

Wk 4 Assignment

Due: Oct. 22, 11:59pm EST

Objective: The objective of this assignment is to familiarize yourself coordinate transformations, robot kinematics.

What to turn in: In a single PDF file, submit your clearly labeled and commented MATLAB script, all supporting MATLAB functions you developed, AND the outputs as displayed in the command window. In addition, place all the requested MATLAB script and functions in a separate zipped file and submit the zipped file with your single PDF file.

1. (5 pts) A vector, v_p^0 , is rotated about the z -axis of frame 0 by θ degrees then rotated about the x -axis of frame 0 by ϕ degrees.

1. What is the rotation matrix corresponding to this set of rotations?
2. Do you obtain the same matrix if you switch the order of the two rotations?
3. What is the resulting matrix for values of $\theta = 45^\circ$ and $\phi = 60^\circ$?

2. (5 pts) Given the following homogeneous transform,

$${}^0H_2 = \begin{bmatrix} c_\phi & 0 & s_\phi & 1 \\ s_\phi s_\theta & c_\theta & -c_\phi s_\theta & 0 \\ -s_\phi c_\theta & s_\theta & c_\phi c_\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

what is 2H_0 ?

3. (5 pts) For the following Cartesian manipulator (*i.e.* all prismatic joints) shown Figure derive the transformation that will take you from the (x_0, y_0, z_0) frame to (x_3, y_3, z_3) frame. Prismatic joints are joints with linear motion. Given the following joint limits, what is the reachable workspace? Give this in terms of ranges in the x_0 , y_0 , and z_0 directions respectively. The units of d_1 , d_2 , and d_3 are length units.

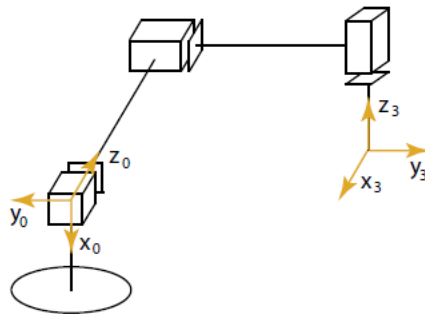


Figure 1: Figure for Problem 3.

Joint	Min	Max
d_1	5	35
d_2	3	20
d_3	2	15

4-6. (15 pts) Do problems 2.4, 2.5, and 2.16 at the end of the reading material this week.