

Homework 11

16-311: Introduction to Robotics

2018

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1 Learning Objectives

1. Build up the basic concepts of inverse kinematics.
2. Understand the limitations of motion based on given mechanical system.

2 Workspace of PR Arm

Draw the workspace for a PR arm as shown in the following image. Show all the locations where the end effector can reach. Point out where there are 0, 1, and multiple solutions. Assume that the prismatic joint can have length between 0 and infinity. Assume that there are no joint limits for the revolute joint.

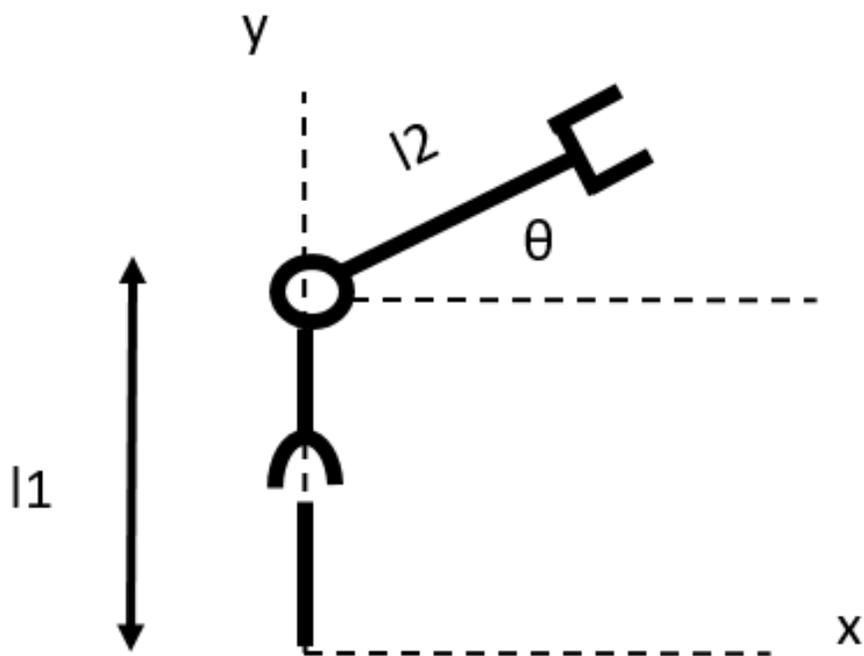


Figure 1: PR arm

3 Inverse Kinematics of PR Arm

Come up with the inverse kinematics for the same robot arm described in the previous section. Write an equation for the length of the prismatic and the angle of the revolute joint in terms of just the position (x,y) of the end effector. Let the second link be length l_2 .

4 Three Link Workspace

Draw the workspace for a revolute, revolute, revolute arm. Assume that you know that $l_1 < l_2 < l_3$, but you do not know their relationship if you sum the joints. Using this information, draw both of the two possible pictures. Indicate where there are 0, 1 and multiple solutions.

5 What To Submit

Submissions are due on Gradescope by the date specified in the Syllabus.

1. Create a .pdf file with the written answers ALL THE SECTIONS named hw11.pdf.
2. Ensure that your .pdf contain a picture for Part 2, two equations for Part 3, and two images for Part 4.