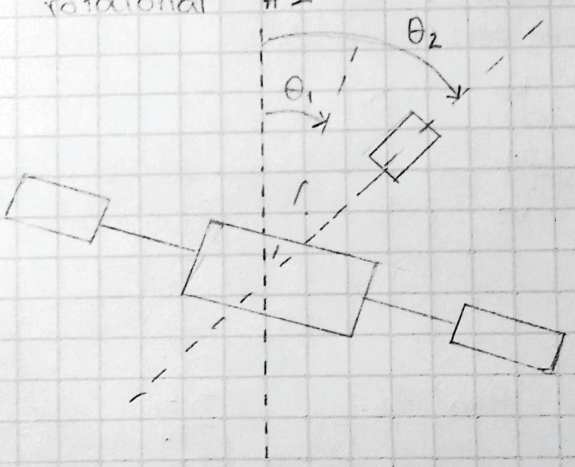
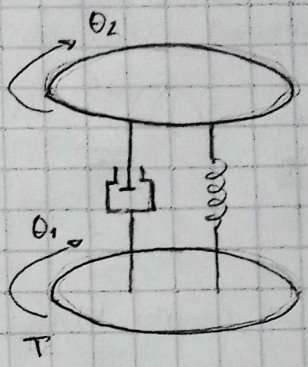
Sistema rotacional #2

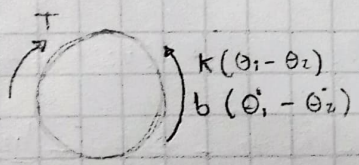
θ_1 body
θ_2 sensor





Diagramas de cuerpo libre

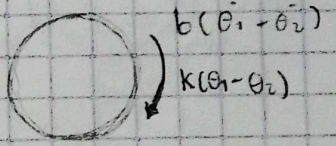
Para θ_1:



$$T - k(\theta_1 - \theta_2) - b(\dot{\theta}_1 - \dot{\theta}_2) = I_1 \ddot{\theta}_1$$

$$\ddot{\theta}_1 = \frac{T}{I_1} - \frac{k}{I_1}(\theta_1 - \theta_2) - \frac{b}{I_1}(\dot{\theta}_1 - \dot{\theta}_2)$$

Para θ_2:



$$k(\theta_1 - \theta_2) + b(\dot{\theta}_1 - \dot{\theta}_2) = I_2 \ddot{\theta}_2$$

$$\ddot{\theta}_2 = \frac{k}{I_2}(\theta_1 - \theta_2) + \frac{b}{I_2}(\dot{\theta}_1 - \dot{\theta}_2)$$

$q_1 = \theta_1$
$q_2 = \dot{q}_1 = \dot{\theta}_1$
$\dot{q}_2 = \ddot{\theta}_1$
$q_3 = \theta_2$
$q_4 = \dot{q}_3 = \dot{\theta}_2$
$\dot{q}_4 = \ddot{\theta}_2$

$$\dot{q}_2 = \frac{T}{I_1} - \frac{k}{I_1} q_1 + \frac{k}{I_1} q_3 - \frac{b}{I_1} q_2 + \frac{b}{I_1} q_4$$

$$\dot{q}_4 = \frac{k}{I_2} q_1 - \frac{k}{I_2} q_3 + \frac{b}{I_2} q_2 - \frac{b}{I_2} q_4$$

$$\begin{bmatrix} \dot{q}_1 \\ \dot{q}_2 \\ \dot{q}_3 \\ \dot{q}_4 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -k/I_1 & -b/I_1 & k/I_1 & b/I_1 \\ 0 & 0 & 0 & 1 \\ k/I_2 & b/I_2 & -k/I_2 & -b/I_2 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \\ q_3 \\ q_4 \end{bmatrix} + T \begin{bmatrix} 0 \\ 1/I_1 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} \theta_1 \\ \theta_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \\ q_3 \\ q_4 \end{bmatrix}$$