15/ENG08/025

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15/ENG03/025

ENG 381

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

CF: RHS = 0

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

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

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

$m = 2 \pm j$

$m = \alpha \pm j$

$\alpha = 2, j = 1$

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

y = P.I

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

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

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

substituting

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

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

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

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

$4C + 4D = 0$

$-4C + 4D = 6$

$8D = 6$

$D = 6/8 = 3/4$

substitute $D = 3/4$ in eqn ①

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

$-4C + 3 = 6$

$-4c = 3$

$c = 3/4$

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

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

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

At steady state

$\frac{dy}{d\theta} = 0$ and $\theta = 2$

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

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

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

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

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

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

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

$EI m^2 = 0$

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

$m_1 = m_2 = 0.$

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

CF: $y = A + Bx$

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

$\frac{dy}{dx} = 2Rx + 15x^2 + 4Tx^3$

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

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$EI(2R + 6Sx + 12Tx^2) = \frac{w}{2}(l-x)^2$

$2REI + 6SxEI + 12Tx^2EI = \frac{w}{2}[l^2 - 2lx + x^2]$

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

$24TEI = 0$

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

$12SEI = 2wL$

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

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

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

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

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

$y = A + Bx + \frac{w}{24EI}(6l^2x^2 - 4lx^3 + x^4)$

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

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

$B = 0$

when $A = B = 0$

$y = 0 + 0x + \frac{wl}{24EI}[6l^2x^2 - 4lx^3 + x^4]$

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

when $x = l$

$y = \frac{w}{24EI}(6l^4 - 4l^4 + l^4]$, $y = \frac{w}{24EI}[3l^4]$

$\therefore y = \frac{wl^4}{8EI}$

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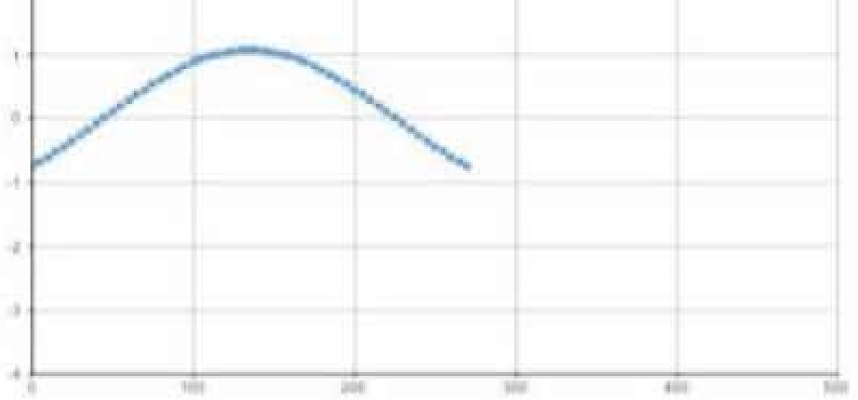
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