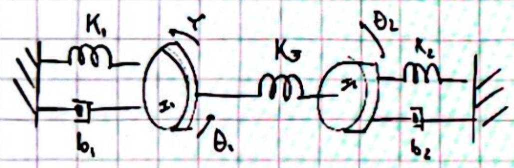
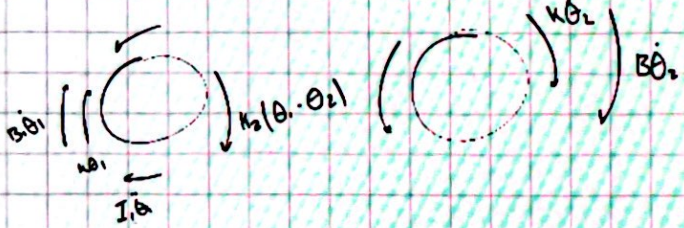
Masas rotacionales





$\rightarrow\ I_1\ddot\theta_1 + B_1\dot\theta_1 + K_1\theta_1 + K_3(\theta_1-\theta_2) = \tau$

$= I_1\ddot\theta_1 + B_1\dot\theta_1 + K_1\theta_1 + K_3\theta_1 - K_3\theta_2 = \tau$

$= I_1\ddot\theta_1 + B_1\dot\theta_1 + \theta_1(K_3+K_1) - K_3\theta_2 = \tau$ ①

$\rightarrow\ K_3(\theta_1-\theta_2) - K_2\theta_2 - B_2\dot\theta_2 - I_2\ddot\theta_2 = 0$

$= K_3\theta_1 - K_3\theta_2 - K_2\theta_2 - B_2\dot\theta_2 - I_2\ddot\theta_2 = 0$

$= I_2\ddot\theta_2 + B_2\dot\theta_2 + K_2\theta_2 + K_3\theta_2 - K_3\theta_1 = 0$

$= I_2\ddot\theta_2 + B_2\dot\theta_2 + \theta_2(K_2+K_3) - K_3\theta_1 = 0$ ②

$\rightarrow\ q_1 = \theta_1 \qquad q_3 = \theta_2$

$q_2 = \dot q_1 = \dot\theta_1 \qquad q_4 = \dot q_3 = \dot\theta_2$

$\dot q_2 = \ddot\theta_1 \qquad \dot q_4 = \ddot\theta_2$

Despejando de ① y ② $\ddot\theta_1$ y $\ddot\theta_2$ respectivamente

$\rightarrow\ I_1\overset{\dot q_2}{\cancel{\ddot\theta_1}} + B_1\overset{q_2}{\cancel{\dot\theta_1}} + \overset{q_1}{\cancel{\theta_1}}(K_3+K_1) - K_3\overset{q_3}{\cancel{\theta_2}} = \tau$ ①

$= \dot q_2 = \frac{\tau}{I_1} - \frac{B_1}{I_1}q_2 - \frac{(K_3+K_1)}{I_1}q_1 + \frac{K_3}{I_1}q_3$

$\rightarrow\ I_2\overset{\dot q_4}{\cancel{\ddot\theta_2}} + B_2\overset{q_4}{\cancel{\dot\theta_2}} + \overset{q_3}{\cancel{\theta_2}}(K_2+K_3) - K_3\overset{q_1}{\cancel{\theta_1}} = 0$ ②

$= \dot q_4 = -\frac{B_2}{I_2}q_4 - \frac{(K_2+K_3)}{I_2}q_3 + \frac{K_3}{I_2}q_1$

$$\begin{bmatrix}\dot q_1\\ \dot q_2\\ \dot q_3\\ \dot q_4\end{bmatrix} = \begin{bmatrix}0 & 1 & 0 & 0\\ -(K_3+K_1)/I_1 & -\frac{B_1}{I_1} & \frac{K_3}{I_1} & 0\\ 0 & 0 & 0 & 1\\ K_3/I_2 & 0 & -\frac{(K_2+K_3)}{I_2} & -\frac{B_2}{I_2}\end{bmatrix}\begin{bmatrix}q_1\\ q_2\\ q_3\\ q_4\end{bmatrix} + \begin{bmatrix}0\\ 1/I_1\\ 0\\ 0\end{bmatrix}\tau$$