Juan Esteban Morano Goenz 2021100505 2

Tarea 2

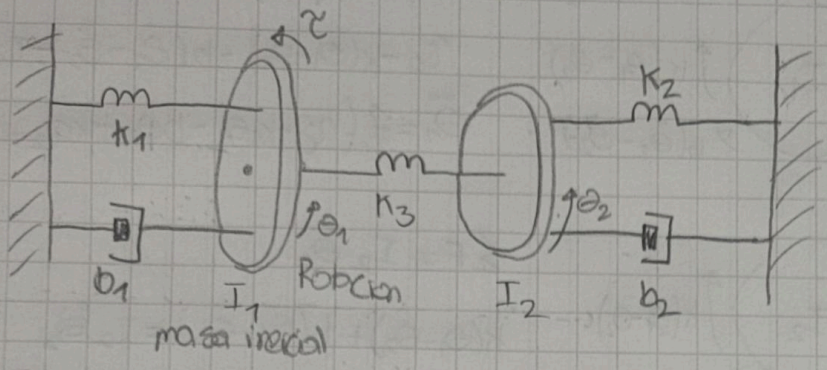
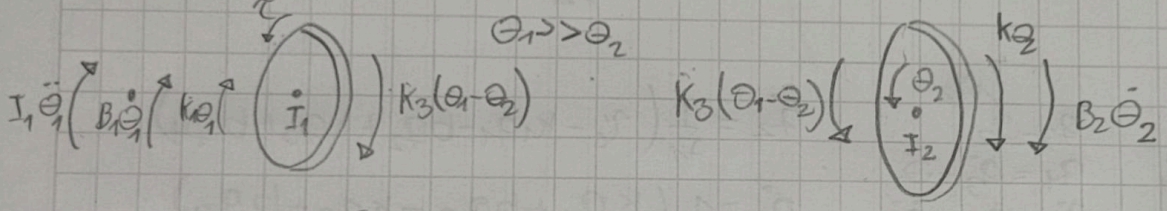


Diagrama de cuerpo libre



$$-I_1\ddot{\theta}_1 + B_1\dot{\theta}_1 + K_1\theta_1 + K_3(\theta_1-\theta_2) = \tau$$

$$-K_3(\theta_1-\theta_2) - B_2\dot{\theta}_2 - K_2\theta_2 - I_2\ddot{\theta}_2 = 0$$

$$-\tau = \ddot{\theta}_1 I_1 + B_1\dot{\theta}_1 + \theta_1(K_1+K_3) - \theta_2 K_3$$

$$-0 = \ddot{\theta}_2 I_2 + B_2\dot{\theta}_2 + \theta_2(K_3+K_2) - K_3\theta_1 = 0$$

$q_1 = \theta_1$
$q_2 = \dot{\theta}_1 = \dot{q}_1$
$q_3 = \theta_2$
$q_4 = \dot{\theta}_2 = \dot{q}_3$

$\dot{q}_2 = \ddot{\theta}_1$
$\dot{q}_4 = \ddot{\theta}_2$

$Y_1 = q_1 = \theta_1$
$Y_2 = q_3 = \theta_2$

$$\tau = \dot{q}_2 I_1 + B_1 q_2 + q_1(K_1+K_3) - q_3 K_3$$

$$0 = \dot{q}_4 I_1 + B_2 q_4 + q_3(K_3+K_2) - K_3 q_1$$

$$\dot{q}_2 = \left(\frac{1}{I_1}\right)\tau - \left(\frac{B_1}{I_1}\right)q_2 - \left(\frac{K_1+K_3}{I_1}\right)q_1 + \left(\frac{K_3}{I_1}\right)q_3$$

$$\dot{q}_4 = \left(\frac{K_3}{I_2}\right)q_1 - \left(\frac{K_3+K_2}{I_2}\right)q_3 - \left(\frac{B_2}{I_2}\right)q_4$$

$$\begin{bmatrix} \dot{q}_1 \\ \dot{q}_2 \\ \dot{q}_3 \\ \dot{q}_4 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -\left(\frac{K_1+K_3}{I_1}\right) & -\frac{B_1}{I_1} & \frac{K_3}{I_1} & 0 \\ 0 & 0 & 0 & 1 \\ \frac{K_3}{I_2} & 0 & -\left(\frac{K_3+K_2}{I_2}\right) & -\frac{B_2}{I_2} \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \\ q_3 \\ q_4 \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{I_1} \\ 0 \\ 0 \end{bmatrix} \tau$$

$$\begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \\ q_3 \\ q_4 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \end{bmatrix} \tau$$