Corrección 1er parcial

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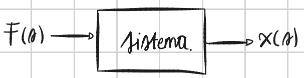
① $\dddot{x}+\ddot{x}+2\dot{x}+x=2f(t)$

$\mathcal{L}(\dddot{x}+\ddot{x}+2\dot{x}+x=2f(t))$

$s^3x(s)+s^2x(s)+2sx(s)+x(s)=2f(s)$

$x(s)[s^3+s^2+2s+1]=2f(s)$

$\frac{x(s)}{f(s)}[s^3+s^2+2s+1]=2$



$\frac{x(s)}{f(s)}=\frac{2}{s^3+s^2+2s+1}=G(s)$

Espacio de Estados.

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

$\dddot{x}=2f(t)-\ddot{x}-2\dot{x}-x$

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

$q_1=x$

$q_2=\dot{x}=\dot{q}_1$

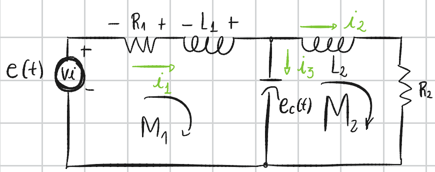
$q_3=\ddot{x}=\dot{q}_2$

$\cancel{q_4}=\dddot{x}=\dot{q}_3=\ddot{q}_2$

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

$$x=[1\ 0\ 0]\begin{bmatrix}q_1\\q_2\\q_3\end{bmatrix}$$

②



Variables de estado ① $V_{L_1}=L_1\frac{di_1(t)}{dt}$ ② $V_{L_2}=L_2\frac{di_2(t)}{dt}$ ③ $i_c=C\frac{dV_c(t)}{dt}$

Malla #1

$V_i=V_{R_1}+V_{L_1}+V_c$

Malla #2.

$V_c=V_{L2}+V_{R_2}$

Nodo V_1 $\dot{i}_1=i_3+i_2$

Para $VL_1\longrightarrow VL_1=V_i-V_{R_1}-V_c$

$VL_1=V_i-R_1i_1-V_c$

$$\frac{di_1}{dt}=\frac{V_i}{L_1}-\frac{R_1}{L_1}i_1-\frac{1}{L_1}V_c \quad ①$$

con $i_3=i_c\longrightarrow i_1=i_3+i_2$

$i_c=i_3=i_1+i_2$

$C\frac{d(V_c)(t)}{dt}=\ ...$

$$\dot{V}_c=\frac{i_1}{C}-\frac{1}{C}i_2$$

Para $V_{L_2}\longrightarrow V_{L_2}=V_c-V_{R_2}$

$VL_2=V_c-R_2i_2$

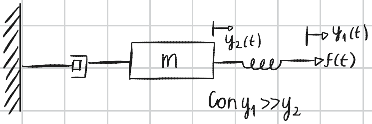
$L_2\frac{di_2(t)}{dt}=V_c-R_2i_2$

$$\frac{di_2(t)}{dt}=\frac{1}{L_2}V_c-\frac{R_2i_2}{L_2} \quad ②$$

Espacio de Estados:

$$\begin{bmatrix}\dot{i}_1\\ \dot{i}_2\\ \dot{V}_c\end{bmatrix}=\begin{bmatrix}\frac{-R_1}{L_1}&0&\frac{-1}{L_1}\\0&\frac{-R_2}{L_2}&\frac{-1}{L_2}\\\frac{1}{C}&\frac{-1}{C}&0\end{bmatrix}\begin{bmatrix}i_1\\i_2\\V_c\end{bmatrix}+\begin{bmatrix}\frac{1}{L_1}\\0\\0\end{bmatrix}V_i$$

$$V_{R_2}=\begin{bmatrix}0&R_2&0\end{bmatrix}\begin{bmatrix}i_1\\i_2\\V_c\end{bmatrix}$$



Con $y_1 >> y_2$

Para y_2

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

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

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

Para y_1

$$0 = f(t) - K(y_1 - y_2)$$

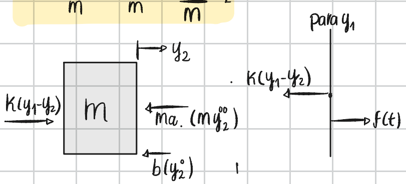
$q_1 = y_2$

$q_3 = y_1$

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

$\cancel{q_3} = \ddot{y}_2 = \dot{q}_2$

$$\dot{q}_2 = \frac{-bq_2}{m} + \frac{Kq_3}{m} - \frac{K}{m}q_1$$



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

$$\begin{bmatrix}y_1\\ y_2\end{bmatrix} = \begin{bmatrix}0 & 0 & 1\\ 1 & 0 & 0\end{bmatrix}\begin{bmatrix}q_1\\ q_2\\ q_3\end{bmatrix}$$