Introduction to Gen3 lite

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KINOVA

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Objectives

This laboratory is an introduction to the manipulation and programming of Kinova's Gen3 lite robot. In our first section, we will use the high-level functionalities available from the Kinova® Kortex™ Web App, a built-in graphical user interface. Then, in the second section, we will present the API Mex interface available for MATLAB which will be used in the subsequent laboratory sessions.

About Gen3 lite

Gen3 lite, illustrated in Figure 1, is a modern 6R manipulator produced by Kinova, a Canadian company. It allows users to perform manipulation tasks with lightweight objects and operate within close proximity to people. The quick start guide describes the steps necessary to set up the robot properly.

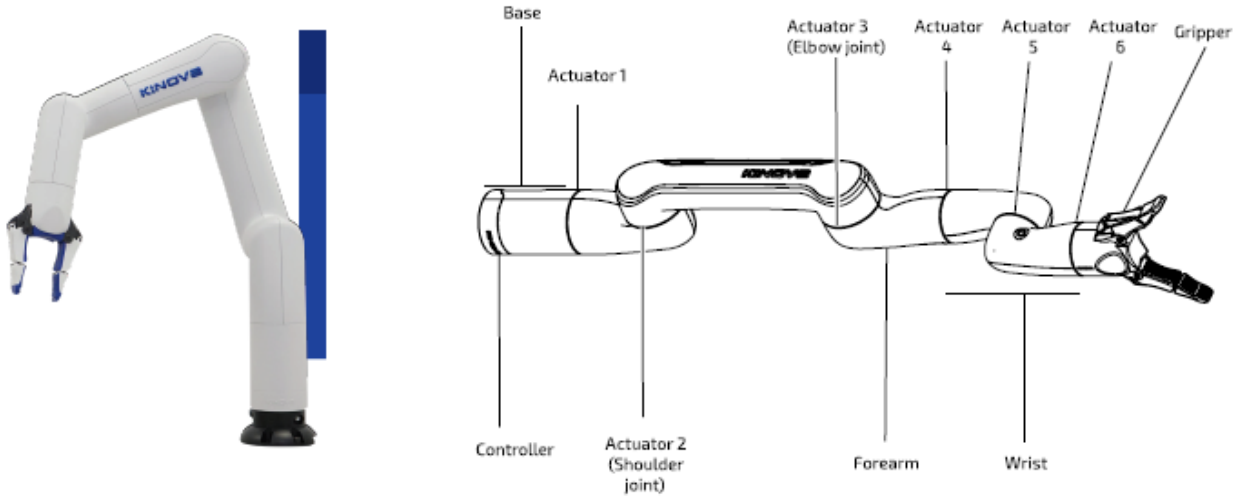

FIGURE 1: Overview of Gen3 lite

Manipulations

Part 1: Using the Kortex Web App

In this section, we will use Web App to perform our first manipulations with the robot. Note that if the robot is connected via USB, the default IP address of the robot is 192.168.1.10. If it is connected via ethernet, then its address is 192.168.2.10. Connect to the webApp, type the IP address of your robot in your web browser, then use the default credentials (admin/admin) to connect to the robot. The User Guide contains detailed information of how to use the Web App. Figure 2 illustrates the position of the Pose and Angular virtual joysticks that we will use in this section.

