times 10^{-3}}{1.406 \times 10^{-5}}$$

$$= 3.84 \times 10^{6}\ \text{N m}^{-2}$$

$$\therefore \quad \text{maximum stress} = 3.84\ \text{MN m}^{-2}$$

Since both edges are equal distances from the neutral axis, then the bottom edge will have a tensile stress of 3.84 MN m^{-2} and the top edge will have a compressive stress of 3.84 MN m^{-2}. Hence, the stress in the beam varies uniformly across the section from 3.84 MN m^{-2} (compressive) at the top to 3.84 MN m^{-2} (tensile) at the bottom. This variation is often represented in the