



$$\frac{d^2 y}{dt^2} + 3 \frac{dy}{dt} + 2y(t) = 4$$

$$y(t) = ?$$

$$\mathcal{L}\left[\frac{d^2 y}{dt^2}\right] = s^2 Y(s) - 3sY(s)$$

$$2\mathcal{L}[y(t)] = 2Y(s) \quad ; \quad \mathcal{L}[4] = \frac{4}{s}$$

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

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

$$y(t) = \mathcal{L}^{-1}[Y(s)] = \mathcal{L}^{-1}\left[\frac{4}{s(s^2 + 3s + 2)}\right]$$

$$s^2 + 3s + 2 = 0$$

$$(s + 2)(s + 1) = 0$$

$$y(t) = \mathcal{L}^{-1}\left[\frac{4}{s(s+1)(s+2)}\right]$$

$$\frac{4}{s(s+1)(s+2)} = \frac{A}{s} + \frac{B}{s+1} + \frac{C}{s+2}$$

$$= \frac{A(s+1)(s+2) + Bs(s+2) + Cs(s+1)}{s(s+1)(s+2)}$$

$$= \frac{As^2 + 3As + 2A + Bs^2 + 2Bs + Cs^2 + Cs}{s(s+1)(s+2)}$$

$$4 = 2A \quad \text{--- (1)}$$

$$4 = 3As + 2Bs + Cs \quad \text{--- (2)}$$

$$4 = As^2 + Bs^2 + Cs^2$$

$$= A + B + C \quad \text{--- (3)}$$

$$A = 2 \text{ From Eq (1)}$$

$$3A + 2B + C = 0$$

$$A + B + C = 0$$

$$3 \times 2 + 2B + C = 0$$

$$2B + C = -6 \quad \text{--- (2)}$$

$$2 + B + C = 0$$

$$B + C = -2 \quad \text{--- (3)}$$

$$\begin{array}{r} 2B + C = -6 \\ -B + C = -2 \quad \text{Multi} \\ \hline \end{array}$$

طريقة المعادلات  
 لا نه تجا هيل / تارت  
 معادلات

الطريقة الثانية

$$\frac{4}{s(s^2 + 3s + 2)} = \frac{A}{s} + \frac{B}{s+1} + \frac{C}{s+2}$$

$$A = \frac{4}{s(s+1)(s+2)} \Big|_{s=0} = \frac{4}{(s+1)(s+2)} \Big|_{s=0} = \frac{4}{2} = 2$$

$$B = \frac{4(s+1)}{s(s+1)(s+2)} \Big|_{s=-1} = \frac{4}{(-1)(-1+2)} = -4$$

$$C = \frac{4(s+2)}{s(s+1)(s+2)} \Big|_{s=-2} = \frac{4}{(-2)(-2+1)} = 2$$

$$y(t) = A + B e^{-t} + C e^{-2t} = 2 - 4e^{-t} + 2e^{-2t}$$

$$3A + 2B + C = 0 \quad \text{--- (2)}$$

$$6 + 2B + C = 0 \quad \text{--- (2)}$$

$$A = 2 \rightarrow (2 + B + C = 0) \times -1$$

$$4 + B = 0 \quad \therefore B = -4$$

Then  $C = 2$  from eq 3

