Lumumba Ebiangpo Emmanuel
17/ENG06/052
Mechanical Engineering
ENG 381

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

$$A.E = k^2 + 5k + 6 = 0$$
$$k^2 + 2k + 3k + 6 = 0$$
$$k(k+2) + 3(k+2) = 0$$
$$k = 3 \qquad k_2 = -2$$
$$x_{C.F} = Ae^{-3t} + Be^{-2t}$$

P.I

$$F(x) = \cos t$$
$$x = C\cos t + D\sin t$$
$$\frac{dx}{dt} = C\sin t + D\cos t$$
$$\frac{d^2x}{dt^2} = -C\cos t + D\sin t$$

$$(-C\cos t + -D\sin t) - 5C\sin t + 5D\cos t + 6C\cos t - 6D\sin t = \cos t$$
$$\cos t : -C + 5D + 6C = 1$$
$$5C + 5D = 1 \quad \cdots (1)$$
$$\sin t : D - 5C + 6D = 0$$
$$-5C + 5D = 0 \quad \cdots (2)$$
$$\text{Eq}^n\ (1)\ \&\ (2) \qquad 10D = 1$$
$$D = \frac{1}{10}$$

Sub D into (1)

$$5C + 5\left[\frac{1}{10}\right] = 1$$
$$5C = 1 - \frac{1}{2}$$
$$C = \frac{1}{2} \times \frac{1}{5}$$

UDOSEN EKEMINI JOHN
17/ENG04/070
ELECT/ELECT

ENG 381

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

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

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

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

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

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

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

$k_1 = -3, -2$

$\therefore C.F = Ae^{-3x} + Be^{-2x}$

P.I $\rightarrow f(x) = \cos t$

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

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

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

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

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

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

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

Solving simultaneously $10D = 1$

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

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

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

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

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

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

$0.1 = 1s \sin(90)$

$\therefore 1s = \frac{0.1}{\sin 90} = 0.1$

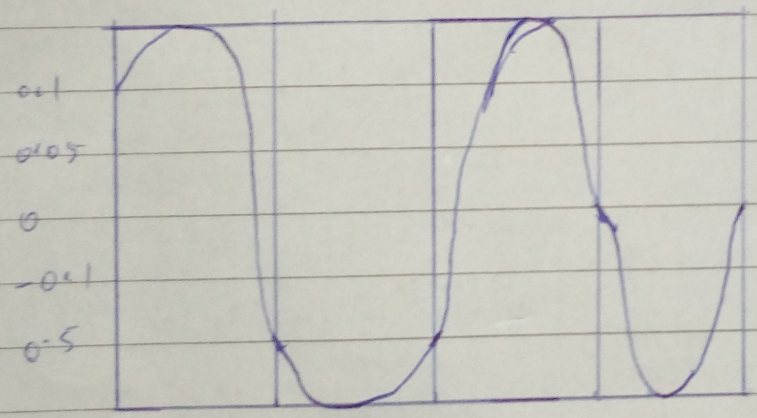
$\therefore x = 0.1 [\sin(t + 90)]$

Command window

```
Close all
clear
clc
Syms t, x
t = [0 : 0.1 : 1s]
x = 0.1 * (sin (t + 90))
plot (t, x)
```

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
```



$x = ks\sin(t, 10)$

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

$\frac{dx}{dt} = ks\cos(t + a)$

$0 = ks\cos(0 + a)$

$\therefore ks\cos(a) = 0$

$0.1 = ks\sin(0 + a)$

$ks\sin(a) = 0.1$ ..... (1)

$\cos a = 0$

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

$a = 90°$

substituting a into (1)