6ELEN018W - Tutorial 4 Exercises

1 Revision of Lecture Slides

Go through all of the Lecture 4 slides, making sure you understand them and run the described Python code. Make sure that you understand what you are doing or otherwise ask your tutor.

2 Pre-defined Robot Models in the Python Robotics Toolbox

Run in the Python toolbox (`rvctool` or simply import the relevant Python modules in your environment) the necessary Python statements to see all the pre-defined robot models in `URDF` format.

1. Create an instance of one of them. Choose one with 6-joints.
2. What are the pre-defined configurations for this robot?
3. Calculate the forward kinematics for a pre-defined configuration.
4. What is the location of the end-effector for this specific configuration?
5. Add a new configuration to the robot with your own defined joint angles.
6. Calculate the forward kinematics for this specific configuration.
7. What is the location of the end-effector for this specific configuration?
8. Plot the robot for your own configuration.
9. Calculate the Jacobian for your own configuration.

3 3-DOF Robot Calculations

A 3-DOF robot has joint angles q_1, q_2, q_3 and link lengths a_1, a_2, a_3.

Use the Python Robotics Toolbox to construct a robot using a chain of robot links (e.g. see the `Link2, ERobot2` classes in the lecture slides). Then using the Robotics toolbox:

1. Find the Jacobian of the robot for a specific configuration.
2. Find the inverse Jacobian of the robot for that configuration.
3. For a specific point in time (no loops required) can you calculate (in Python) the velocities of the joint angles that need to be applied by the actuators, in order to achieve a specific velocity of the end-effector?