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15/ENG03/020
CIVIL ENGINEERING
ENG 381

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

Let $6\sin\theta = 0$

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

$a = 1 \quad b = 4 \quad c = 5$

$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-4 \pm \sqrt{4^2 - 4 \times 1 \times 5}}{2 \times 1}$

$= \frac{-4 \pm \sqrt{-4}}{2}$

$= \frac{-4 \pm j\sqrt{4}}{2}$

$= \frac{-4 \pm j2}{2}$

$m = -2 \pm j$

$m = \alpha \pm j\beta$

$C.F : y = e^{-2x}(A\cos\theta + B\sin\theta)$

$f(x) = 6\sin\theta$

$P.I : y = C\cos\theta + D\sin\theta$

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

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

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

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

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

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

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

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

$4C + 4D = 0$ -- (i)

$-4C + 4D = 6$ -- (ii)

$8D = 6$

$D = \frac{3}{4}$

From eqn (i)

$4C + 4\left(\frac{3}{4}\right) = 0$

$4C + 3 = 0$

$4C = -3$

$C = \frac{-3}{4}$

P.I : $y = -\frac{3}{4}\cos\theta + \frac{3}{4}\sin\theta$

G.S = C.F + P.I

$y = e^{-2x}(A\cos\theta + B\sin\theta) - \frac{3}{4}\cos\theta + \frac{3}{4}\sin\theta$

Steady State Equation

$y' = +3/4\sin\theta + \frac{3}{4}\cos\theta = 0$

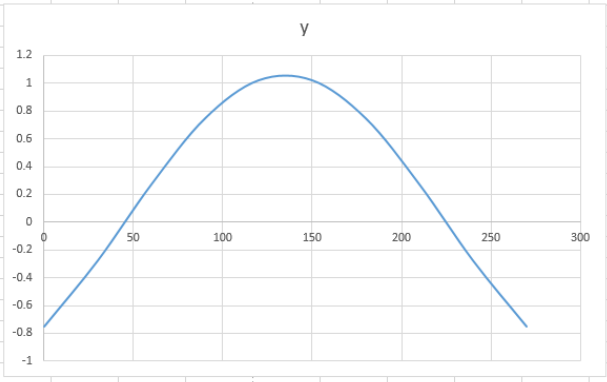
$\frac{3/4\sin\theta}{3/4\cos\theta} = \frac{-3/4\cos\theta}{3/4\cos\theta}$

$\tan\theta = -1$

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

$\theta = -45^\circ$

	A	B
1	e	y
2	0	-0.75
3	30	-0.27452
4	60	0.274519
5	90	0.75
6	120	1.024519
7	150	1.024519
8	180	0.75
9	210	0.274519
10	240	-0.27452
11	270	-0.75



Sheet1

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

$EI\,m^2 = 0$

$m^2 = 0$

$m = \pm\sqrt{0}$

$m = \pm 0$

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

$C.F = y = A + Bx$

$P.I = y = fx^2 + Gx^3 + Hx^4$

$\frac{dy}{dx} = 2Fx + 3Gx^2 + 4Hx^3$

$\frac{d^2y}{dx^2} = 2F + 6Gx + 12Hx^2$

$EI\left[2F + 6Gx + 12Hx^2\right] = \frac{w}{2}(l-x)^2$

$2FEI + 6GxEI + 12HEIx^2 = \frac{w}{2}(l-x)^2$

$4FEI + 12GxEI + 24HEIx^2 = w(l^2 - 2lx + x^2)$

$24HEI = w$

$H = \frac{w}{24EI}$ ... (1)

$12GEI = -2wl$

$G = \frac{-2wl}{12EI} = -\frac{wl}{6EI}$ ... (2)

$4FEI = wl^2$

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

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

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

$$y = \frac{6wL^2x^2 - 4wLx^3 + wx^4}{24EI}$$

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

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

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

$A = 0$

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

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

$B = 0$

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

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

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

When $x = L$

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

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

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