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16|ENGO4|045

ELECT/ELECT

ENG 381

Assignment

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

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

$$C.F: m^2 + 5m + 6 = 0$$

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

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

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

$$m = -3 \text{ or } m = -2$$

$$x = Ae^{m_1t} + Be^{m_2t}$$

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

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

$$x = A \cos t + B \sin t$$

$$\frac{dx}{dt} = -A \sin t + B \cos t$$

$$\frac{d^2x}{dt^2} = -A \cos t - B \sin t$$

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

$$\Rightarrow (-A \cos t - B \sin t) + (-5A \sin t + 5B \cos t) + (6A \cos t + 6B \sin t) = \cos t$$

$$(-A \cos t + 6A \cos t - 5A \sin t - B \sin t + 5B \cos t + 6B \sin t) = \cos t$$

$$5A \cos t + 5B \sin t + 5B \cos t = \cos t$$

Comparing and collecting like terms

$$s_A + s_B = 1$$

$$-s_A + s_B = 0$$

$$10s_B = 1$$

$$s_B = 1/10$$

$$s_A + s_B = 1$$

$$s_A + s\left(\frac{1}{10}\right) = 1$$

$$s_A + 1/2 = 1$$

$$s_A = 1 - 1/2$$

$$10s_A = 1$$

$$s_A = 1/10$$

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

Recall, $x = C.F + P.I$

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

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

x =

$$\exp(-3*t)/10 - \exp(-2*t) + \cos(t) + \sin(t)$$

tn =

0
0.0100
15.0000

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xn =
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cos(1/100) - exp(-1/50) + exp(-3/100)/10 + sin(1/100)
cos(15) - exp(-30) + exp(-45)/10 + sin(15)
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>>
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COPMMANDS
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commandwindow
clear
clc
close all
syms t
x = 0.1*(exp(-3*t)) - exp(-2*t) + cos(t) + sin(t)
tn = [0;0.01;15]
xn = subs(x,tn)
figure (1)
plot(tn,xn)
grid on
grid minor
axis tight
xlabel ('t')
ylabel ('x')
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