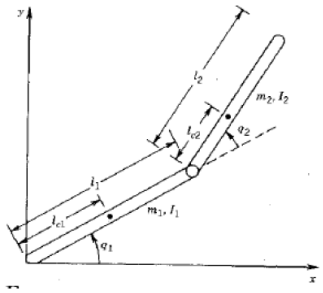
MECEE 4602

This homework is optional, it can replace a grade of a previous HW

Homework 8

Consider the two-link planar manipulator shown below with link length l_1, l_2, mass m_1, m_2, the distance of the center of mass of the links from the joints l_{c1}, l_{c2}, and centroid moment of inertia I_1, I_2. The coordinates describing the system are q_1, q_2 and the respective joint torques τ_1, τ_2.



1. Using the equations of motion derived in HW6 and HW7 for this 2-link manipulator. Implement a controller in Matlab using the computed torque method for this sytem. Assume all parameters are unit in their respective MKS units and the center of mass for each link is located at its midpoint.

   Use the following boundary conditions to plan a motion using a 3^{rd} order polynomial:

$$t_f = 5s$$

$$q_1^d(0) = 0 \ , \ q_2^d(0) = 0$$

$$\dot{q}_1^d(0) = 0 \ , \ \dot{q}_2^d(0) = 0$$

$$q_1^d(t_f) = \frac{\pi}{3} \ , \ q_2^d(t_f) = \frac{\pi}{4}$$

$$\dot{q}_1^d(t_f) = 0 \ , \ \dot{q}_2^d(t_f) = 0$$

2. Show the same plots as the example code for tracking desired trajectory of each joint assuming the system is modeled perfectly.
3. Show the same plots as the example code for tracking desired trajectory of each joint but add a modeling error to the actual system.
4. Change the controller gains, modeling error and boundary conditions and run the simulation again. Explain the changes of the tracking performance observed.

   You can adapt the example provided or create your own functions, notice the example is for a single link and it uses Matlab object-oriented programming

Submission:

1. Please zip all code files and writing part of your homework into **one file (.zip)** and submit online before 11:59 pm on Wednesday (Nov. 30).
2. **IMPORTANT: No late submission is allowed.**

You can submit your homework on Courseworks however many times you want before the deadline. Please submit it early so that you will not run into unsuccessful submission. Please make sure the final version of your submission is the version that you want to be graded since this is a **hard deadline** and **no late change in submission will be taken for any excuses**.