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15/Eng02/030

Assignment 2

(1) $\frac{d^2y}{dt^2} + 4\frac{dy}{d\theta} + 5y = 6\sin\theta$

$m^2 + 4m + 5 = 0$

$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $\quad m = \frac{-4 \pm \sqrt{4^2 - (4 \times 1 \times 5)}}{2 \times 1}$

$m = \frac{-4 \pm \sqrt{16 - 20}}{2} = \frac{-4 \pm \sqrt{-4}}{2}$

$m = \frac{-4 \pm \sqrt{4} \cdot \sqrt{1}}{2}$

$m = -4/2 \pm 2j/2$

$m = -2 \pm j$

$y = e^{-2\theta}[C\cos\theta + D\sin\theta]$

PI =>

$y = A\cos\theta + B\sin\theta$

$dy/d\theta = -A\sin\theta + B\cos\theta$

$d^2y/d\theta^2 = -A\cos\theta - B\sin\theta$

$\therefore [A\cos\theta - B\sin\theta] + 4[-A\sin\theta + B\cos\theta] + 5[A\cos\theta + B\sin\theta] = 6\sin\theta$

$-A\cos\theta - B\sin\theta - 4A\sin\theta - 4B\cos\theta + 5A\cos\theta + 5A\sin\theta = 6\sin\theta$

$-A\cos\theta + 4B\sin\theta + 5A\cos\theta - B\sin\theta - 4A\sin\theta + 5B\sin\theta = 6\sin\theta$

Comparing Coefficient.

$-A + 4B + 5A + 5A = 0$

$4A + 4B = 0$ --- eqn (1)

$-B - 4A + 5B = 6$

$-4A + 4B = 6$ --- eqn (2)

adding eqn (1) & eqn (2)

$C = 6$

$B = 3/4$

$2A + 4(3/4) = 0$

$4A = -3 \quad A = -3/4$

$y = -3/4\cos\theta + 3/4\sin\theta \quad --- PI$

$y = e^{2x}(C\cos\theta + D\sin\theta) - 3/4\cos\theta + 3/4\sin\theta$

when $\theta = 0$ & $dy/d\theta = 0$

$\frac{dy}{d\theta} = e^{2\theta}[(\sin\theta D\cos\theta] + [(\cos\theta + D\sin\theta]$

$-2e^{2\theta} + 3/4\sin\theta + 3/4\cos\theta$

when $\theta = x$ & $dy/dx = 0$

$0 = 3/4\sin\theta + 3/4\cos\theta$

$-3/4\cos\theta = 3/4\sin\theta$

$-\cos\theta = \sin\theta$

divide both sides by $-\cos\theta$

$\frac{-\cos\theta}{-\cos\theta} = \frac{\sin\theta}{-\cos\theta}$

$\frac{-\sin\theta}{-\cos\theta} = 1$

$-\tan\theta = 1$

$\tan\theta = -1$

$\theta = \tan^{-1}(-1)$

$\theta = 45°$

(2) $EI\frac{d^2y}{dx^2} = w/2(l-x)^2$

solution

$EIm^2 = 0$

$m^2 = 0$

$m = \pm\sqrt{0}$

$m = 0$

$y = e^{0x}(A + Bx)$

$y = A + Bx \quad --- (I)$

$y = Px^2 + Qx^3 + Rx^4$

$d^3y/dx = 2Px + 3Qx^2 + 4Rx^3$

$d^2y/dx^2 = 2P + 6Qx + 12Rx^2$

$EI(2P + 6Qx + 12Rx^2) = w/2(l-x)^2$

$2PEI + 6QEIx + 12REIx^2 = w/2(l^2 - 2lx + x^2)$

$4PEI + 12QEIx + 24REIx^2 = w(l^2 - 2lx + x^2)$

$24REI = w$

$R = \frac{w}{24EI} \quad --- (1)$

$12QEI = -2wl$

$Q = \frac{-2wl}{12EI} = \frac{-wl}{6EI} \quad --- (2)$

$4PEI = wl^2$

$P = \frac{wl^2}{4EI}$

$y = \left[\frac{wl^2}{4EI}\right]x^2 - \left[\frac{wl}{6EI}\right]x^3 + \left[\frac{w}{24EI}\right]x^4$

$= \frac{wl^2x^2}{4EI} - \frac{wlx^3}{6EI} + \frac{wx^4}{24EI}$

$= \frac{6wl^2x^2 - 4wlx^3 + wx^4}{24EI}$

$= \frac{w}{24EI}\left[6l^2x^2 - 4lx^3 + x^4\right] - PI$

$y = A + Bx + \frac{w}{24EI}\left[6l^2x^2 - 4lx^3 + x^4\right]$

at $y = 0, \ x = 0 \ \frac{dy}{dx} = 0$

$0 = A + B(0) + \frac{w}{24EI}\left[6l^2(0) - 4l(0) + 0\right]$

$A = 0$

$$\frac{dy}{dx} = \frac{B + w}{24EI}\left[6L^2(0) - 4L(0) + 0\right]$$

$$0 = \frac{B + w}{24EI}\left[12(0) - 12(0) + 4(0)\right]$$

$$B = 0$$

Particular equation

$$y = \frac{w}{24EI}\left[6L^2x^2 - 4Lx^3 + x^4\right]$$

$$y = \frac{wx^2}{24EI}\left[6L^2 - 4Lx + x^2\right]$$

$$y = \frac{wx^2}{24EI}\left[x^2 - 4Lx + 6L^2\right]$$

When $x = L$

$$y = \frac{wL^2}{24EI}\left[L^2 - 4L^2 + 6L^2\right]$$

$$y = \frac{wL^4}{8EI} //$$