TEMA 3b SISTEMAS DE ECS. DIF. ORD. LINEALES

$$\boxed{\begin{aligned} (1)\quad \frac{dx_1}{dt} &= 2x_1 + 3x_2 \\ (2)\quad \frac{dx_2}{dt} &= x_1 + 4x_2 \end{aligned}}$$

$\frac{d}{dt}\bar{x} = A\bar{x}$

S(2)EDO(1)LccH.

$\frac{d}{dt}\bar{x} = A\bar{x} + \bar{b}(t)$ ~~H~~.

De (2)

$$x_1 = \frac{dx_2}{dt} - 4x_2$$

$$\frac{d}{dt}: \quad \frac{dx_1}{dt} = \frac{d^2x_2}{dt^2} - 4\frac{dx_2}{dt}.$$

Sust. (1)

$$\frac{d^2x_2}{dt^2} - 4\frac{dx_2}{dt} = 2\left(\frac{dx_2}{dt} - 4x_2\right) + 3x_2$$

$$\frac{d^2x_2}{dt^2} - 4\frac{dx_2}{dt} - 2\frac{dx_2}{dt} + 8x_2 - 3x_2 = 0$$

$$\boxed{\frac{d^2x_2}{dt^2} - 6\frac{dx_2}{dt} + 5x_2 = 0}$$ EDO(2)LccH.

$$(D^2 - 6D + 5)x_2 = 0$$

$$(D-1)(D-5)x_2 = 0$$

$$\boxed{x_2(t) = C_1e^t + C_2e^{5t}}$$

$$\frac{dx_2}{dt} = C_1e^t + 5C_2e^{5t}$$

$$x_1(t) = (C_1e^t + 5C_2e^{5t}) - 4(C_1e^t + C_2e^{5t})$$

$$\boxed{\begin{aligned} x_1(t) &= -3C_1e^t + C_2e^{5t} \\ x_2(t) &= C_1e^t + C_2e^{5t} \end{aligned}}$$ SG - S(2)EDO(1)LccH.

$$\boxed{\begin{aligned} \frac{dx_1}{dt} &= 2x_1(t) + 3x_2(t) \\ \frac{dx_2}{dt} &= x_1(t) + 4x_2(t). \end{aligned}}$$

$$\frac{d^3y(t)}{dt^3} + 2\frac{d^2y(t)}{dt^2} - 4\frac{dy}{dt} - 6y = 0$$

EDO(3) LCCH.

$$y(t) \Rightarrow y_1(t)$$

$$\frac{dy(t)}{dt} \Rightarrow y_1'(t) = y_2(t)$$

$$\frac{d^2y(t)}{dt^2} \Rightarrow y_2'(t) = y_3(t)$$

$$\frac{d^3y(t)}{dt^3} = y_3'(t)$$

$$\boxed{\begin{aligned} y_1'(t) &= y_2(t) \\ y_2'(t) &= y_3(t) \\ y_3'(t) &= 6y_1(t) + 4y_2(t) - 2y_3(t) \end{aligned}}$$

S(3) EDO(1) LCCH.

$$\frac{dx_1(t)}{dt} = 2x_1 + 3x_2$$

$$\frac{dx_2(t)}{dt} = x_1 + 4x_2$$

$$\bar{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \quad \frac{d\bar{x}}{dt} = \begin{bmatrix} \frac{dx_1}{dt} \\ \frac{dx_2}{dt} \end{bmatrix}$$

$$\frac{d}{dt}\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} \times \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$$

$$e^{At}$$

$$\frac{d}{dt}\bar{x} = A\bar{x}$$

$$\bar{x} = \left[e^{At}\right]\bar{x}(0) \quad \bar{x}(0) = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix}$$

$$e^{at} \qquad e^{At}$$

$$\frac{d}{dt}e^{at} = ae^{at} \qquad \frac{d}{dt}e^{At} = A \times e^{At}$$

$$e^{a(0)} = 1 \qquad e^{A(0)} = I$$

$$e^{a(-1)} = \frac{1}{e^{a}}$$

$$\left(e^{at}\right)\left(e^{a-t}\right) = 1 \qquad e^{A(-t)} = e^{-A(t)}$$

$$e^{A(-t)} \times e^{At} = I.$$