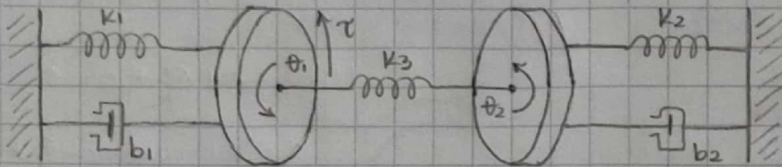
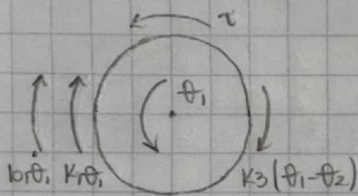


## Tarea: Espacio de estados Sistema Rotacional

Encontrar el espacio de estados del siguiente sistema: considerar  $\theta_1 \gg \theta_2$ .

\* Para el disco 1:

$$\sum F = I a = I_1 \ddot{\theta}_1$$

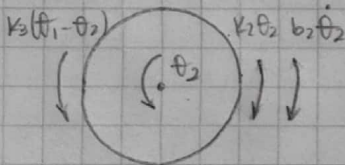


$$\tau - K_1 \theta_1 - b_1 \dot{\theta}_1 - K_3 (\theta_1 - \theta_2) = I_1 \ddot{\theta}_1$$

$$\hookrightarrow \ddot{\theta}_1 = \frac{\tau}{I_1} + \left( \frac{-K_1 - K_3}{I_1} \right) \theta_1 - \frac{b_1}{I_1} \dot{\theta}_1 + \frac{K_3}{I_1} \theta_2$$

\* Para el disco 2:

$$\sum F = I a = I_2 \ddot{\theta}_2$$



$$K_3 (\theta_1 - \theta_2) - K_2 \theta_2 - b_2 \dot{\theta}_2 = I_2 \ddot{\theta}_2$$

$$\hookrightarrow \ddot{\theta}_2 = \frac{K_3}{I_2} \theta_1 + \left( \frac{-K_3 - K_2}{I_2} \right) \theta_2 - \frac{b_2}{I_2} \dot{\theta}_2$$

\* Variables de estado:

$$q_1 = \theta_1$$

$$q_3 = \theta_2$$

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

$$q_4 = \dot{q}_3 = \dot{\theta}_2$$

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

$$\dot{q}_4 = \ddot{q}_3 = \ddot{\theta}_2$$

$$\begin{bmatrix} \dot{q}_1 \\ \dot{q}_2 \\ \dot{q}_3 \\ \dot{q}_4 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ \frac{-(K_1 + K_3)}{I_1} & -b_1/I_1 & K_3/I_1 & 0 \\ 0 & 0 & 0 & 1 \\ K_3/I_2 & 0 & \frac{-(K_3 + K_2)}{I_2} & -b_2/I_2 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \\ q_3 \\ q_4 \end{bmatrix} + \begin{bmatrix} 0 \\ 1/I_1 \\ 0 \\ 0 \end{bmatrix} \tau$$

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