ENOCH AKPOKPODION E
15/ENG02/003
ENG 381 ASSIGNMENT 2
COMPUTER ENGINEERING

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

converting equ ① into homogenous equation

$\frac{\delta^2 y}{\delta \theta^2} + 4\frac{\delta y}{\delta x} + 5y = 0$

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

where $a = 1, b = 4$ & $c = 5$

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

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

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

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

$\frac{\delta y}{\delta x} = -C\sin\theta + D\cos\theta$

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

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

$-C + 4D + 5C = 0$ ——— ①

$-D + 4C + 5D = 6$ ——— ②

$8D = 6$

$D = \frac{6}{8} = \frac{3}{4}$

sub $D = \frac{3}{4}$ in equ ②

$4 \times \frac{3}{4} - 4C = 6$

$4C = 3 - 6$

$4C = -3$

$c = -3/4$

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

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

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

at steady state when $\frac{\delta y}{\delta\theta} = 0$ & $\theta = \alpha$

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

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

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

$\frac{\delta y}{\delta\theta} = 3/4(\sin\alpha - \cos\alpha)$

$\frac{\delta y}{\delta\theta} = 3/4(\sin\theta - \cos\theta)$

2) $EI\frac{dy}{dx} = \frac{W}{2}(L-x)^2$

$EI\frac{\delta^2 y}{\delta x^2} = 0$

$EI\frac{\delta^2 y}{\delta x^2} = 0$

$EI\,m^2 = 0$

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

$m_1 = m_2 = 0$

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

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

$\frac{\delta y}{\delta x} = 2Rx + 3Sx^2 + 4Tx^3$

$\frac{\delta^2 y}{\delta x^2} = 2R + 6Sx + 12Tx^2$

$EI(2R + 6Sx + 12Tx^2) = W(L-x)^2$

multiply through by 2

$$4REI + 12Sx\,EI + 24Tx^2\,EI = WL^2 - 2WLx + Wx^2$$

$$24TEI = W$$

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

$$y = \frac{WL^2x^2}{4EI} - \frac{WLx^2}{6EI} + \frac{Wx^4}{24EI}$$

$$y = \frac{6WL^2x^2 - 4WLx^3 + Wx^4}{24EI}$$

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

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

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

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

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

$$B = 0$$

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 $x = L$

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

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

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