



$$T_c - mg \sin \theta = I \ddot{\theta}$$

$$\ddot{\theta} + \frac{g}{l} \sin \theta - \frac{T_c}{ml^2} = 0$$

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

$$q_1 = \theta$$

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

$$q_3 = \dot{q}_2$$

$$\Rightarrow q_2 = \frac{T_c}{ml^2} - \frac{g}{l} \sin q_1$$

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

$$[q_1] = [1 \ 0] \begin{bmatrix} q_1 \\ q_2 \end{bmatrix}$$