

Assignment - Module 4

18th January 2024

Instructions:

- Please go through the provided material fully while attempting the questions, and mention the intermediate steps clearly.
- Total Marks : 20 (4 marks for each sub part)
- Due date: 25th January 2024

- Q 1. The shown 2-R manipulator in Figure 1 consists of mass-less rods of length L_1 and L_2 and masses m_1 and m_2 .
- Find the Kinetic and Potential Energies of m_1 , m_2 and the entire manipulator.
 - Define the Lagrangian function for the manipulator
 - Using the Lagrangian function derive the Euler-Lagrange Dynamics for the manipulator.
 - Clearly show the Mass matrix(M), the combined Coriolis and Centripetal terms matrix (C), the gravity term matrix(G) for the standard Euler-Lagrange model for the manipulator.

$$M(\theta)\ddot{\theta} + C(\theta, \dot{\theta}) + g(\theta) = \tau \quad (1.1)$$

where $\theta = [\theta_1^T \theta_2^T]^T$

- Assuming 1.1 as the compact formulation for the Euler-Lagrange model you have derived, derive the control input $\tau_{desired}$.

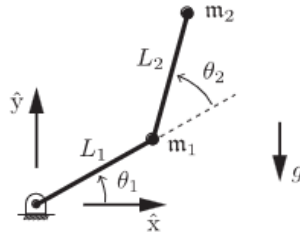


Figure 1: 2R Manipulator