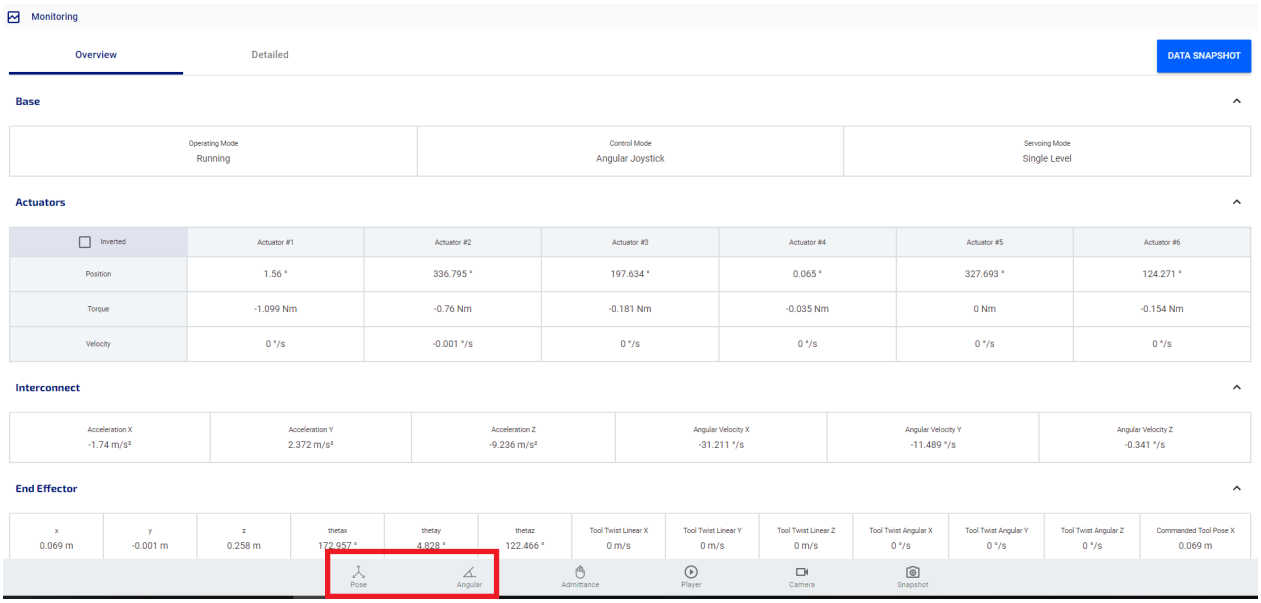

FIGURE 2: Position of the Pose and Angular virtual joysticks on the interface

1.1 The Pose virtual joystick allows you to control the robot in space by modifying the position and orientation of the end-effector. Using this, reach a position close to [-11, -29, -57] cm with an orientation of [0, 0, 0] degrees. Explain your approach.

1.2 The Angular virtual joystick allows you to control the position of each joint of the robot. Using this, reach the cartesian position [0, 50, 0] cm with an orientation of [180, 0, 0] degrees. How many different sets of angular positions allow you to reach this cartesian pose? Describe these different sets.

1.3 Find the cartesian pose of the robot when it is in zero position, meaning that all the joints positions are set to zero. Explain your approach and results.

Part 2: Using the MATLAB API wrapper

The documentation of the MATLAB API wrapper is available here. Here is a snippet of code that allows you to initialize the connection to the robot, send an angular command and then disconnect.

```
gen3_lite = struct('IP_ADDRESS','192.168.1.10','ID','admin','PASSWORD','admin', ...
    'SESSION_TIMEOUT',uint32(60000),'CONTROL_TIMEOUT',uint32(2000));
q=[0 0 0 0 0 0];
[~, gen3_lite_handle, ~] = kortexApiMexInterface('CreateRobotApisWrapper', ...
    gen3_lite.IP_ADDRESS, gen3_lite.ID, gen3_lite.PASSWORD, ...
    gen3_lite.SESSION_TIMEOUT, gen3_lite.CONTROL_TIMEOUT);
[~] = kortexApiMexInterface('ReachJointAngles', gen3_lite_handle,int32(0), 0, ...
    0, q);
pause(10)
[~] = kortexApiMexInterface('DestroyRobotApisWrapper', gen3_lite_handle);
```

2.1 Implement the above example and compare the precision with the manual method used in the previous section.

2.2 Write a program allowing you to read the current pose (position and orientation) of the end-effector of the robot. You can read the **BaseFeedback** using the **RefreshFeedback()** function. The structure of this program should be similar to the above example.

2.3 Using the script developed in **2.1**, send the robot to each of the angular poses indicated in Table 1. These poses are singularities of Gen3 lite. Describe which pairs of aligned axes causes each of these singularities. Using the cartesian virtual joystick from the Web App, try to move the robot. What can you notice?

Singularity	θ_1	θ_2	θ_3	θ_4	θ_5	θ_6
1	45	0	45	45	0	45
2	45	0	0	45	45	45
3	45	45	0	90	45	45
4	45	45	45	90	0	45

TABLE 1: List of singularities to study

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