

$$1) (D^2 + 4D + 3)y(t) = (D + 5)f(t) \quad h(t) = ?$$

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

(M=1, N=2) ikinci dereceden sistem

• Sistemin karakteristik polinomu:

$$\lambda^2 + 4\lambda + 3 = (\lambda + 1)(\lambda + 3)$$

• katsız (tekrar etmeyen) kökler:  $\lambda_1 = -1$ ,  $\lambda_2 = -3$

$$\Rightarrow y_n(t) = c_1 e^{-t} + c_2 e^{-3t}$$

$$\Rightarrow \dot{y}_n(t) = -c_1 e^{-t} - 3c_2 e^{-3t}$$

• Başlangıç koşullardan:

$$y_n(0) = 1 \Rightarrow \dot{y}_n(0) = 1, y_n(0) = 0$$

$$\Rightarrow \begin{cases} c_1 + c_2 = 0 \\ -c_1 - 3c_2 = 1 \end{cases} \Rightarrow \begin{cases} c_1 = \frac{1}{2} \\ c_2 = -\frac{1}{2} \end{cases}$$

$$\Rightarrow y_n(t) = \frac{1}{2} e^{-t} - \frac{1}{2} e^{-3t}$$

$$\bullet p(D) = D + 5 : h(t) = D\left(\frac{1}{2} e^{-t} - \frac{1}{2} e^{-3t}\right) + 5\left(\frac{1}{2} e^{-t} - \frac{1}{2} e^{-3t}\right)$$

$$\Rightarrow h(t) = -\frac{1}{2} e^{-t} + \frac{3}{2} e^{-3t} + \frac{5}{2} e^{-t} - \frac{5}{2} e^{-3t}$$

$$\Rightarrow h(t) = (2e^{-t} - e^{-3t})u(t)$$

Birim darbe cevabı.

2)  $\Rightarrow$  Sıfır durum cevabı :  $y(t) = f(t) * h(t)$

•  $f(t) = e^{-2t} u(t)$

•  $h(t) = (2e^{-t} - e^{-3t}) u(t)$

$$\Rightarrow y(t) = e^{-2t} u(t) * [2e^{-t} - e^{-3t}] u(t)$$

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

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

• konvolüsyon tablosu (4. ifade) kullanarak:

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

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

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

Sıfır durum cevabı

$$3) h(t) = 8e^{5t} u(t), \quad x(t) = u(t), \quad y(t) = x(t) * h(t).$$

• konvolüsyon tablosu (2. ifade) kullanarak:

$$y(t) = u(t) * 8e^{5t} u(t)$$

$$y(t) = 8 \left( \frac{1 - e^{5t}}{-5} \right) u(t)$$

$$y(t) = \left( \frac{8e^{5t} - 8}{5} \right) u(t)$$