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161Eng041052

Electrical Electronics Engineering  
ENG 381

Assignment

$$1. @ \frac{d^2x}{dt^2} + 5\frac{dx}{dt} + 6x = \text{Cost}$$

Soln

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

$$m = -b \pm \sqrt{b^2 - 4ac}$$

29

$$= -5 \pm \sqrt{5^2 - 4(1)(6)}$$

2C1)

$$= -5 \pm \sqrt{25 - 24}$$

2

$$= \frac{-5+1}{2} \text{ or } \frac{-5-1}{2}$$

$$= -4/2 \text{ or } -6/2$$

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

$$CF: x = 4e^{-2t} + Be^{-3t}$$

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

$$\frac{dx}{dt} = -Csint + Dcost$$

$$\frac{d^2x}{dt^2} = -Ccost - Dsint$$

$$= -C(cost + Dsint) + 5(-Csint + Dcost) + 6(Ccost + Dsint) = cost$$

= ~~cost~~

$$= -Ccost - Dsint - 5Csint + 5Dcost + 6Ccst + 6Dsint = cost$$

$$= C(-6 + 5D + 6C)cost + (-D - 5C + 6D)sint = cost$$

Equating coefficient

$$-C + 5D + 6C = 1$$

$$5c + 5D = 0 \quad \dots \dots \quad ①$$

$$-D - 5C + 6D = 0$$

$$③ \dots \dots \quad 3 = cost + 2c$$

$$1 = 0c + 32$$

$$0 = 0c + 32$$

$$1 = 32$$

$$0N = 0$$

$$1 = 0c + (0N)c$$

$$1 = 0c + 0N$$

$$32 = 1 - 0c$$

$$0N = 0$$

$$true cost + true snt = x$$

$$I9 + 7C =$$

$$true snt + true cost + I8 - 2c + I2 - 8f =$$

$$(true snt + true cost) + (I8 - 2c + I2 - 8f) = 36$$

$$I9 + 7C =$$

$$(true snt + true cost) = 36$$

$$36 + 2 \mu 1000 + 2 \mu 1000, 0 = 36 \mu 1000 + 3$$

$$I9$$

$$0 = (true snt + true cost) \quad 1 = \frac{2c}{I9}$$

$$0 = 0 \quad 01 = \frac{2c}{I9}$$

$$0 = +200 + 2m2 -$$

$$+2m2 = 200 -$$

$$+2f =$$

$$true snt + true cost = 36$$

$$0 + +200 + 2m2 = 36 + 200 + 2m2$$

$$(0 + 0 - 2m2) = (36 - 200) + 2m2$$

$$-200 =$$

$$-200 = -200 + 2m2$$

$$-5C + 50 = 1$$

$$-5C + 50 = 0$$

$$10C = 1$$

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

$$5(Y_{10}) + 50 = 1$$

$$\frac{1}{2} + 50 = 1$$

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

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

$$x = \frac{1}{10} \cos t + \frac{1}{10} \sin t$$

$$= CF + PI$$

$$= 4e^{-2t} + Be^{-3t} + \frac{1}{10} \cos t + \frac{1}{10} \sin t$$

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

solt

$$x = \frac{1}{10} (\cos t + \sin t)$$

we know  $\frac{dx}{dt} = 0$ , for steady state

$$\frac{dx}{dt} = \frac{1}{10} (-\sin t + \cos t) = 0$$

$$-\sin t + \cos t = 0$$

$$-\cos t = \sin t$$

$$t = 45^\circ$$

from sinusoidal expression

$$A \cos \omega t + B \sin \omega t = 4 \cos(\omega t + \theta)$$

$$\text{But, } \cos(\omega t - \theta) = \sin(\omega t - \theta + 90^\circ)$$

$$\text{where, } K = \sqrt{A^2 + B^2} = \sqrt{(Y_{10})^2 + (Y_{10})^2} = \sqrt{\frac{1}{50}} = \frac{\sqrt{2}}{10}$$

$$\theta = 0^\circ *$$

since its in the same phase

$$\text{Recall, } x = K \sin(\omega t + \alpha)$$

$$\frac{\sqrt{2}}{10} = \frac{\sqrt{2}}{10} \sin(45^\circ + \alpha)$$

$$10. 10$$

$$\alpha = 90^\circ - 45^\circ$$

$$= 45^\circ = \pi/4$$

$$\therefore \text{Steady state solution: } x = \frac{\sqrt{2}}{10} (\sin t + \frac{x}{4}),$$