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16/ENE021001

Comp ENGR

300 L

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

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

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

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

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

$$m_1 = -3$$

$$m_2 = -2$$

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

P.T

$$F(t) = \cos t$$

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

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

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

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

$$(5D + 6C - C) \cos t + (-5C - D + 6D) \sin t = \cos t + 0$$

Substitute C in equation (i)

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

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

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

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

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

$$\therefore C = D$$

General Solution \Rightarrow

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

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

When $t=0$ and $x=0.1$

$$0.1 = A + B + \frac{1}{10}(1 + 0)$$

$$A + B = 0.1 - 0.1$$

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

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

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

$$0 = 3A - 2B + 0.1$$

$$3A + 2B = 0.1 \quad \text{--- (ii)}$$

from equ (i)

$$A = -B$$

$$B = -0.1$$

$$A = -(-0.1)$$

$$A = 0.1$$

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

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

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

 Notes

7 October 2018 at 11:37 PM

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16/ENG02/001

Computer engineering

300 level

commandwindow

clear

clc

close all

$$\text{syms } t \quad x = -2 \cdot \exp(-3 \cdot t) / 10 + \exp(-2 \cdot t) / 10 + \cos(t) /$$
$$10 + \sin(t) / 10 \quad \text{tn} = [0; 0.01; 15]$$
$$\text{xn} = \text{subs}(x, \text{tn})$$
$$\text{plot}(\text{tn}, \text{xn})$$
$$\text{xlabel} = ('time')$$
$$\text{ylabel} = ('variable')$$

axis tight

grid on

grid minor

