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Mechanical Eng
15/Eh/aob/C/4
ENG 381

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

convert to homogenous equation

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

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

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

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

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

$m = -2 \pm j$

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

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

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

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

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

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

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

$4C + 4D = 0 \quad \cdots (i)$

$-4C + 4D = 6 \quad \cdots (ii)$

$8D = 6$

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

sub D in eqn (2)

$-4C + 4(\frac{3}{4}) = 6$

$-4C + 3 = 6$

$= 4B = 3$

$B = -3/4$

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

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

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

on steady state

$dy/d\theta = 0$ and $\theta = \infty$

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

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

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

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

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

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

$EIm^2 = 0$

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

$m_1 = m_2 = 0$

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

CF $y = A + Bx$

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

$dy/dx = 2Rx + 3Sx^2 + 4Tx^3$

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

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

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

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

$$24TEI = w$$
$$T = \frac{w}{24EI}$$
$$12SEI = -2wl$$
$$S = \frac{-2wl}{24EI}$$
$$y = \left[\frac{wl^2}{-4EI}\right]x^2 - \left[\frac{wl}{6EI}\right]x^3 + \left[\frac{w}{24EI}\right]x^4$$
$$y = \frac{wl^2x^2}{4EI} - \frac{wlx^3}{6EI} + \frac{wx^4}{24EI}$$
$$y = \frac{6wl^2x^2 - 4wlx^3 + wx^4}{24EI}$$
$$y = \frac{6wl^2x^2 - 4wlx^3 + wx^4}{24EI}$$

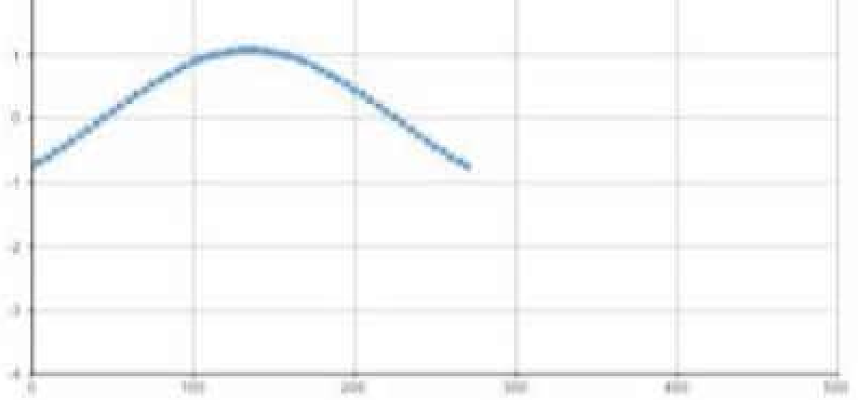
P1: $y = w/_{24EI}\left[6l^2x^2 - 4lx^3 + x^4\right]$

$$y = A + Bx + w/_{24EI}\left[6l^2x^2 - 4lx^3 + x^4\right]$$

at $x = 0$, $y = 0$, $dy/dx = 0$
$$0 = A + B(0) + w/_{24EI}\left[12l^2x - 12lx^2 + 4x^3\right]$$
$$0 = B + \frac{w}{24EI}\left[12l^2(0) - 12l(0)^2 + 4(0)^3\right]$$
$$B = 0$$
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 $x = L$
$$y = \frac{w}{24EI}\left[6l^4 - 4l^4 + l^4\right]$$

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

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


1
0
-1
-2
-3
-4
0
100
200
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