

11) MatLab

Command Window

Clear

clc

close all

t = 0:0.01:15

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

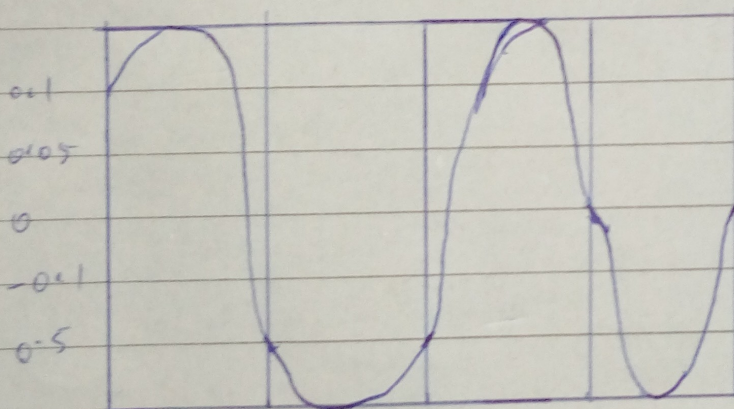
xn = subs(x)

plot(t, xn)

axis tight

grid on

grid minor



$$x = k \sin(t, \theta)$$

knowing that $x = 0.1$, at $t = 0$ and $\frac{dx}{dt} = 0$.

$$\frac{dx}{dt} = k \cos(t + \theta)$$

$$0 = k \cos(\theta + \theta)$$

$$\therefore k \cos(\theta) = 0$$

$$0.1 = k \sin(\theta + \theta)$$

$$k \sin(\theta) = 0.1 \quad \dots \dots (1)$$

$$\cos \theta = 0$$

$$\therefore \theta = \cos^{-1} 0$$

$$\theta = 90^\circ$$

substituting θ into (1)

$$0.1 = 15 \sin(90)$$

$$\therefore 15 = \frac{0.1}{\sin 90} = 0.1$$

$$\therefore x = 0.1 [\sin(t + 90)]$$

Command window

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Syms t, x

t = [0:0.1:15]

x = 0.1 * (sin(t + 90))

plot(t, x)

$$1) \frac{dx^2}{dt^2} + 5 \frac{dx}{dt} + 6x = \cos t$$

$$\text{Assuming } \frac{d^2x}{dt^2} + 5 \frac{dx}{dt} + 6x = 0$$

$$\therefore \frac{d^2x}{dt^2} + 5 \frac{dx}{dt} + 6x = k^2 + 5k + 6 = 0$$

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

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

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

$$k+3=0 \quad k+2=0$$

$$k_1 = -3, -2$$

$$\therefore \text{C.F.} = A e^{-3x} + B e^{-2x}$$

$$\text{P.I.} \Rightarrow f(x) = \cos t$$

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

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

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

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

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

$$5D + 5C = 1 \quad \dots \dots \dots (1)$$

$$5D - 5C = 0 \quad \dots \dots \dots (2)$$

Solving Simultaneously $10D = 1$

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

Substituting $D = \frac{1}{10}$ into (1)

$$5\left(\frac{1}{10}\right) + 5C = 1 \Rightarrow \frac{1}{2} + 5C = 1$$

$$5C = 1 - \frac{1}{2} \Rightarrow 5C = \frac{1}{2}$$

$$\therefore \text{P.I.} = C = \frac{1}{10}$$

$$\therefore \text{P.I.} = x \Rightarrow \frac{1}{10} \cos t + \frac{1}{10} \sin t$$

Therefore $G.S = P.I + C.F$
 $= Ae^{-3x} + Be^{-2x} + \frac{1}{10} \sin t + \frac{1}{10} \cos t$
 $= Ae^{-3x} + Be^{-2x} + \frac{1}{10} (\sin t + \cos t)$

When $t=0$, $x=0.1$ and $\frac{dx}{dt} = 0$

Substituting these values into equation

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

$$0.1 = A + B + 0.1$$

$$A + B = 0.1 - 0.1$$

$$A + B = 0 \quad \dots \dots \dots (1)$$

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

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

$$3A + 2B = \frac{1}{10} \quad \dots \dots \dots (2)$$

$$A + B = 0 \quad \text{---} \times 2$$

$$3A + 2B = \frac{1}{10} \quad \text{---} \times 1$$

$$2A + 2B = 0$$

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

$$-A = -0.1 \Rightarrow \frac{1}{10}$$

$$\therefore A = 0.1$$

To find B is substitute A into equ (1)

$$0.1 + B = 0$$

$$B = -0.1$$

$$B = -0.1$$

$$\therefore G.S = 0.1e^{-3t} - 0.1e^{-2t} + \frac{1}{10} (\sin t + \cos t)$$

$$= 0.1 (e^{-3t} - e^{-2t} + \sin t + \cos t)$$