Forward Kinematics and 3D Viewer

1. Write a program (Matlab preferred) to compute the direct/forward (position) kinematics and display a manipulator in three dimensions.

   The program should take the following as inputs:

   (a) DH table with parameters, and

   (b) joint variables $\vec{q}$ keeping in mind we will likely use a series of joint variables in the future for animation of motion.

   The program should output or show:

   (a) homogeneous transformation matrix T_n^0 representing the end-effector's pose;

   (b) 3D visualization of robot using lines, cylinders or fancier objects to represent joints and links (see figure below as simple example); and

   (c) display of frames 0 to n (with ability to turn them on/off).

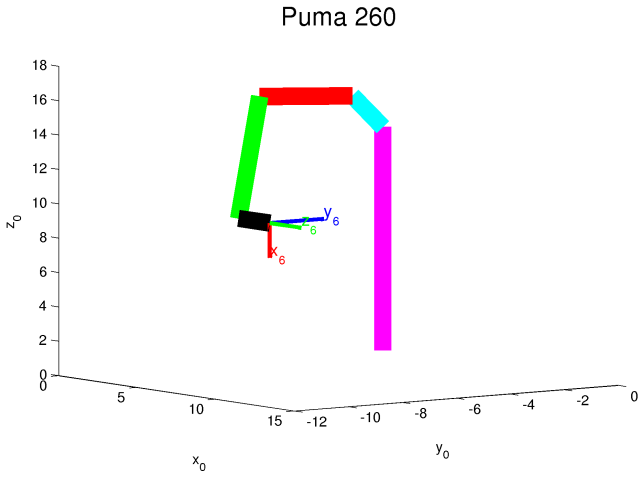

Figure 1: Visualization of Puma 260 via Matlab using line(), quiver() and text()

2. Implement the following robots (with details provided in handout) in your program: Stanford Arm, Puma 260, Adept Cobra s800, and planar RRP. Note it should be easy to implement a new manipulator through specification of its DH table and joint variables.

3. Test your forward kinematics and visualizations for a variety of values of joint variables including moving one joint at a time. Turn in a copy of your programs, and results (T_n^0 plus visualization) for the cases when all $q_i = 0$ (rad or dist); all $q_i = 1$ (rad or dist), and all $q_i = -1$ (rad or dist).