Capítulo 3. Sistemas de Ecuaciones Diferenciales ordinarias Lineales

$x_1(t) \quad x_2(t) \quad \ldots\ldots \quad x_n(t) \qquad n \in \mathbb{N}$

$$
n \left\{
\begin{array}{l}
\dfrac{dx_1(t)}{dt} = a_{11}x_1(t) + a_{12}x_2(t) + \ldots\ldots + a_{1n}x_n(t) + b_1(t) \\[2mm]
\dfrac{dx_2(t)}{dt} = a_{21}x_1(t) + a_{22}x_2(t) + \ldots\ldots + a_{2n}x_n(t) + b_2(t) \\
\qquad\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow \qquad\qquad\qquad \downarrow \qquad\qquad \downarrow \\
\dfrac{dx_n(t)}{dt} = a_{n1}x_1(t) + a_{n2}x_2(t) + \ldots\ldots + a_{nn}x_n(t) + b_n(t)
\end{array}
\right.
$$

$S(n)$ EDOL(1) cc NH.

S(2) EDOL(1) CC NH.

a) $$\frac{dx_1(t)}{dt} = 2x_1(t) + 3x_2(t) + 4e^{2t}$$

b) $$\frac{dx_2(t)}{dt} = x_1(t) + 4x_2(t) + 8t$$

$$x_1(t) \qquad x_2(t)$$

de b)

$$x_1(t) = \frac{dx_2(t)}{dt} - 4x_2(t) - 8t$$

$$\frac{dx_1(t)}{dt} = \frac{d^2x_2(t)}{dt^2} - 4\frac{dx_2(t)}{dt} - 8$$

a) $$\left[\frac{d^2x_2(t)}{dt^2} - 4\frac{dx_2(t)}{dt} - 8\right] = 2\left(\frac{dx_2(t)}{dt} - 4x_2(t) - 8t\right) + 3x_2(t) + 4e^{2t}$$

$$\frac{d^2x_2(t)}{dt} - 6\frac{dx_2(t)}{dt} + 5x_2(t) = 4e^{2t} - 16t + 8$$

$S(n)\ \underbrace{EDOL(1)CC}\ NH$

$\Updownarrow$

$EDOL(n)\ CC\ NH.$

$$\frac{dx_1(t)}{dt} = 2x_1(t) + 3x_2(t) + 4e^{2t}$$

$$\frac{dx_2(t)}{dt} = x_1(t) + 4x_2(t) + 8t$$

$$\bar{x}(t) = \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} \qquad \frac{d}{dt}\bar{x}(t) = \begin{bmatrix} \frac{d}{dt}x_1(t) \\ \frac{d}{dt}x_2(t) \end{bmatrix}$$

$$\frac{d}{dt}\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} = \begin{bmatrix} 2x_1(t) + 3x_2(t) \\ x_1(t) + 4x_2(t) \end{bmatrix} + \begin{bmatrix} 4e^{2t} \\ 8t \end{bmatrix}$$

$$\frac{d}{dt}\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} \times \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 4e^{2t} \\ 8t \end{bmatrix}$$

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

$$\left[e^{At}\right] \to \frac{d}{dt}\left[e^{At}\right] = A\left[e^{At}\right]$$

$$\left[e^{At}\right]_{t=0} = I.$$

$$\left[e^{At}\right]^{-1} = \left[e^{A(-t)}\right]$$

$$\bar{x}(t) = \left[e^{At}\right]\bar{x}(0) + \int_0^t \left[e^{A(t-\tau)}\right]\bar{b}(\tau)\,d\tau.$$

$$\bar{x}(t) = \left[e^{A(t-a)}\right]\bar{x}(a) + \int_a^t \left[e^{A(t-\tau)}\right]\bar{b}(\tau)\,d\tau.$$

$$a \neq 0$$

$$\frac{d^3y(t)}{dt^3} - 4\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} - 8y(t) = 6\cos(3t)$$

EDOL(3) CC NH.

