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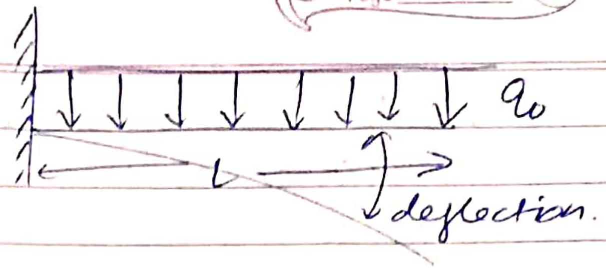

governing equation
for the deflection : $EI \frac{\partial^4 v}{\partial x^4} - q_0 = 0$

Boundary conditions - (i) $v(0) = 0$

(ii) $\left.\frac{\partial v}{\partial x}\right|_{x=0} = 0$

(iii) $\left.\frac{\partial^2 v}{\partial x^2}\right|_{x=L} = 0$

(iv) $\left.\frac{\partial^3 v}{\partial x^3}\right|_{x=L} = 0$

let the deflection be $\hat{v}(x)$, it is not the exact solution.

assume $\underset{\uparrow \text{ exact}}{v(x)} \simeq \hat{v}(x)$

we assume that deflection be a polynomial of degree four.

$$\hat{v}(x) = c_0 + c_1 x + c_2 x^2 + c_3 x^3 + c_4 x^4 \quad \text{— (1)}$$

Now by appling boundary cond^n we can find c_0, c_1, c_2, c_3, c_4.

$v(0) \simeq \hat{v}(0) = c_0 = 0$

$\therefore \; c_0 = 0$

$$\left.\frac{\partial v(x)}{\partial x}\right|_{x=0} \simeq \left.\frac{\partial \hat{v}}{\partial x}\right|_{x=0} = 0$$

$$\frac{\partial \hat{v}(x)}{\partial x} = c_1 + 2c_2x + 3c_3x^2 + 4c_4x^3$$

$$\left.\frac{\partial \hat{v}}{\partial x}\right|_{x=0} = c_1 = 0$$

$$\boxed{c_1 = 0}$$

$$\left.\frac{\partial^2 v}{\partial x^2}\right|_{x=L} \simeq \left.\frac{\partial^2 \hat{v}}{\partial x^2}\right|_{x=L} = 0$$

$$\left.\frac{\partial^2 \hat{v}}{\partial x^2}\right|_{x=L} = 2c_2 + 6c_3L + 12c_4L^2 = 0 \quad \text{--- (2)}$$

$$\left.\frac{\partial^3 \hat{v}}{\partial x^3}\right|_{x=L} = 6c_3 + 12c_4L = 0$$

$$c_3 = -4c_4L \quad \text{--- (3)}$$

put (3) in (2) we get,

$$\boxed{c_2 = 6c_4L^2}$$

putting all the coefficient value in eq (1) we get

$$\hat{v}(x) = 6C_4L^2x^2 - 4C_4Lx^3 + C_4x^4$$

$$\boxed{\hat{v}(x) = C_4x^2(6L^2 - 4Lx + x^2)} \quad \text{— (4)}$$

Now this must satisfy the governing eq^n. But as this is not the exact solution it must incur some residual error

$$EI\frac{\partial^4 \hat{v}(x)}{\partial x^4} - q_0 = R_e$$

Residual error

$$EI(C_4) - q_0 = R_e$$

We want our solution close to exact sol^n in order to that $R_e \to 0$

here R_e can be absolute '0'

$$\therefore \quad EI(C_4) - q_0 = 0$$

$$C_4 = \frac{q_0}{EI} \quad \text{— (5)}$$

putting this in eq (4)

we get

$$\boxed{\hat{v}(x) = \frac{q_0}{EI}x^2(6L^2 - 4Lx + x^2) = v(x)}$$