

NORWAH-AWDAH AN-NUJUMH-NUYWAH.

16 ENG 04 035

ELECT ELECT

ENG 381

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

Let  $x = e^{kx}$

$$\frac{dx}{dt} = kx = kx$$

$$\frac{d^2x}{dt^2} = k^2x$$

$$k^2x + 5kx + 6x = 0$$

$$x(k^2 + 5k + 6) = 0$$

$$k^2 + 5k + 6 = 0$$

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

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

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

$$k = -2, -3$$

~~C.F = A e^{k\_1 t} + B e^{k\_2 t}~~ C.F = A e^{k\_1 t} + B e^{k\_2 t}

~~C.F = A \cos 2t + B \sin 3t~~ C.F = A e^{2t} + B e^{-3t}

P.I:

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

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

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

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

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

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

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

$$5C + 5D = 1 \quad \text{--- (i)}$$

$$-5C + 5D = 0 \quad \text{--- (ii)}$$

$$10C = 1$$

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

subt C into equ-1.

$$5C + 5D = 1$$

$$5\left(\frac{1}{10}\right) + 5D = 1$$

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

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

$$5D = \frac{1}{2}$$

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

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

$$\therefore (C, D) = \left(\frac{1}{10}, \frac{1}{10}\right)$$

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

The general solution becomes:

$$x = \text{C.I} + \text{P.I}$$

~~$$x = A \cos 2t + B \sin 3t + \frac{1}{10} \cos t + \frac{1}{10} \sin t$$~~

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

Execution perfected, excellence delivered.

## ■ Afriland Properties Plc

At Initial Condition.

$$x = Ae^{-2t} + Be^{-3t} + \frac{1}{10} \cos t + \frac{1}{10} \sin t \quad \text{--- (1)}$$

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

$$\text{(a) } t=0, x=0.1, \frac{dx}{dt}=0$$

Subst. into equ 1:

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

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

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

$$A + B = 0$$

$$\therefore A = -B$$

Subst. into equ 2:

$$0 = -2Ae^{-2(0)} - 3Be^{-3(0)} - \frac{1}{10} \sin(0) + \frac{1}{10} \cos(0)$$

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

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

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

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

Execution perfected, excellence delivered.

$$+\frac{1}{10} = +B$$

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

But  $A = -B$

$$\therefore A = -\frac{1}{10}$$

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

```
1 - commandwindow
2 - clear
3 - clc
4 - close all
5 - syms t
6 - x = -0.1*exp(-2*t)+0.1*exp(-3*t)+0.1*cos(t) + 0.1*sin(t)
7 - tn = [0:0.01:15]
8 - xn = subs(x,tn)
9 - figure(1)
10 - grid on
11 - grid minor
12 - axis tight
13 - ylabel('x')
14 - xlabel('t')
```