NWOGU AMARACHUKWU SARAH
15/ENG01/009
CHEMICAL ENGINEERING
ENG 381

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

Let $6\sin\theta = 0$

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

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

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

$= \frac{-4 + \sqrt{4^2 - 4(1)(5)}}{2(1)} = \frac{-4 \pm \sqrt{-4}}{2} = \frac{-4 \pm j2}{2}$

$m = -2 \pm j$

$m = \alpha \pm j\beta$

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

$f(x) = 6\sin\theta$, $P.I = y = C\cos\theta + D\sin\theta$

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

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

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

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

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

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

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

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

$4C + 4D = 0 \quad \cdots (1)$

$-4C+4D=6$ ... (II)

$8D=6$

$D=3/4$

from eqn (1)

$4C+A(3/4)=0$

$4C+3=0$; $C=-3/4$

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

$G.S=C.F+P.I$

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

steady state eqn

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

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

$\tan\theta=-1$; $\theta=\tan^{-1}(-1)$; $\theta=-45°$

2) $EI\,d^2y/dx^2=w/2(1-x)^2$

$EI\,m^2=0$

$m^2=0$

$m=\pm\sqrt{0}$; $m=\pm 0$

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

$C.F=y=A+Bx$

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

$dy/dx=2fx+3Gx^2+4Hx^3$

$d^2y/dx^2=2f+6Gx+12Hx^2$

$EI(2F + 6Gx + 12Hx^2) = w/2\ (l-x)^2$

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

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

$24HEI = w$

$H = \frac{w}{24EI}$ Comparing both equations

$12GEI = -2wl$

$G = \frac{-2wl}{12EI} = \frac{-w}{6EI}$

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

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

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

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

G.S $= y = A + Bx + \frac{w}{24EI}[6l^2x^2 - 4lx^2 + x^4]$

at $y = 0$; $x = 0$ $= dy/dx = 0$

$0 = A + B(0) + \frac{w}{24EI}[6l^2(0)^2 - 4l(0)^3 + 0^4]$

$A = 0$

$dy/dx = B + \frac{w}{24EI}[12x^2l^2 - 12xl + 4x^3]$

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

$B = 0$

$y = fx^2 + Gx^3 + Hx^4$

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

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

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

when $x = l$

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

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

$$y = \frac{3wl^4}{24EI}$$

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