Assignment 1 –Simple Forward & Inverse KinematicsBiomedical Engineering, Northwestern U,Winterterm, 2021

BME 467(Biomedical Robotics)
Due: 1/18/2021

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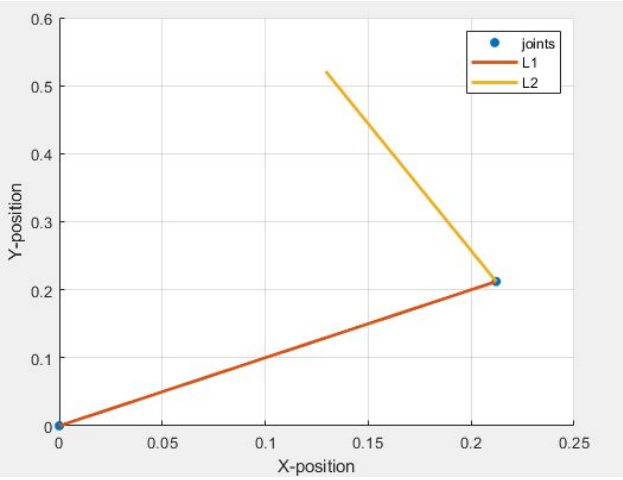
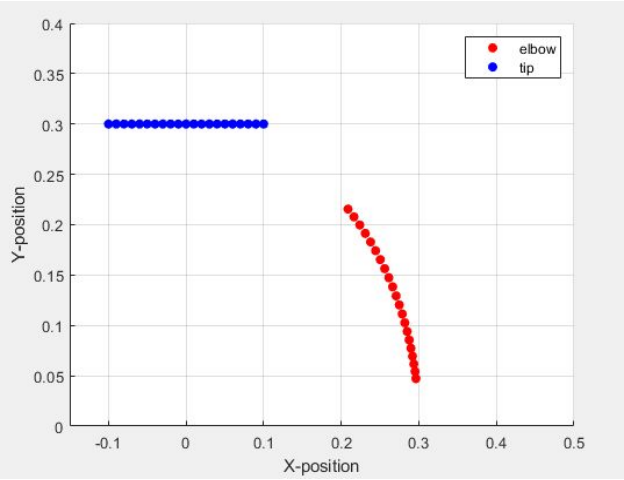
OVERVIEW

This assignment utilizes forward kinematics and inverse kinematics to calculate the cartesian coordinates of the end-effector from the angles of the two-revolute-joint robot and vice versa. I wrote two MATLAB functions which are forwardKinematics.m and inverseKinematics.m. The function forwardKinematics takes inputs of the matrix q containing angles of two joints and lengths of two arms, and it gives the output of x and y positions of the end-effector(tip) and the elbow. On the other hand, the inverseKinematics function takes input of the matrix containing the configurations of the end effector and lengths of two arms and gives output of a matrix consisting of angles of the two joints. Lengths of the arms which are L1 and L2 are defined in the functions in this assignment. The file main.m includes the tasks asked for the problem statement.

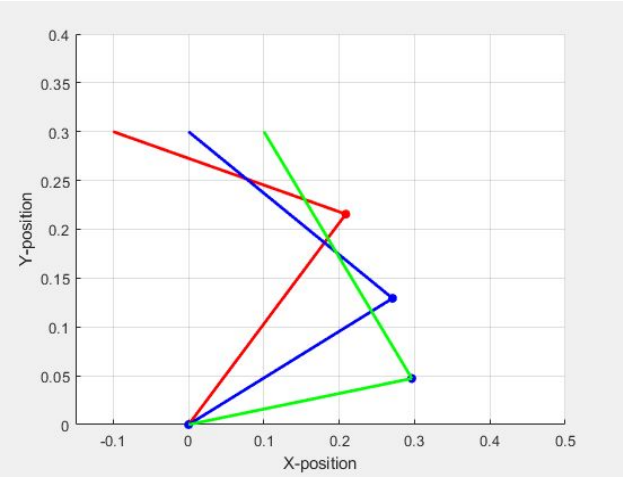
RESULTS



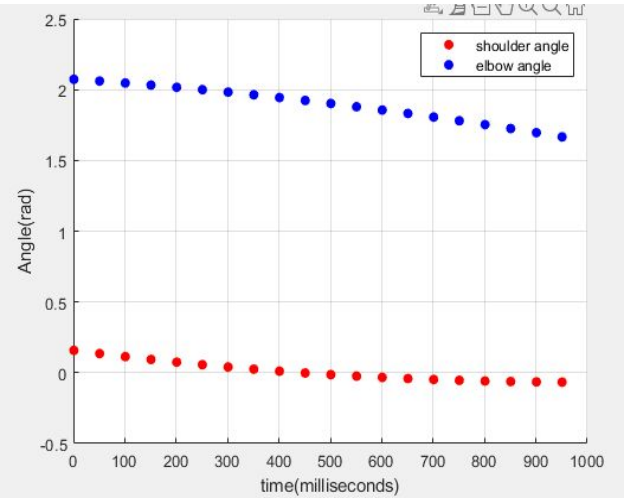
Robot Configuration at q=[pi/4,pi/3]



Trajectories of elbow and tip (refer to the 'Animation' file)



a) Arms at the start, midway, and at the end



b&c) the angles of shoulder and elbow vs time

None of the angles' time derivatives change their signs since the displacement in x of the end-effector is not large enough. However, shoulder angle's time derivative will change if the end-effector has to reach over around 0.3 at x because decreasing shoulder angle limits the end-effector's x-range.