ME/CS 133(a): Homework #4

(Due Wednesday, November 29, 2017)

Problem #1: (10 points) Consider the simple manipulators that are associated with Prob.3 (Figure 3.23) in Chapter 3 of the MLS text. Determine the Denavit-Hartenberg parameters for manipulators (i), (ii), and (iv).

Problem #2: (20 points) Consider the simple "Stanford Manipulator," seen in Figure 3.23 (iv) or Figure 3.24 (iii) of the MLS text.

- Find the forward kinematics of the first 3 joints (i.e., manipulator (iv) in Figure 3.23) using the Denavit-Hartenberg approach.

- Find the forward kinematics for the same mechanism using the Product-of-Exponentials approach.

Problem #3: (15 points) Figure 1 shows a schematic of an 3-jointed "cylindrical" robot manipulator. This manipulator consists of two revolute joints (joints #1 and #2) and one prismatic joint (the third joint). All three joint axes are vertical and parallel to each other.

- Derive the Denavit-Hartenberg parameters.

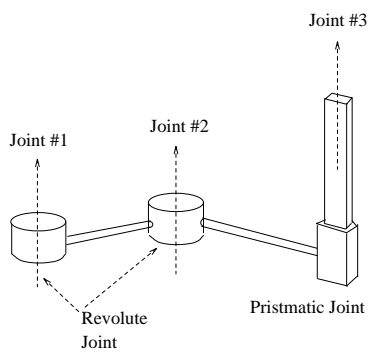- Derive the forward kinematic solution, assuming that the goal is to position the tool frame origin at some desired position, (x_T, y_T, z_T).

Figure 1: Cylindrical Manipulator