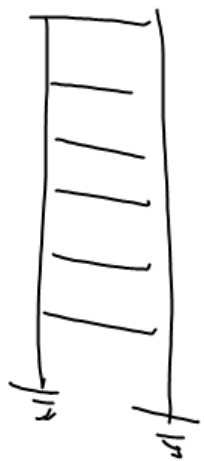


# Capítulo 3.- Sistema de Ecuaciones Diferenciales Lineales

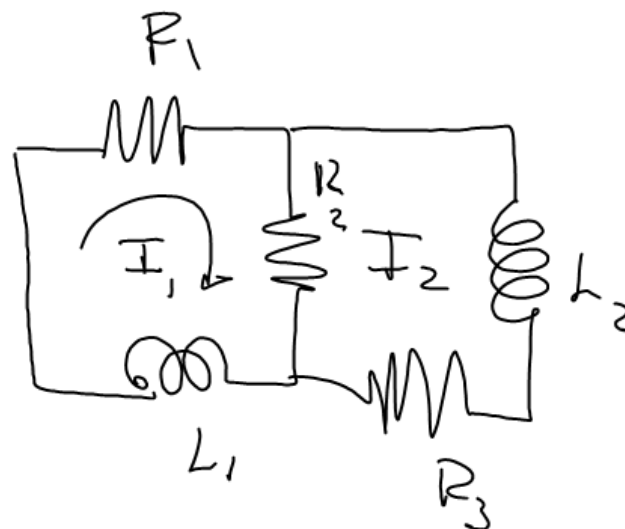
$x(t)$      $y(t)$



$$\frac{dx}{dt} = 2x + 3y$$

$$\frac{dy}{dt} = x + 4y$$

$$J(z) \in \mathcal{DO}(1) \subset \mathcal{H}.$$



$$L_1 \frac{dI_1}{dt} + R_1 I_1 + R_2 (I_2 - I_1) = 0$$

$$L_2 \frac{dI_2}{dt} + R_3 I_2 + R_2 (I_1 - I_2) = 0$$

$$\frac{dx}{dt} = 2x + 3y$$

$$\frac{dy}{dt} = x + 4y$$

$$x(t)$$

$$x(0) = 2$$

$$y(t)$$

$$y(0) = -2$$

disp  
x

$$x = \frac{dy}{dt} - 4y$$

$\frac{d}{dt}$

$$\frac{dx}{dt} = \frac{d^2y}{dt^2} - 4\frac{dy}{dt}$$

$$\left[ \frac{d^2y}{dt^2} - 4\frac{dy}{dt} \right] = 2 \left[ \frac{dy}{dt} - 4y \right] + 3y$$

$$\frac{d^2y}{dt^2} - 6\frac{dy}{dt} + 5y = 0$$

$$\frac{d^2 y}{dt^2} - 6 \frac{dy}{dt} + 5y = 0$$

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

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

$$y = C_1 e^t + C_2 e^{5t}$$

$$\frac{dy}{dt} = C_1 e^t + 5C_2 e^{5t}$$

$$x(0) = 2 \quad -3C_1 + C_2 = 2$$

$$y(0) = -2 \quad C_1 + C_2 = -2$$

$$3C_1 - C_2 = -2$$

$$4C_1 = -4$$

$$C_1 = -1$$

$$C_2 = -2 + 1$$

$$C_2 = -1$$

$$x = (C_1 e^t + 5C_2 e^{5t}) - 4(C_1 e^t + C_2 e^{5t})$$

$$x = -3C_1 e^t + C_2 e^{5t}$$

$$y = C_1 e^t + C_2 e^{5t}$$

Soluzioni  
General

$$x = +3e^t - e^{5t}$$
$$y = -e^t - e^{5t}$$

Solución particular

$$\frac{dx}{dt} = 2x + 3y$$

$$x(0) = 2$$

$$\frac{dy}{dt} = x + 4y$$

$$y(0) = -2$$

$$\frac{dx}{dt} = 2x + 3y$$

$$\frac{dy}{dt} = x + 4y$$

$$\begin{bmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} \begin{bmatrix} x(t) \\ y(t) \end{bmatrix}$$

$$\bar{X}(t) = \begin{bmatrix} x(t) \\ y(t) \end{bmatrix}$$

$$\downarrow \frac{d}{dt}$$

$$\frac{d}{dt} \bar{X}(t) = \begin{bmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{bmatrix}$$

$$\bar{X}(0) = \begin{bmatrix} 2 \\ -2 \end{bmatrix}$$

$SolGral := evalm(MatrizExponencial \&* Xinicial) : XX(t)$   
 $= simplify(SolGral_1);$

$$XX(t) = \frac{3}{4} C1 e^t + \frac{1}{4} C1 e^{5t} + \frac{3}{4} C2 e^t - \frac{3}{4} C2 e^{5t}$$

$YY(t) = simplify(SolGral_2)$

$$YY(t) = \frac{1}{4} C1 e^{5t} - \frac{1}{4} C1 e^t + \frac{1}{4} C2 e^t + \frac{3}{4} C2 e^{5t}$$

$$x(t) = \left( \frac{3}{4} C_1 - \frac{3}{4} C_2 \right) e^t + \left( \frac{1}{4} C_1 + \frac{3}{4} C_2 \right) e^{5t}$$

$$y(t) = \left( -\frac{1}{4} C_1 + \frac{1}{4} C_2 \right) e^t + \left( \frac{1}{4} C_1 + \frac{3}{4} C_2 \right) e^{5t}$$

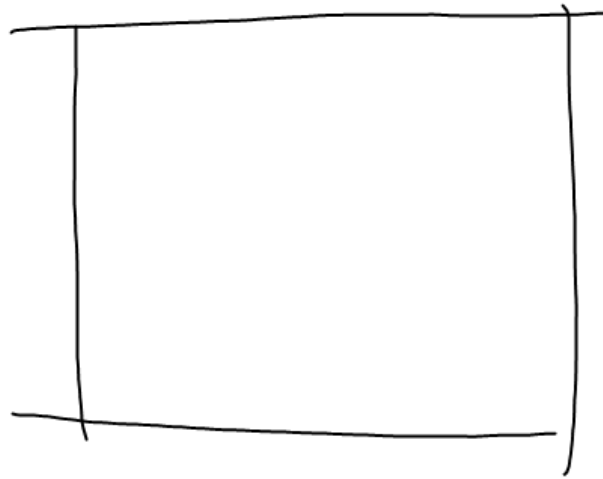
$$C_{10} = -\frac{1}{4} C_1 + \frac{1}{4} C_2 \quad C_{20} = \frac{1}{4} C_1 + \frac{3}{4} C_2$$

$$x(t) = -3 C_{10} e^t + C_{20} e^{5t}$$

$$y(t) = C_{10} e^t + C_{20} e^{5t}$$

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

$$\bar{x} = \left[ e^{At} \right] \bar{x}(0)$$



$$\frac{dP}{dt} = k_1 P - k_2 PD$$

$$\frac{dD}{dt} = -k_3 D + k_4 PD$$