

# Assignment

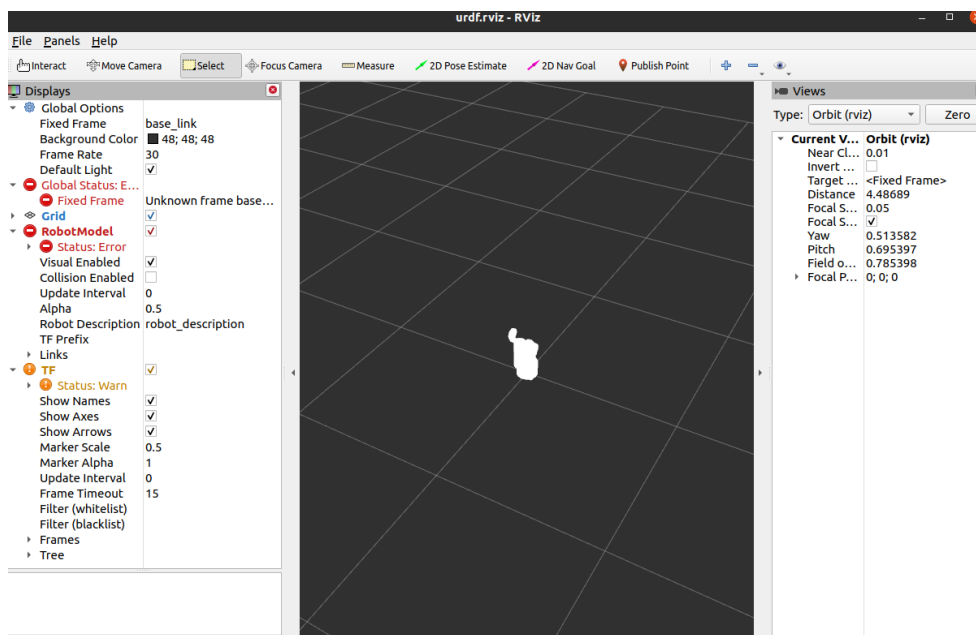
1. Write the forward kinematic equation for a 2DoF planar manipulator with revolute joints.
2. Solve the inverse kinematics problem for a 2DoF planar manipulator with revolute joints.
3. How many inverse kinematics solutions will exist for a 2DoF planar manipulator with revolute joints?

## ROS

4. Using the manipulator file shared, find the transformation between the end effector and the base frame.

## Instructions

- In src/mobile\_manipulator/urdf
- `roslaunch urdf_tutorial display.launch model:=robot_arm.urdf`
- If your model does not load properly In RVIZ: select fixed frames as 'arm\_base' from the left panel in RVIZ GUI.



Now,

1. Using the Sliders, change the orientation of the manipulator and find the Transformation between the Last link and the Base link. (Hint: Refer Introduction to ROS session pdf.)

Attach at least 3 Images of the different orientation of the manipulator along with its transformation matrix.

2. Explain about the message that you see on finding the transformation. Does it have the correct shape as the Transformation matrix should have? If not, why?

3. Attach an Image of all the links and connections of the manipulator. (Tree Structure)

Hint: Refer Introduction to ROS session pdf.

### **Bonus:**

Add a LIDAR sensor to the Mobile Robot provided in the file. ( Used during the tutorial).

Attach images and relevant information of the sensor data.