

1. $\frac{d^2x}{dt^2} = 5 \sin t + 6 \cos t$
 2. $\frac{dx}{dt} = 5 \cos t - 6 \sin t$
 3. $x = 5 \sin t + 6 \cos t + C$

$0.1 \cdot R + 0.9x + 0 = 0$
 $R = 10x + 1000 = 0$
 $R = 10(5 \sin t + 6 \cos t + C) + 1000 = 0$
 $50 \sin t + 60 \cos t + 10C + 1000 = 0$
 $50 \sin t + 60 \cos t + 10C = -1000$
 $5 \sin t + 6 \cos t + C = -100$

Pf

$F(x) = c \cos t$

$2.1 c \cos t + D \sin t$

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

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

$[-(c \cos t - D \sin t)] = 0 \Rightarrow c \cos t + 5D \cos t + 6 \sin t = 6D \sin t + c \cos t$

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

$5D + 5D = 1 \dots 0$

$\sin t = D - 5c + 6D \geq 0$

$-5c + 5D = 0 \dots 0$

Eqn (1) $10D = 1$

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

Sub D into 0

$5c + 5[\frac{1}{10}] = 1$

$5c + \frac{1}{2} = 1$

$5c = 1 - \frac{1}{2}$

$c = \frac{1}{2} \times \frac{1}{5}$

$= \frac{1}{10}$

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

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

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

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

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

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

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

$$k_1 = -3, -2$$

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

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

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

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

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

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

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

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

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

Solving Simultaneously $10D = 1$

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

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

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

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

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

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

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)]

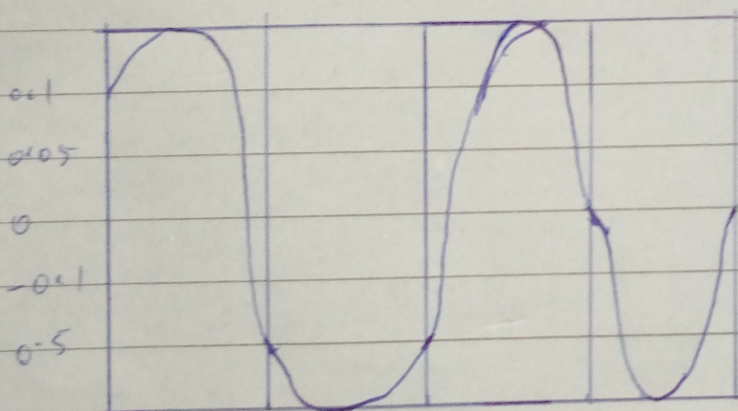
xn = subs(x)

plot(t, xn)

axis tight

grid on

grid minor



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

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

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

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

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

$$0.1 = k \sin(0 + \theta)$$

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

$$\cos \theta = 0$$

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

$$\theta = 90^\circ$$

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

close all

clear

clc

syms t, x

t = [0:0.1:15]

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

plot(t, x)