

P.s $x = Ae^{-3t} + Be^{-2t} + 0.1 \sin t + 0.1 \cos t$

when $v = 0$,
 $0 = 0.1 \frac{dx}{dt} = 0$

$0.1 = A + B + 0.1$

$A + B = 0$ (b)

$\frac{dy}{dx} = -3Ae^{-3t} - 2Be^{-2t} + 0.1 \sin t + 0.1 \cos t$

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

$B = -A$

$0 = -3A - 2(-A) + 0.1$

$0 = -A + 0.1$

$B = -A$

$B = 0.1$

G.s $0.1Ae^{-3t} - 0.1e^{-2t} + 0.1 \sin t + 0.1 \cos t$

2) Command window

clear

clc

close all

syms x t

$x = 0.1 * \exp(-3*t) - 0.1 * \exp(-2*t) + 0.1 * \cos t + 0.1 * \sin t$

$t = 0; 0.1 : 1.5$

$x_n = \text{subs}(x, t, t_n)$

Plot(t, x_n)

k 'label('time')'

grid on

grid minor

axis tight

$$(c) 0.1 \cos t + 0.1 \sin t = k \sin(1+t) \text{ at steady flow}$$

$$0.1 \cos t + 0.1 \sin t = k \sin \cos \text{ at } k \sin \cos^4$$

Comparing Coefficient

$$\text{Coefficient of } \cos t = 0.1 = k \sin a$$

$$\text{Coefficient of } \sin t = 0.1 = k \cos a$$

Square $k \sin a$ and $k \cos a$ and equate it to the addition

$$k^2 \sin^2 a + k^2 \cos^2 a = 0.1 + 0.1$$

$$k^2 (\sin^2 a + \cos^2 a) = 0.2$$

$$k^2 = 0.2$$

$$k^2 = \frac{2}{10} \quad (\sin^2 a + \cos^2 a = 1)$$

$$k = \frac{1}{\sqrt{5}}$$

$$k = \frac{\sqrt{2}}{10}$$

$$k \sin a = \frac{0.1}{0.1}$$

$$\tan a = 1$$

$$a = \tan^{-1}(1)$$

$$a = 45^\circ \text{ or } \frac{\pi}{4}$$

$\therefore k$ steady state

$$k_{ss} = \frac{\sqrt{2}}{10} \sin\left(\frac{\pi + t}{4}\right) //$$

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soln

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

Auxiliary eqn - $m^2 + 5m + 6 = 0$

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

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

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

Cf - $x = Ae^{-3x} + Be^{-2x}$

P.I $x = C \cos t + D \sin t$

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

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

putting the value of $\frac{d^2x}{dt^2}$ & $\frac{dx}{dt}$ in the eqn.

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

Comparing

$$\cos t : C + 5D + 6C = 1 \quad (i)$$

$$D - 5C + 6D = 0 \quad (ii)$$

$$5C + 5D = 1 \quad (3)$$

$$5D - 5C = 0 \quad (4)$$

$$5D = 1 - 5C \quad (5)$$

putting eqn (5) in eqn (4)

$$1 - 5C - 5C = 0$$

$$1 - 10C = 0$$

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

$$5D = 1 - 5C$$

$$5D = 0.5 \quad D = 0.5/5 = 0.1$$