Hand-In Exercise: Admittance Controller

Name 1 (Username 1), Name 2 (Username 2), Name 3 (Username 3)

1 System Modeling

Insert a sketch of the robot including kinematic parameters.

1.1 Robot Dynamics including External Forces

Insert the equations of motion for the robot including external force. You should not compute the dynamical equations but only write the symbolic equation. Also add an external force at the end-effector to the robot simulation in Simulink.

2 Admittance Control

Design an admittance controller in operational space with the orientational part expressed with quaternion.

2.1 Control Law

Describe the admittance controller in operational space.

2.2 Gain Selection

Write how the gains should be selected to obtain a critically damped system.

2.3 Implementation

The controller should be implemented in discrete time with a sample frequency of 500 Hz. Explain the implementation. You should modify the subsystems "Admittance Controller" and "Inverse Kinematics". You can choose if you want to control the robot with velocity or position commands.

3 Simulation

Insert simulation results for the admittance controlled robot. The admittance controller should have a desired motion of your choice. In addition, no external force should be applied for the first five seconds, then a force $f = (1, 2, 3)$ N should be added for five seconds, then no external force for five seconds, then a torque $\mu = (1, 0.5, 1)$ Nm for five seconds and lastly no external force for five seconds. You should include figures that documents the simulation including applied wrench, desired motion, actual motion.