$\longrightarrow$ S(3) EDOL(1) CC NH.

$$y(t) \longrightarrow y_1(t)$$

$$\frac{dy}{dt}(t) \longrightarrow \frac{dy_1(t)}{dt} = y_2(t)$$

$$\frac{d^2y(t)}{dt^2} \longrightarrow \frac{dy_2(t)}{dt} = y_3(t)$$

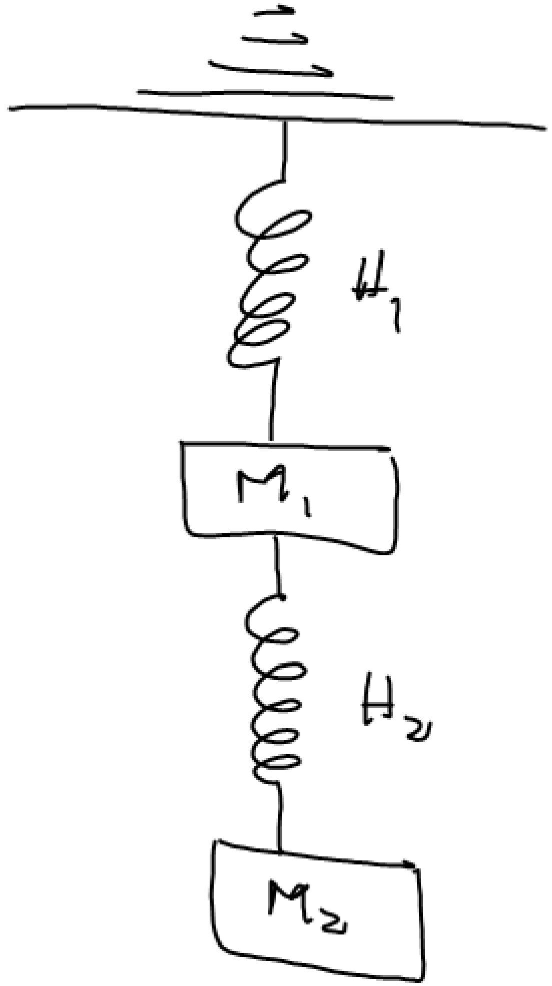
$$\frac{d^3y(t)}{dt} \longrightarrow \frac{dy_3(t)}{dt}$$

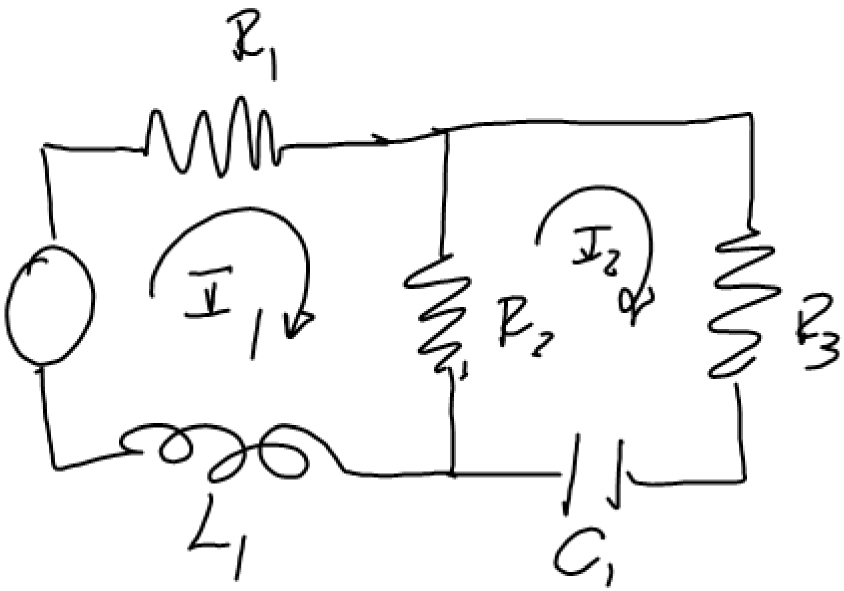
$$\frac{dy_1(t)}{dt} = y_2(t)$$

$$\frac{dy_2(t)}{dt} = y_3(t)$$

$$\frac{dy_3(t)}{dt} = 8y_1(t) - 6y_2(t) + 4y_3(t) + 6\cos(3t)$$

$$\frac{d}{dt}\begin{bmatrix} y_1(t) \\ y_2(t) \\ y_3(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 8 & -6 & 4 \end{bmatrix}\begin{bmatrix} y_1(t) \\ y_2(t) \\ y_3(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 6\cos(3t) \end{bmatrix}$$


H_1
M_1
H_2
M_2


R_1
I
I_2
R_2
R_3
L_1
C_1