

ID6040 INTRODUCTION TO ROBOTICS – ASSIGNMENT 1

To be submitted through Moodle by 19th March 11:59 PM

Question 1: Prove that once the co-ordinate frames are assigned according to DH conventions, there exists unique DH parameters such that the homogenous transformation can be expressed as a combination of 2 rotation and 2 translation matrices. [2 Marks]

Question 2: Figure below shows a 6-dof manipulator . [5 Marks]

- Assign coordinate frames to all the links
- Determine DH parameters
- Using the numerical values of the DH parameters, get the Transformation matrix T_{base}^{elbow}
- Verify your results for an assumed soft home position of arm.

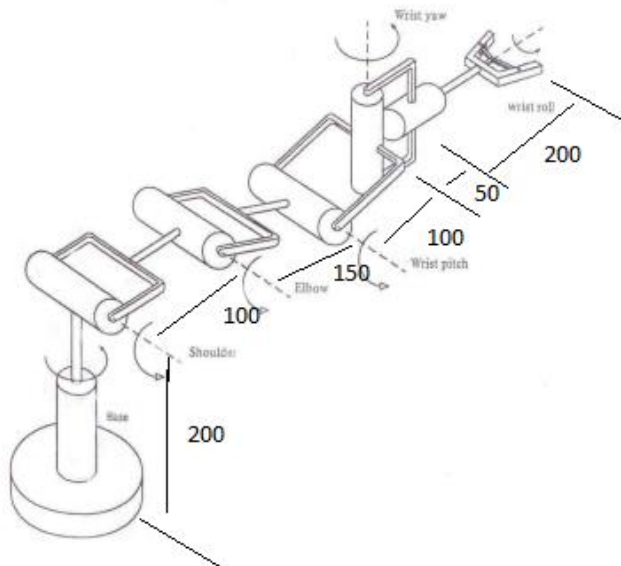


Figure 1

Question 3: [3 Marks]

Write a computer program to solve the forward kinematics of a manipulator. Specifically, given the joint variables and DH parameters, your program should be able to:

1. Calculate a T_{i-1}^i matrix;
2. Calculate the manipulator transformation matrix, i.e., T_0^n ;
3. Calculate the Cartesian space coordinates of the end-effector, i.e., the position vector and the orientation relative to the base of the manipulator.

Your program should be written in a generic way independent of any specific manipulator configuration. Use C / C++ /Python programming language.

Use the data from the PUMA manipulator to test your program.

Assume non-zero joint angles for the arm.

Submit your source codes (well-documented) and the output of calculation for the PUMA.