1. Items done this session:

TASK-1: Using the information provided in the "Dynamics" document, derive the dynamic equations for our "Robot" (single inverted pendulum as shown in the above figure). This should result in one equation for each joint (two equations).

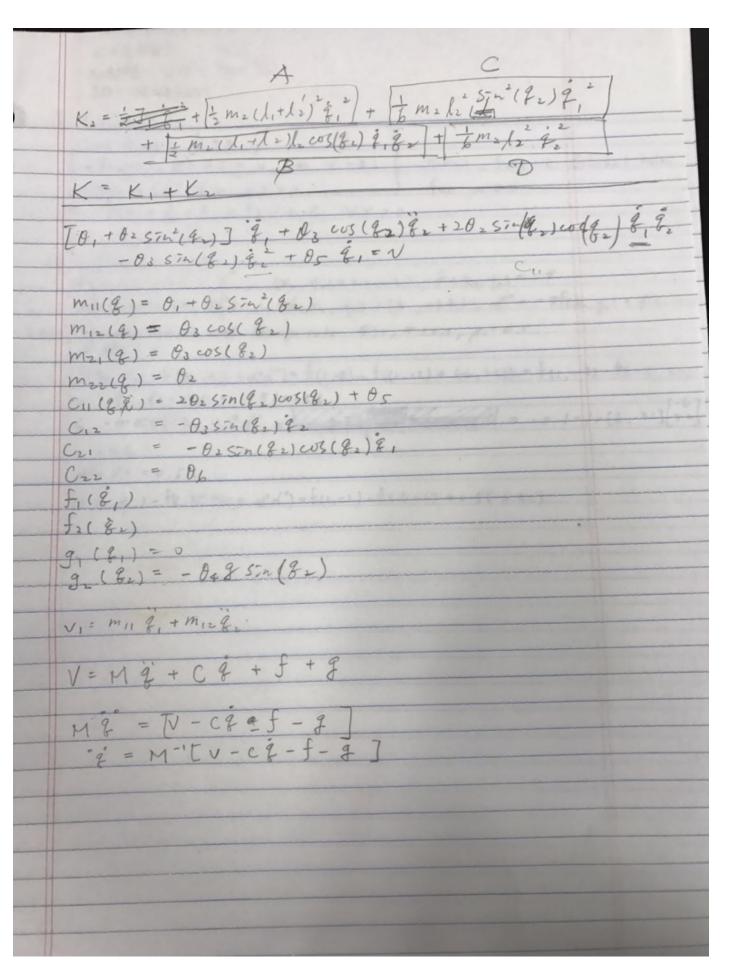
In this session, we continue to work on mathematical derivation of Lagrangian Dynamics equation.

$$V = m_1 q_{2\alpha} + m_2 q_{1\alpha} \cos q_{1\alpha}, \qquad \theta_1' = rn_2 l_{1\alpha}, \\ d_1(q, \dot{q}) = K - V \\ = i \theta_1' + b_1' \sin^2 q_{1\lambda}] \dot{\theta}_1^2 + \theta_2' \cos q_{1\lambda} \dot{q}_1 \ddot{q}_2 + \frac{1}{5} (b_1' \dot{q}_2')^2 - rn_1 g_{2\alpha}^2 - \theta_2 g_{2\alpha}^2 q_2 \\ \frac{d}{dt} \frac{dI(q, \dot{q})}{dt_1} - \frac{dI(q, \dot{q})}{dq_2} = r, \\ \frac{\partial I(q, \dot{q})}{\partial q_2} = 0 \\ \frac{d}{dt} \frac{dI(q, \dot{q})}{d\dot{q}_1} = 2 l_1' \sin q_{1\lambda} \cos q_{1\lambda} \dot{q}_1 \dot{q}_1 + l_2' \cos q_{1\lambda}) \dot{q}_2 \\ + l_2' \cos q_{1\lambda} \cos q_{1\lambda} \cos q_{1\lambda} \cos q_{1\lambda} \dot{q}_1 + l_2' \cos q_{1\lambda}) \ddot{q}_2 - l_2' \sin q_{1\lambda} \sin q_{1\lambda} \cos q_{1\lambda}) \ddot{q}_2 - l_2' \sin q_{1\lambda} \cos q_{1\lambda} \dot{q}_2 \dot{q}_2 - l_2' \sin q_{1\lambda} \cos q_{1\lambda}) \dot{q}_2' - l_2' g_1' \sin q_{1\lambda} \cos q_{1\lambda}) \dot{q}_1' + l_2' g_1' \cos q_1' g_1' + l_2'$$

TASK-2: Arrange the equations in the matrix form shown below where 'v' represents voltage and 'q' represents the generalized coordinate system (joint variables).

$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} m_{11}(q) & m_{12}(q) \\ m_{21}(q) & m_{22}(q) \end{bmatrix} * \begin{bmatrix} \ddot{q_1} \\ \ddot{q_2} \end{bmatrix} + \begin{bmatrix} c_{11}(q,\dot{q}) & c_{12}(q,\dot{q}) \\ c_{21}(q,\dot{q}) & c_{22}(q,\dot{q}) \end{bmatrix} * \begin{bmatrix} \dot{q_1} \\ \dot{q_2} \end{bmatrix} + \begin{bmatrix} f_1(\dot{q}_1) \\ f_2(\dot{q}_2) \end{bmatrix} + \begin{bmatrix} g_1(q_1) \\ g_2(q_2) \end{bmatrix}$$

After finishing Task-1, where transfer energy with gear ratio to voltage, then we separated two equations of each robot joint into a matrix form with individual coefficient.



2. Items for next session:

Implementing the equation into MATLAB function and build simulation.