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15/ENG04/051
ELECT ELECT
ENG 381

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

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

$\frac{-4 \pm \sqrt{(4)^2 - 4\times1\times5}}{2\times1} = \frac{-4\pm\sqrt{4}}{2} = -2 \pm j$

$m_1 = -2 + j$

$m_2 = -2 - j$

CF: $y = e^{-2\theta}(C\cos\theta + D\sin\theta)$

PI: $y = C\cos\theta + D\sin\theta$

$\frac{dy}{d\theta} = -C\sin\theta + D\cos\theta$

$\frac{d^2y}{d\theta} = -C\cos\theta - D\sin\theta$

$-C\cos\theta - D\sin\theta - 4(C\sin\theta + D\cos\theta) + 5(C\cos\theta + D\sin\theta) = 6\sin\theta$

$-C\cos\theta - 4D\cos\theta + 5C\cos\theta - D\sin\theta - 4C\sin\theta + 5D\sin\theta = 6\sin\theta$

$\cos\theta(4C - 4D) - \sin\theta(4C + 4D) = 6\sin\theta$

Comparing coefficients

$4C - 4D = 0$ — 1

$4C + 4D = 6$ — 2

$4C = 4D$

$C = D$

Sub value of C in eqn 2

$4D + 4D = 6$

$8D = 6$

$D = 6/8 = 3/4$

$\therefore C = 3/4$

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

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

(ii) at $\theta = \infty$ and $dy/d\theta = 0$

$\frac{dy}{d\theta} = e^{-2\theta}[-C\cos\theta + D\cos\theta] + [C\cos\theta + D\sin\theta] - 2e^{-2\theta} + 3/4\sin\theta + 3/4\cos\theta$

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

$$-\tfrac{3}{4}\cos\theta = \tfrac{3}{4}\sin\theta$$

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

divide both sides by $-\cos\theta$

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

$$-\tan\theta = 1$$

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

$$\theta = -45^{0}$$

2. $$EI\frac{d^2y}{dx^2} = \frac{\omega}{2}(L-x)^2$$

$$EI\_\ m^2 = 0$$

$$m = \pm\sqrt{0}$$

$$m = \pm 0$$

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

$$y = A + Bx \text{ --- } CF$$

To obtain Percular integral

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

$$\frac{dy}{dx} = 2Px + 3Qx^2 + 4Rx^3$$

$$\frac{d^2y}{dx^2} = 2P + 6Qx + 12Rx^2$$

$$EI(2P + 6Qx + 12Rx^2] = \omega/2\,(L-x)^2$$

$$2PEI + 6QEIx + 12REIx^2 = \omega/2\,(L^2 - 2Lx + x^2)$$

$$24REI = \omega$$

$$R = \frac{\omega}{24EI} \text{ --- } (1)$$

$$12QEI = -2\omega L$$

$$Q = \frac{-2\omega L}{12EI} = \frac{-\omega L}{6EI} \text{ --- } (2)$$

$$4PEI = \omega L^2$$

$$P = \frac{\omega L^2}{4EI}$$

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

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

G.S

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

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

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

$$\frac{dy}{dx} = B + \frac{w}{24EI}\left[12L^2x - 12Lx^2 + 4x^3\right]$$

$$0 = B + \frac{w}{24EI}\left[12L^2x - 12Lx^2 + 4x^3\right]$$

$$B = 0$$

Particular solution

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

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

when $x = L$

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

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

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