SANI JOHNPAUL AKOJI
15/ENG04/055
EEE/EEE
ENG 381

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

Convert into a homogenous equation.

$\frac{d^2y}{d\theta^2} + 4\frac{dy}{d\theta} + 5y = 0$

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

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

$m = \frac{-4 \pm \sqrt{4^2 - 4\times1\times5}}{2\times1} \Rightarrow m = \frac{-4 \pm \sqrt{-4}}{2}$

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

$m = -2 \pm j$

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

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

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

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

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

$-C + 4D + 5C = 0$

$-D + 4C + 5D = 6$

$+\quad 4C + 4D = 0 \quad —— (1)$

$\quad -4C + 4D = 6 \quad —— (2)$

$8D = 6$

$D = 6/8 = 3/4$

Substitute $D = 3/4$ in eqn (2)

$-4C + 4(3/4) = 6$

$-4C + 3 = 6$

$-4C = 3$

$C = -3/4$

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

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

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

at steady state.

$\frac{dy}{d\theta} = 0$ and $\theta = \alpha$

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

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

$dy/dt = e^{-2\alpha}(B\cos\alpha - A\sin\alpha) - 2e^{-2\alpha}(A\cos\alpha + B\sin\alpha) + 3/4(\sin\alpha - \cos\alpha)$

$dy/d\theta = 3/4(\sin\alpha - \cos\alpha)$

$dy/d\theta = 3/4(\sin\theta - \cos\theta)$

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

$EI\frac{d^2y}{dx^2} = 0$

$EIm^2 = 0$

$m^2 = 0 \Rightarrow m = \pm\sqrt{0} = 0$

$m_1 = m_2 = 0$

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

Cf : $y = A + Bx$

$y = Rx^2 + Sx^3 + Tx^4$

$\frac{dy}{dx} = 2Rx + 3Sx^2 + 4Tx^3$

$\frac{d^2y}{dx^2} = 2R + 6Sx + 12Tx^2$

$EI[2R + 6Sx + 12Tx^2] = w/2(L-x)^2$

$2REI + 6SxEI + 12Tx^2EI = w/2[L^2 - 2Lx + x^2]$

$4REI + 12SxEI + 24Tx^2EI = wL^2 - 2wLx + wx^2$

$24TEI = w$

$T = \frac{w}{24EI}$

$R\, S EI = -2wL$

$S = \frac{-2wL}{24EI}$

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

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

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

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

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

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

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

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

$B = 0$

when $A = B = 0$

$$y = 0 + 0x + \frac{w}{24EI}\left[6L^2x^2 - 4Lx^3 + x^4\right]$$

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

when $x = L$

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

$$y = \frac{w}{24EI}\left[3L^4\right]$$

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

graph1 Sheet1