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15/ENG04/003

ELECTRICAL ELECTRONICS

1) $\frac{dy}{dt} + 3y = e^{-2t}$

$y(t) + 3y(t) = e^{-2t}$

$L[y(t)] = sY(s) - Y(s)$

$L[y(t)] = Y(s)$

$L^{-1}[e^{-2t}] = 1/s + 2$

$sY(s) - Y(s) - 3Y(s) = \frac{1}{s+2}$

$(s-3)Y(s) - 2 = \frac{1}{s+2}$

$(s-3)Y(s) = \frac{1}{s+2} + 2 = \frac{1+2s+4}{2} = \frac{2s+5}{s+2}$

$Y(s) = \frac{2s+5}{(s+2)(s-3)} = \frac{A}{s+2} + \frac{B}{s-3}$

$2(-2)+5 = A(-2-3) \Rightarrow A = 1/-5$

$2(3)+5 = 3(3+2) \Rightarrow B = 11/5$

$Y(s) = \frac{-1}{s(3+2)} = \frac{11}{5(3-3)} = \frac{-1}{5}e^{-2t} + \frac{11}{5}e^{3t}$

2) $3\frac{dy}{dt} - 6y = \sin 2t = 3y(t) - (y(t))$

$L[y(t)] = sy(s) - y(s)$

~~$L[y(t)] = sy(s) -$~~

$L[y(t)] = Y(s)$

$L[\sin 2t] = \frac{2}{s^2+2^2} = \frac{2}{s^2+4}$

-2)

$$3s + Y(s) - 3Y(s) - 6Y(s) = \frac{2}{s^2+4}$$

$$Y(s)[3s-6] = \frac{2}{s^2+4} + 3 = \frac{2+3s^2+12}{s^2+4} = \frac{3s^2+14}{s^2+4}$$

$$Y(s) = \frac{3s^2+4}{(3s-4)(s^2+4)} = \frac{A}{3s-6} + \frac{B}{s^2+4}$$

$$3s^2+14 = A(B^2+4) + B(3s-6)$$

$$4A - 6B = 14$$

$$B = -1/3$$

$$Y(s) = \frac{3}{3(s-2)} = \frac{1}{3(s^2+4)}$$

$$= \ell^{2t} - 1/6 \sin 2t$$

3) $\frac{dy}{dt} - 4y = 8$

$$y'(t) = 4Y(s) = 8$$

$$y'(t) - 4y(t) = 8$$

$$sy(s) - y(s) - 4y(s) = 8/s$$

$$(s-4)Y(s) = 8/s + 2 = \frac{8+2s}{s}$$

$$Y(s) = \frac{2s+8}{s(s-4)}$$

$$\frac{2s+8}{s(s-4)} = \frac{A}{s} + \frac{B}{s-4}$$

$$2s+8 = A(s-4) + B(s)$$

$2(0)+8 = A(0-4)$

$2(4)+8 = A(4-4) + B(4) \quad = B = 4$

$$L^{-1}\left[\frac{2}{s} + \frac{4}{s-4}\right] = -2 + 4e^{4t}$$

4) $\frac{d^2y}{dx^2} - \frac{2dy}{dt} + 5y = e^{2t}$

$y''(t) - 2y'(t) + 5y(t) = e^{2t}$

$L[y''(t)] = sY(s) - 5y(0) - y'(0)$

$L[y'(t)] = sy(s) - Y(s)$

$L[y(t)] = Y(s)$

$s^1y(s) - sy(s) - y'(s) - 2sY(s) + 2Y(s) + 5y(s) = \frac{1}{s-2}$

$(s^2 - 2s + 5)\,y(s) + (2-5)y_0 \Rightarrow y'(s) = \frac{1}{s-2}$

$[s^2 - 2s + 5]\,Y(s) = \frac{1}{s-2} - (2-s)2 + 1 = \frac{1}{s-2} + 2s - 4 + 1$

$= \frac{1}{s-2} + 2s - 3 = \frac{1 + (2s+3)(s-2)}{(s-2)}$

$= \frac{1 + 2s^2 - 4s - 3s + 6}{s-2}$

$Y(s) = \frac{2s^2 - 7s + 7}{(s-2)(s^2 - 3s + 5)}$

$2s^2 - 7s + 7 = \frac{A}{s-2} + \frac{B}{s^2 - 3s + 5}$

$2s^2 - 7s + 7 = A(s^2 - 2s + 5) + B(s-2)$

$A = 2$

$-2A + B = -7$

$$B = -3$$

$$Y(s) = \frac{2}{s-2} - \frac{3}{s^2-2s+5}$$

$$= 3e^{2t} - \frac{7}{3} + \sin 2t$$