

(I) (I)

$$(\mathcal{D}^2 + 7\mathcal{D} + 12)y(t) = (\mathcal{D} + 2)x(t)$$

$$\bullet y_0(0) = 2$$

$$\bullet \hat{y}_0(0) = -2$$

(II)

$$\lambda^2 + 7\lambda + 12 = 0$$

$$A = 1$$

$$\lambda = \frac{-7 \pm \sqrt{49}}{2} = -3, -4$$

(III)

$$\left. \begin{aligned} y_0(t) &= Ae^{-3t} + Be^{-4t} \\ y_0(0) &= A + B = 2 \end{aligned} \right\} \begin{aligned} \hat{y}_0(t) &= -3Ae^{-3t} - 4Be^{-4t} \\ \hat{y}_0(0) &= -3A - 4B = -2 \end{aligned}$$

(IV)

$$\bullet A + B = 2 \quad (\times 3)$$

$$-3A - 4B = -2$$

$$\bullet 3A + 3B = 6$$

$$-3A - 4B = -2$$

$$\underline{\underline{y_0(t) = 6e^{-3t} - 7e^{-4t}}}$$

$$-B = 4 \Rightarrow \boxed{B = -4}$$

$$A - 4 = 2 \Rightarrow \boxed{A = 6}$$

(2) (I)

$$(D+3)(D^2+6D+8)y(t) = (D+1)x(t)$$

$$b_0 = 0; h(t)$$

⊕ Som impulse

(II)

$$(\lambda+3)(\lambda^2+6\lambda+8)=0$$

$$\lambda = -3$$

$$\lambda = -3$$

$$\frac{-6 \pm \sqrt{4}}{2} = -2 \pm 1$$

(III)

$$h(t) = [P(D) y_n(t)] u(t)$$

$$y_n(t) = Ae^{-3t} + Be^{-4t} + Ce^{-2t}$$

$$y_n(0) = A + B + C = 0$$

$$y_n'(t) = -3Ae^{-3t} - 4Be^{-4t} - 2Ce^{-2t}$$

$$y_n'(0) = -3A - 4B - 2C = 0$$

$$y_n''(t) = 9Ae^{-3t} + 16Be^{-4t} + 4Ce^{-2t}$$

$$y_n''(0) = 9A + 16B + 4C = 1$$

(IV)

$$1. A + B + C = 0$$

$$2. -3A - 4B - 2C = 0$$

$$3. 9A + 16B + 4C = 1$$

$$[2 \times 3] -9A -12B -6C = 0$$

$$9A + 16B + 4C = 1$$

$$4. 4B - 2C = 1$$

$$[2 \times 1] 3A + 3B + 3C = 0$$

$$-3A - 4B - 2C = 0$$

$$5. -B + C = 0$$

$$[2 \times 5] 4B - 2C = 1$$

$$-2B + 2C = 0$$

$$2B = 1$$

$$B = 1/2$$

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(iv)

$$\bullet A + C = -1/2$$

$$-3A - 2C = 2$$

$$\bullet 2A + 2C = -1$$

$$-3A - 2C = 2$$

$$-A = 1 \Rightarrow \boxed{A = -1}$$

$$-1 + \frac{1}{2} + C = 0$$

$$\boxed{C = \frac{1}{2}}$$

(v)

$$h(t) = \left[(D+1) \left(-1e^{-3t} + \frac{1}{2}e^{-2t} + \frac{1}{2}e^{-2t} \right) \right] u(t)$$

$$h(t) = \left[3e^{-3t} - 2e^{-2t} - e^{-2t} + \frac{1}{2}e^{-2t} + \frac{1}{2}e^{-2t} \right] u(t)$$

$$h(t) = \left[2e^{-3t} - \frac{3}{2}e^{-2t} - \frac{1}{2}e^{-2t} \right] u(t)$$

③ (J)

$$h(t) = e^{-t/2} u(t)$$

$$p(t) = u(t) - u(t-3)$$

(I)

$$y(t) = h(t) \cdot p(t) = [u(t) - u(t-3)] \cdot e^{-t/2} u(t)$$

$$y(t) = u(t) \cdot e^{-t/2} u(t) - u(t-3) \cdot e^{-t/2} u(t)$$

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

(4) (i)

$$x(t) = 2 \cos(3t) u(t)$$

$$(D^2 + 5D + 4)y(t) = (D+3)x(t)$$

$$y(0) = 0; y'(0) = -2$$

(ii)

$$\lambda^2 + 5\lambda + 4 = 0 \quad \text{NATURAL}$$

$$\lambda = -1, -4$$

(iii)

$$y_n(t) = Ce^{-t} + De^{-4t}$$

$$y(0) = A \sin(3t) + B \cos(3t)$$

$$y'(0) = 3A \cos(3t) - 3B \sin(3t)$$

$$y''(0) = -9A \sin(3t) - 9B \cos(3t)$$

FOFSA DA

$$4y(0) = 4A \sin(3t) + 4B \cos(3t)$$

$$5y'(0) = 15A \cos(3t) - 15B \sin(3t)$$

$$y''(0) = -9A \sin(3t) - 9B \cos(3t)$$

$$\left. \begin{aligned} &(-5A - 15B) \sin(3t) + (15A - 5B) \cos(3t) = \\ &-6 \sin(3t) + 6 \cos(3t) \end{aligned} \right\}$$

$$(D+3)x(t)$$

(iv)

$$-5A - 15B = 6$$

$$-5A - 15B = 6 \quad (v)$$

$$15A - 5B = 6$$

$$-45A + 15B = -18$$

$$y_p(t) = \frac{12}{25} \sin(3t) + \frac{6}{25} \cos(3t)$$

$$-15A - 45B = 18$$

$$A = \frac{+12}{50} = \frac{6}{25}$$

$$y(t) = Ce^{-t} + De^{-4t} + \frac{12}{25} \sin(3t) + \frac{6}{25} \cos(3t)$$

$$15A - 5B = 6$$

$$\frac{24}{50} = \frac{12}{25}$$

data

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(V)

$$y(0) = C + D + \frac{6}{25} = 0 \quad y'(t) = -C e^{-t} - 4t + \frac{36}{25} \cos(3t) - \frac{18}{25} \sin(3t)$$

$$C + D = -\frac{6}{25} \quad y'(0) = -C - 4D + \frac{36}{25} = -2$$

$$-C - 4D = -\frac{86}{25}$$

(VI)

$$C + D = -\frac{6}{25}$$

$$-C - 4D = -\frac{86}{25}$$

$$y(t) = -\frac{22}{15} e^{-t} + \frac{92}{75} e^{-4t} + \frac{12}{25} \sin(3t) + \frac{6}{25} \cos(3t)$$

$$C = -\frac{22}{15}, D = \frac{92}{75}$$