

$$\frac{d^2x}{dt^2} + 5\frac{dx}{dt} + 6x = \cos(t)$$

Given that  $t=0, x = 0.1, \frac{dx}{dt} = 0$ .

$$C.F = m^2 + 5m + 6 = 0$$

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

$$m_1 = -3, m_2 = -2$$

$$x = Ae^{-3t} + Be^{-2t}$$

$$f(t) = \cos t$$

P.I.

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

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

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

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

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

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

$$= 5D + 5C = 1$$

$$\rightarrow 5D - 5C = 0$$

$$10D = 1$$

$$D = 1/10$$

to find C.

$$5C(1/10) + 5C = 1$$

$$1/2 + 5C = 1$$

$$C = 1/10$$

$$\therefore \cos x = Ae^{-3t} + Be^{-2t} + 1/10 \cos t + 1/10 \sin t$$

Subst: ( $x = 0.1$ ),  $t = 0$ .

$$0.1 = Ae^{-0} + Be^{-0} + 1/10 \cos 0 + 1/10 \sin 0$$

$$0.1 = A + B + 0.1$$

$$A + B = 0 \quad \text{--- (i)}$$

$$\frac{dx}{dt} = -3Ae^{-3t} - 2Be^{-2t} - 1/10 \sin t + 1/10 \cos t$$

$$0 = -3A + 2B + 1/10$$

$$3A + 2B = 1/10 \quad \text{--- (ii)}$$

$$A + B = 0 \quad \times 2$$

$$3A + 2B = 0.1 \quad \times 1$$

$$2A + 2B = 0$$

$$3A + 2B = 0.1$$

$$-A = -0.1$$

$$A = 0.1$$

To get B

$$0.1 + B = 0$$

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

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

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

$$= \frac{1}{10} (e^{-2t} - e^{-3t} + \cos t + \sin t)$$

MATLAB mfile

\* Command window

\* clear

\* clc

\* close all

\* hzms t

\* t = 0:0.01:15

\* x = 0.1 \* [exp(-2\*t) - exp(-3\*t) + cos(t) + sin(t)]

\* Xm = subs(x)

\* plot(t, Xm)

\* axis tight

\* Grid on

\* Grid minor