CMPSCI 403: Introduction to Robotics: Perception, Mechanics, Dynamics, and Control

HW 04

Due Online, Sunday, Oct. 2nd, 11:30 PM

All questions refer to the robot arm sketched in the figure below. Answer the questions below with text, mathematical statements, and supporting sketches where appropriate. Include a commented copy of your MATLAB code.

1. Build the robot kinematic simulation and submit a screenshot of the robot in the following two configurations. You can use the given "drawLine3D.m" and "draw_Coordinat3D.m" functions to plot and refer to "matlab_test3D.m" for instruction.
   (a) $q = (0^0, 90^0, 0^0, 30^0, 90^0, 0^0)$
   (b) $q = (0^0, 120^0, 0^0, 60^0, 90^0, 0^0)$
2. Find the corresponding end-effector (i.e EE) SE(3) for the following two configurations.
   (a) $q = (0^0, 90^0, 90^0, 30^0, 90^0, 0^0)$
   (b) $q = (0^0, 60^0, 45^0, 60^0, 90^0, 0^0)$

Tip:
Use the functions you implemented for homework 3 to construct SE(3) matrices.

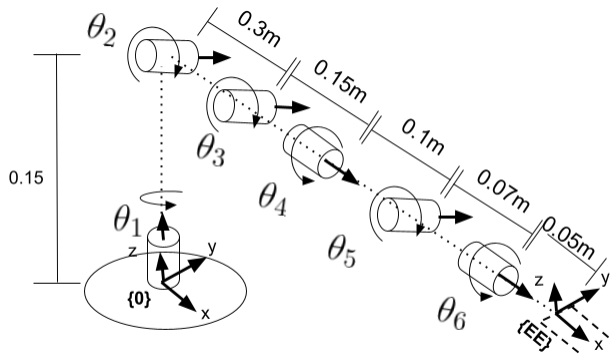

Figure 1: Six DOF arm in its home configuration (i.e $\theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = 0$). Notice the local frame of the end-effector $\{\mathbf{EE}\}$ is aligned with the global frame $\{\mathbf{0}\}$. Each of the cylinders represent the joints of the robot and the arrows going through the cylinders represent the axes of rotation. Therefore, θ_1 is the rotation around z axis, $\theta_{2,3,5}$ are the rotation around y axis, and $\theta_{4,6}$ are the rotation around x axis.