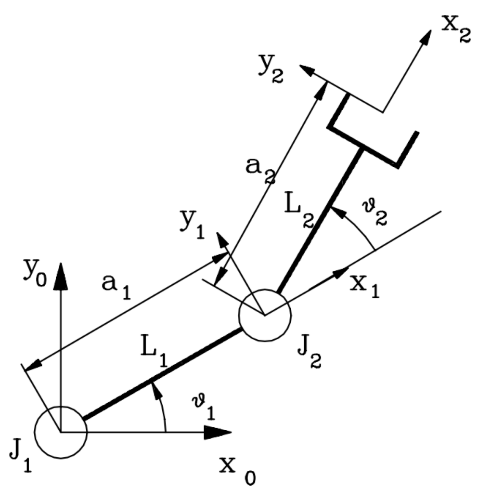
Problem 1

partial credits will be given if you complete a subset of the problems:
Consider the twolink robotic arm (not a planar):



Using the provided matlab code in homework 4 (TwoLinkArm.m) for a two-link arm manipulator.
Let $\mathbf{q} = [q_1, q_2]^\intercal$ where $q_1 = \theta_1$ and $q_2 = \theta_2$. The dynamic model of the system is given by

$$M(\mathbf{q}, \dot{\mathbf{q}})\ddot{\mathbf{q}} + C(\mathbf{q}, \dot{\mathbf{q}})\dot{\mathbf{q}} + N(\mathbf{q}) = \tau$$

Using the provided matlab code, which include the symbolic expressions for matrices $M(\cdot)$, $C(\cdot)$, $N(\cdot)$. Implement:

2.5pt A PD+gravity compensation control for set point tracking in the *task space*, with a chosen set point (reachable in the task space).

5pt Inverse dynamic control in the task space for tracking a trajectory of a cycle with unit radius r. That is $x(t) = r\cos(t)$ and $y(t) = r\sin(t)$ (with this r up to your choice). Evaluate your controller experimentally with initial state error in the task space. That is, the initial state of the end effector is not on the trajectory.

5pt Implement the passivity based control in the task space for the same tracking problem. Compare the two controllers for trajectory tracking in terms of input efforts and error rejection.