Homework 3

Intro to Robotics

Due Date: May 10th, 2023

1 Quaternions

1. rotate the 3d vector $P_1 = \begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$ by 175° on xz plane and then 35° on the yz plane using quaternions.
2. Convert ${}^{A}_{B}R_{Z'Y'X'}(50°, 150°, 200°)$ to quaternion coordinates.
3. Convert rotation matrix $R = \begin{bmatrix} .28 & .77 & .57 \\ -.94 & .34 & 0 \\ -.19 & -.54 & .82 \end{bmatrix}$ to quaternion coordinates.
4. consider quaternion $q_1 = (0.845 + 0.191\text{i} + 0.462\text{j} + 0.191\text{k})$, convert to $R_{Z'Y'X'}(\alpha, \beta, \gamma)$.
5. Write a function that rotates 3d vectors using quaternions to verify your answers for 1-3.
6. Write a function that takes a rotation matrix as input and returns the equivalent quaternions.
7. Write a function that takes a quaternions as input and returns the equivalent rotation matrix.

2 Kinematics 1

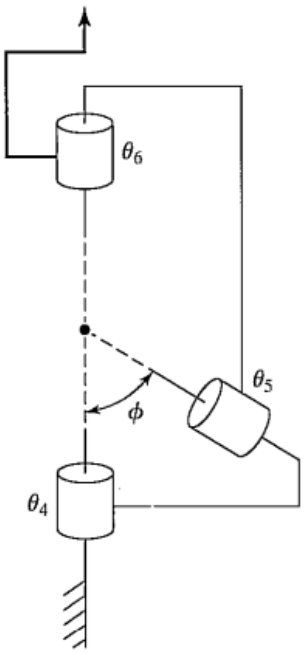

Figure 1:

1. Compute the frames, dh table and rotation matrices for the given schematic.

3 Kinematics 2

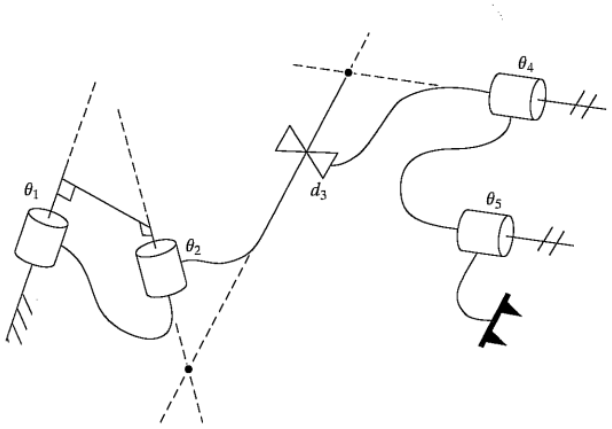

Figure 2:

1. Compute the frames, dh table and rotation matrices for the given schematic.