ASM - MST 1

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2nd Question

Displacement field in a body is given by

$$u = [2y^2 i + 6yzj + (8 + 12x^2)k]10^{-2}$$

Using only linear terms, evaluate the rectangular strain components at the point P(1,0,2).

Solution

$$u_x = 2y^2 \cdot 10^{-2} \qquad u_y = 6yz \cdot 10^{-2} \qquad u_z = (8 + 12x^2) \cdot 10^{-2}$$

$$\frac{\partial u_x}{\partial x} = 0 \qquad \frac{\partial u_y}{\partial x} = 0 \qquad \frac{\partial u_z}{\partial x} = 24x \cdot 10^{-2}$$

$$\frac{\partial u_x}{\partial y} = 4y.10^{-2} \qquad \frac{\partial u_y}{\partial y} = 6z.10^{-2} \qquad \frac{\partial u_z}{\partial z} = 0$$

$$\frac{\partial u_x}{\partial z} = 0 \qquad \frac{\partial u_y}{\partial z} = 6y \cdot 10^{-2} \qquad \frac{\partial u_z}{\partial z} = 0$$

Strains at P(1,0,2)

$$\epsilon_{xx} = \frac{\partial u_x}{\partial x} = 0 \qquad \epsilon_{yy} = \frac{\partial u_y}{\partial y} = 12 \cdot 10^{-2} \qquad \epsilon_{zz} = \frac{\partial u_z}{\partial z} = 0$$

$$\gamma_{xy} = \frac{\partial u_x}{\partial y} + \frac{\partial u_y}{\partial x} = 0 + 0 = 0$$

$$\gamma_{yz} = \frac{\partial u_y}{\partial z} + \frac{\partial u_z}{\partial y} = 0 + 0 = 0$$

$$\gamma_{xz} = \frac{\partial u_x}{\partial z} + \frac{\partial u_z}{\partial x} = 0 + 24 \cdot 10^{-2} = 24 \cdot 10^{-2}$$