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MECHANICAL ENGR.

ENG 381

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

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

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

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

$m+2 = 0 \qquad m+3 = 0$

$m = -2 \quad or \quad m = -3$

$\therefore C.f = Ae^{-2t} + Be^{-3}$

$P.I = \cos.t$

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

$dy/dt = -C\sin t + D\cos t$

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

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

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

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

$= \cos t$

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

$5D\sin t - 5C\sin t = 0$

$5C + 5D = 1$

$-5C + 5D = 0$

$10D = 1$

$D = 1/10$

$5C + 5D = 1$

$5C + 5/10 = 1$

$C = 1/10$

$\therefore P.I = 1/10(\cos t + \sin t)$

$\therefore x = C.f + P.I$

Scanned by CamScanner

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

when $t=0$ $x=0.1$ & $dx/dt = 0$.

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

$0.1 = A + B - 0.1$

$A + B = 0.1 + 0.1$

$A + B = 0.2$ —— equ.

$dx/dt = -(\sin t + B\cos t$

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

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

$= -2A + 3B + 0.1$

$= 3A + 2B = 0.1$ —— ①

$A + B = 0.2$

$A = 0.2 - B$ —— ③

Sub equ ③ in to equ ②

$= 3(0.2 - B) + 2B = 0.1$

$0.6 - 3B + 2B = 0.1$

$-B = -0.5$

$B = 0.5$

$A = 0.3$

$x = -0.3^{-2t} + 0.5e^{-3t} + \frac{1}{10}(\cos t + \sin t$

. Command window

clear

clc

close all

Sym x, t.

$t = [0 = 0.1 : 15]$;

$x = 0.1(\sin(t + \%0)]$

plot [t, x).

c. $x = K\sin(t+\varphi)$

$x = 0.1 \quad t = 0$

$\frac{dx}{dt} = K\cos(t+\varphi)$.

$0 = K\cos(0+\varphi)$.

$0 = K\cos\varphi$

$0.1 = K\sin(\varphi)$.

$K\sin\varphi = 0.1$

$\cos\varphi = 0$

$\varphi = 90°$ $\qquad \varphi = \cos^{-1}(0)$.

$\varphi = 90°$

Sub into eqn (1)

$0.1 = K\sin 90°$

$K = 0.1 / \sin 90°$

$K = 0.1$

$x = 0.1\sin(t+90°)$