

CS289 Mobile Manipulation

Fall 2024

Assignment 1

Due: 23:59, Oct. 31, 2024

Submit your solutions to GitLab in folder called hw1

Dear students,

This semester, we will be using the `rv3python` package for practical assignments. We will be utilizing its Python version. As there is relatively limited online information available about the `rv3python` package, we encourage all of you to carefully read the literature and dedicate time and effort to learning this library.

This assignment is related to Chapter I Foundations – 2 Representing Position and Orientation, starting from page 23). There is an installing tutorial at page 716 or you can go to its github website for reference:

<https://github.com/petercorke/RVC3-python/tree/main>

For the first two tasks, you need to finish them in the given jupyter notebook file. The last one we prefer you to use latex to give your answer, but handwritten answers are also acceptable.

Problem 1:

Create a 2D rotation matrix. Visualize the rotation using `trplot2`. Use it to transform a vector. Invert it and multiply it by the original matrix; what is the result? Reverse the order of multiplication; what is the result? What is the determinant of the matrix and its inverse?

Problem 2:

Now we have a robot which is at the position (4,5,6) in world coordinate. The rotation sequence from the robot coordinate system to the world coordinate system is as follows: first, rotate 45 degrees around the X-axis, and then rotate 30 degrees around the Y-axis.

Now we have a point P at the position (1,2,3) in world coordinate. Now you need to find out the position of P in robot coordinate.

Problem 3:

Write down the rotation matrices that correspond to a coordinate frame rotation of θ about the x-, y- and z-axes separately.

Then calculate and write down the rotation matrix that corresponds to a coordinate frame rotation of α about the x-axes, β about the y-axes and γ about z-axes.