

MECH 544
Robotics

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PROJECT 01

In this project, you will derive the forward and inverse kinematics of the PHANToM (Model 1.0) haptic interface (see the details below). The PHANToM haptic device enables 3D touch interactions with virtual objects ($L_1 = 14\text{ cm}$, $L_2 = 14\text{ cm}$).

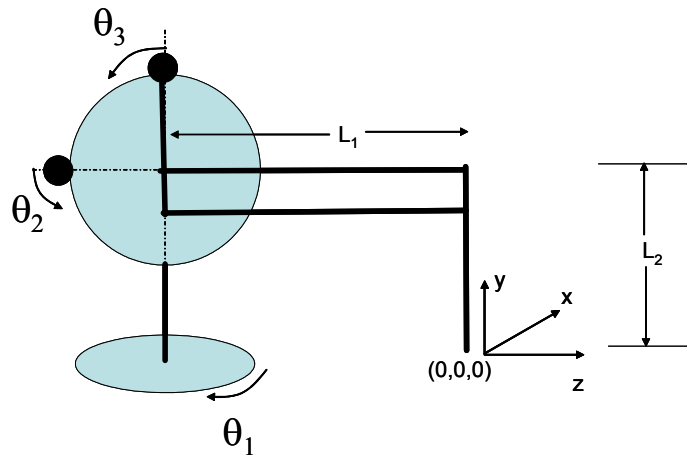


Figure 1. The equilibrium position for PHANToM haptic device. Note that the encoders read end-effector position with respect to the coordinate frame given in the figure.

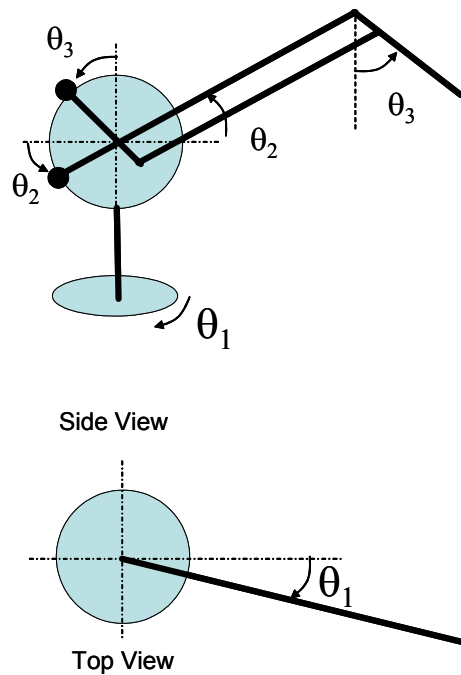


Figure 2. The top and side views of the PHANToM haptic device.

Project Details:

- a) Derive the forward kinematics of the robot arm
- b) Derive the inverse kinematics of the robot arm
- c) Write a MATLAB function that calculates the end effector position for the given joint angles (with respect to the coordinate frame given in Figure 1)
- d) Write a MATLAB function that calculates the joint angles for the given end-effector position (with respect to the directions given in Figure 2)

Notes:

- Visit the laboratory (ENG-259) and run the utility program that prints out the joint angles and end-effector position as you manipulate the Phantom arm. You can use this utility program to check your forward and inverse kinematics computations.
- You can take advantage of the symbolic computation package of MATLAB to derive the equations for forward and inverse kinematics.