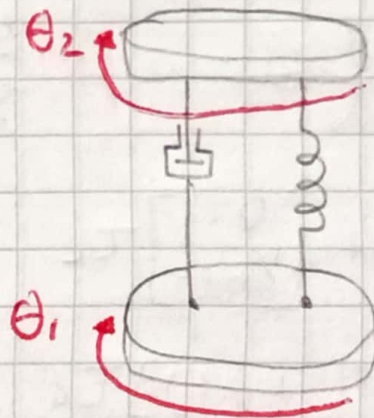
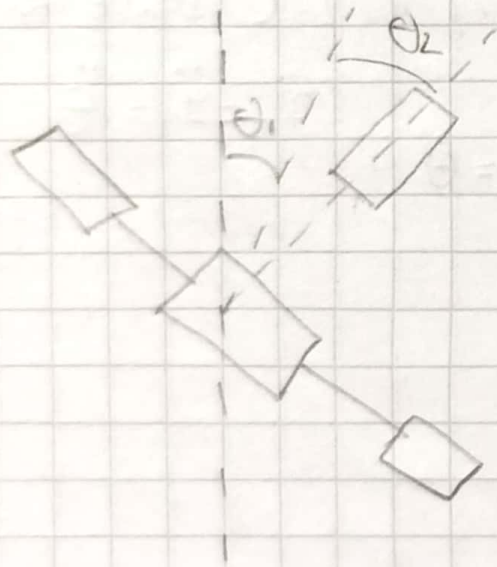
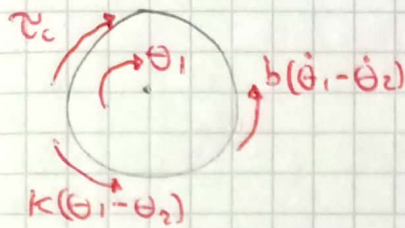


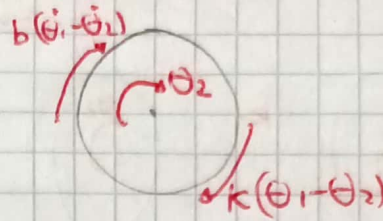
Espacio de estados sistema rotacional
de 1 satélite



Disco 1



Disco 2



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

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

$$\ddot{\theta}_1 = \frac{\tau_c}{I_1} - \frac{k}{I_1} \theta_1 + \frac{k}{I_1} \theta_2 - \frac{b}{I_1} \dot{\theta}_1 + \frac{b}{I_1} \dot{\theta}_2$$

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

$$q_1 = \theta_1$$

$$q_3 = \theta_2$$

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

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

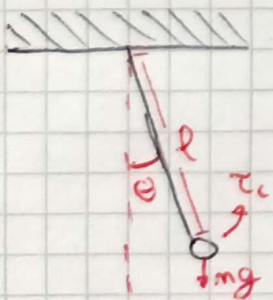
$$\ddot{q}_2 = \ddot{q}_1 = \ddot{\theta}_1$$

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

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

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

Espacio de estados del péndulo simple



$$\tau_c - mgl \sin(\theta) = ml^2 \ddot{\theta}$$

$$\ddot{\theta} = \frac{\tau_c}{ml^2} - \frac{g}{l} \sin \theta$$

linealizamos con $\theta \ll 1$
de manera que $\sin(\theta) \approx \theta$

$$\ddot{\theta} = \frac{\tau_c}{ml^2} - \frac{g}{l} \theta$$

$$q_1 = \theta$$

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

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

$$\begin{bmatrix} \dot{q}_1 \\ \dot{q}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -g/l & 0 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1/ml^2 \end{bmatrix} \tau_c$$

$$\theta = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \end{bmatrix} + \begin{bmatrix} 0 \end{bmatrix} \tau_c$$