Corrección Parcial   Manuel Guio   20211005061

1. $\dddot{x} + \ddot{x} + 2\dot{x} + x = 2f(t) \rightarrow$

$$q_1 = x$$
$$q_2 = \dot{q}_1 = \dot{x}$$
$$q_3 = \dot{q}_2 = \ddot{x}$$
$$\dot{q}_3 = \dddot{x}$$

Variables de Estado

→ Reescribiendo la ecuación

$$= \dot{q}_3 + q_3 + 2q_2 + q_1 = 2f(t)$$

$$= \dot{q}_3 = 2f(t) - q_1 - 2q_2 - q_3$$

$$\rightarrow \begin{bmatrix} \dot{q}_1 \\ \dot{q}_2 \\ \dot{q}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -1 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \\ q_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} f(t)$$

→ Aplicando laplace

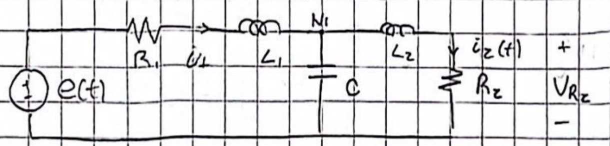
$$= s^3X(s) + s^2X(s) + 2sX(s) + X(s) = 2F(s)$$

$$= X(s)(s^3 + s^2 + 2s + 1) = 2F(s)$$

$$= \frac{X(s)}{F(s)} = G(s) = \frac{2}{s^3 + s^2 + 2s + 1}$$

2.

Salida V_{R_2} Variables Estado: V_c, i_{L_1}, i_{L_2}



$$V_c = L\dot{i}_L$$

$$i_c = C\dot{V}_c$$

Nodo 1

$$i_1 = i_{L_1} \qquad i_2 = i_{L_2} \qquad i_c = C\dot{V}_c$$

$$\rightarrow i_{L_1} = i_c + i_{L_2} \quad = \quad i_{L_1} = C\dot{V}_c + i_{L_2}$$

$$\rightarrow \dot{V}_c = \frac{i_{L_1}}{C} - \frac{i_{L_2}}{C}$$

Malla 1

$$\rightarrow e(t) = V_{R_1} + V_{L_1} + V_c$$

$$= e(t) = i_{L_1}R_1 + L\dot{i}_{L_1} + V_c$$

$$= \dot{i}_{L_1} = -\frac{i_{L_1}R_1}{L_1} - \frac{V_c}{L_1} + \frac{e(t)}{L_1}$$

Malla 2

$$\rightarrow V_c = V_{L_2} + V_{R_2}$$

$$= V_c = L\dot{i}_{L_2} + i_{L_2}R_2$$

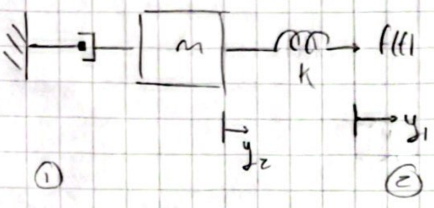
$$= \dot{i}_{L_2} = \frac{V_c}{L_2} - \frac{i_{L_2}R_2}{L_2}$$

$\rightarrow V_{R_2} = i_{L_2} \cdot R_2$

$$\begin{bmatrix} \dot{V}_c \\ \dot{i}_{L_1} \\ \dot{i}_{L_2} \end{bmatrix} = \begin{bmatrix} 0 & 1/C & -1/C \\ -1/L_1 & -\frac{R_1}{L_1} & 0 \\ 1/L_2 & 0 & \frac{-R_2}{L_2} \end{bmatrix} \begin{bmatrix} V_c \\ i_{L_1} \\ i_{L_2} \end{bmatrix} + \begin{bmatrix} 0 \\ 1/L_1 \\ 0 \end{bmatrix} e(t)$$

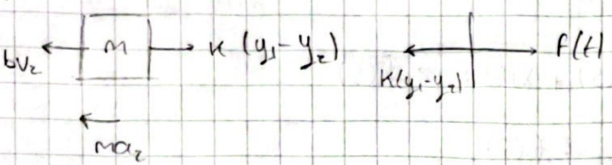
$$V_{R_2} = \begin{bmatrix} 0 & 0 & R_2 \end{bmatrix} \begin{bmatrix} V_c \\ i_{L_1} \\ i_{L_2} \end{bmatrix}$$

3.



Salidas y_1, y_2

$\rightarrow$



$\rightarrow \Sigma F = 0$

$= M\ddot{y}_2 + b\dot{y}_2 = K(y_1 - y_2)$ ①

$= \ddot{y}_2 = \frac{K}{m} y_1 - \frac{K}{m} y_2 - \frac{B}{m} \dot{y}_2$

$K(y_1 - y_2) = f(t)$

$\rightarrow$

$K y_1 - K y_2 = f(t)$

$\rightarrow y_1 = \frac{f(t)}{K} + y_2$

$= m\ddot{y}_2 + B\dot{y}_2 = f(t)$

$\rightarrow \ddot{y}_2 = \frac{f(t)}{m} - \frac{B}{m} \dot{y}_2$

$q_1 = y_2$

$q_2 = \dot{q}_1 = \dot{y}_2$

$\dot{q}_2 = \ddot{y}_2$

$$\begin{bmatrix} \dot{q}_1 \\ \dot{q}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & -\frac{B}{m} \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1/m \end{bmatrix} f(t)$$

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \end{bmatrix} + \begin{bmatrix} 1/K \\ 0 \end{bmatrix} f(t)$$