

EE6221 – Assignment for Kinematics
(not for submission)

1. A planar robot with four joints is shown in Figure 1. The first two joints are prismatic joints. The other two joints are revolute joints with their axes intersecting at the distal end of link 2. The length of the tool is 200 mm.

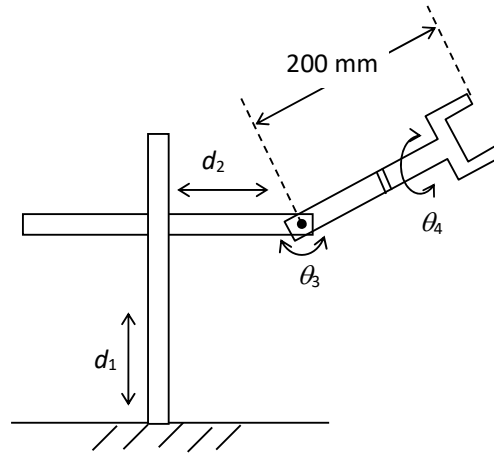


Figure 1

- (a) Using the D-H algorithm, develop a link-coordinate diagram for the robot and tabulate all the kinematic parameters.
- (b) Derive the direct kinematics in the form of the transformation matrices T_{wrist}^{tool} and T_{base}^{wrist} .
- (c) Derive the tool configuration vector and solve the inverse kinematics.
- (d) Derive the tool configuration Jacobian matrix.

2. Consider the top view of a robotic workstation, with parts A and B, shown in Figure 2. Suppose the centroid of part A has coordinates $[6, 12, 2]^T$ and the centroid of part B has coordinates $[10, 5, 1]^T$.

(a) Find the arm matrix value T_{base}^{pick} needed to pick up part A from above by grasping it on the long sides.

(b) Find the arm matrix value T_{base}^{place} needed to place part A on top of part B aligning the centroids and the major axes.

