ANDREWS DORCAS IGHI.
17/ENG01/033.
ENG 381

1) $m^2 + 5m + 6 = 0$

$m^2 + 3m + 2m + 6 = 0$

$m(m+3) + 2(m+3) = 0$

$(m+2)(m+3) = 0$

$m = -2, \quad m = -3.$

P.I: $x = C\cos t + D\sin t$

C.f: $x = Ae^{-2t} + Be^{-3t}$

$x = C\cos t + D\sin t.$

$\dfrac{dx}{dt} = -C\sin t + D\cos t.$

$\dfrac{d^2x}{dt^2} = -C\cos t - D\sin t.$

$-C\cos t + D\sin t - 5C\sin t + 5D\cos t + 6(C\cos t + D\sin t) = \cos t.$

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

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

$\cos t(-C + 5D + 6C) + \sin t(-D - 5 + 6D) = \cos t.$

$\cos t(5D + 5C) + \sin t(-5C + 5D) = \cos t.$

$$5D + 5C = 1$$

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

$$5D = 5C$$

$$5D + 5C = 1$$

$$5D + 5(D) = 1$$

$$10D = 1$$

$$D = \frac{1}{10}$$

$$\therefore C = \frac{1}{10}$$

P.I - Partial integral

$$x = \frac{1}{10}\cos t + \frac{1}{10}\sin t$$

General solution = C.F + P.I.

$$x = Ae^{-2t} + B.e^{-3t} + \frac{1}{10}\cos t + \frac{1}{10}\sin t$$

$$\frac{dx}{dt} = -2Ae^{-2t} - 3Be^{-3t} - \frac{\sin t}{10} + \frac{\cos t}{10}$$

when $x = 0.1$

$$\frac{dx}{dt} = 0 \quad \text{\&} \quad t = 0.$$

$$0.1 = Ae^{-2(0)} + B.e^{-3(0)} + \frac{1}{10}\cos(0) + \frac{1}{10}\sin(0)$$

$$0.1 = A + B + \frac{1}{10} + 0$$

$$0.1 = -\frac{1}{10} = A + B$$

$$0.1 - 0.1 = A + B.$$

$$0 = A + B \quad ---- \quad (3).$$

$$A = -B.$$

Also,

$$0 = -2Ae^{-2(0)} - 3Be^{-3(0)} - \frac{\sin(0)}{10} + \frac{\cos(0)}{10}$$

$$0 = 2A - 3B + \frac{1}{10}$$

$$-\frac{1}{10} = -2A - 3B \quad ---- \quad (4)$$

Solving equations (3) & 4 simultaneously.

$$A + B = 0.$$

$$-2A - 3B = -\frac{1}{10}$$

$$A = -B$$

$$-2(-B) - 3B = -\frac{1}{10}$$

$$2B - 3B = -\frac{1}{10}$$

$$-B = -\tfrac{1}{10} \quad ; \quad B = \tfrac{1}{10}$$

$$\lambda = -B$$

$$A = -\left(\tfrac{1}{10}\right)$$

$$A = -\tfrac{1}{10}.$$

$$x = -\tfrac{1}{10} e^{-2t} + \tfrac{1}{10} e^{-3t} + \tfrac{1}{10} \cos t + \tfrac{1}{10} \sin t.$$

③ from the graph plotted on matlab,

Amplitude, $k = 0.14$.

$$A \sin (\omega t + \phi)$$

Period, $T = 8.55 - 2.40 = 6.15$

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{6.15}$$

$$= 1 \text{ rod/s} \quad \text{or} \quad \pi/3 \text{ rad}.$$

$a = $ the value of t for which $\sin t = \cos t$

$$a = 45° \quad \text{or} \quad \frac{\pi}{4} \text{ rad}.$$

Comparing with $K \sin (t + a)$

The steady state solution is given as

$$0.4 \sin (t + 45°).$$

or

$$\frac{\sqrt{2}}{10} \sin \left(t + \pi/4\right)$$