HW 3, 10/27/2020

Robot Dynamics

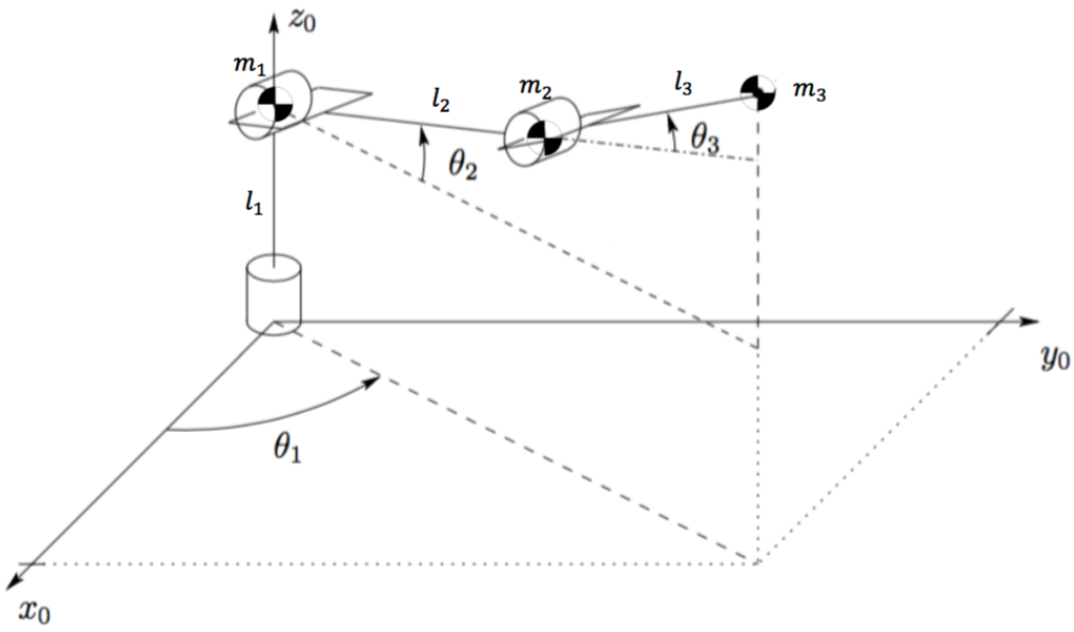
Due: Tuesday, 11/10/2020 @11:59 PM

Problem 1: Three-Link Arm Robot – Dynamic Modeling (Point Masses)

For the 3-link RRR elbow manipulator (3-DOF) shown below, let l_1, l_2, and l_3 be the length of the three links. Also let m_1 , m_2, and m_3 be the masses of the three links.

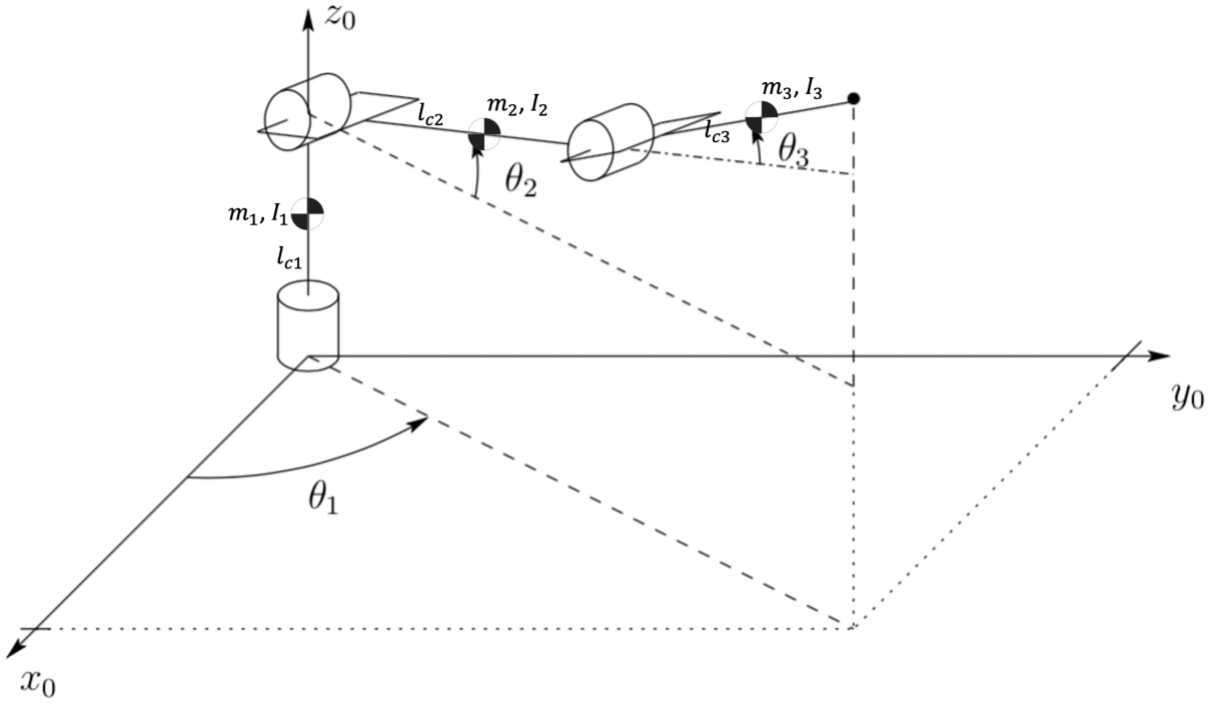
a) Form the dynamical model of the robot symbolically in the compact form $\tau = M(q)\ddot{q} + C(q,\dot{q})\dot{q} + g(q)$.

b) Consider : $l_1 = l_2 = l_3 = 0.3\,m$, $m_1 = m_2 = m_3 = 0.5\,kg, g = 9.8$. Then, using the model derived in Part a), solve, numerically, for the dynamical model of the robot when the robot is in its home position i.e. $q_i = \theta_i = 0$.



Problem 2: Three-Link Arm Robot – Dynamic Modeling (Lagrange's Method)

For the 3-link RRR elbow manipulator (3-DOF) shown below, let l_{c1}, l_{c2}, and l_{c3} be the distances of the centers of mass of the three links from the respective joint axes and l_1, l_2, and l_3 be the length of the three links. Also let m_1 , m_2, and m_3 be the masses of the three links. Finally, let I_1, I_2, and I_3 be the moments of inertia *relative to the centers of mass* of the three links, respectively. For this problem, Symbolically, derive the total kinetic energy of the robot and form the 3-by-3 Inertia Matrix $D(q)$.



Good Luck!