Project Kratos

Electronics QSTP

Week 4-b : Robotic Arm

Transformations:

- Go through the week 2 lectures of the course given below.
  https://courses.edx.org/courses/course-v1:ColumbiaX+CSMM.103x+1T2017/course/
- Go through tut1, tut2. You don't have to understand everything. If you understand the code shown in the last video, then that is enough.

Forward Kinematics:

- Go through videos 1-5 in the lectures series given below. You may go through the other videos if further interested. You don't have to implement the matlab part, just watch it. Forward kinematics lectures

Inverse Kinematics:

- Go through videos 1-6 in the lectures series given below. You may go through the other videos if further interested. You don't have to implement the matlab part, just watch it. Inverse kinematics lectures

Additional Resources:

1. http://gazebosim.org/ Official website of the gazebo simulator
2. Forward and Inverse Kinematics: Jacobians and Differential Motion and the ROS exercise at the end of the article.
3. Inverse kinematics Slides on Inverse Kinematics by Prof Alessandro De Luca. Containing examples of robot manipulators of various degrees of freedom.

Assignment questions (Submit before Wednesday, 11.59pm 17th June 2020)

1. We define three coordinate frames, ‘base’, ‘camera’, ‘object’. The relationship between them are

    ○ The transform from the 'base' coordinate frame to the 'camera' coordinate frame consists of a rotation expressed as (roll, pitch, yaw) of (0.79, 0.0, 0.79) followed by a translation of 1.0m along the resulting y-axis and 1.0m along the resulting z-axis.

    ○ The transform from the 'camera' coordinate frame to the 'object' coordinate frame consists of a rotation around the z-axis by 1.5 radians followed by a translation along the resulting y-axis of 1.0m.

    Create a node solution.py which broadcasts the ‘base’ to ‘camera’ transform using the tf library.

2. There is a 2-D, two link robotic arm. The link lengths are 1m each. Create a ros node that subscribes to a topic ‘/end_effector_position’ (which contains x,y) and publishes to a topic ‘/joint_angles’ (which contains theta1, theta2 in radians). Use ‘geometry_msgs/Point’ as the message type for both the topics. You can use only x and y, as the question is for a 2-D arm.

Note 1: Submit the assignments before the due date. Any delay has to be notified with reasons. Punctuality is an essential part of the Kratos Team.

Note 2: Most of you would be doing these things for the first time, so you are bound to get struck at some point and may get overwhelmed by the course content. We don't expect you to solve everything in the first try. You have a week. We highly encourage you to ask any doubt, however small or dumb you think it is. That is the only way by which you grow. Your job here is to learn and our job is to help you.

Note 3: Any feedback regarding the course structure or the assignments, is very valuable. We are also students, just like you and we have a lot of scope for improvement.