Lab Procedure for Simulink
Inverse Kinematics

Setup

1. It is recommended that you review Lab 2 – Application Guide before starting this lab.
2. Launch Quanser Interactive Labs, scroll to the "QBot Platform" menu item and then select the "Warehouse" world.
3. Open the Simulink Model inv_kin.slx, as shown in Figure 1. The loading of the Simulink model also triggers the setup script for QLab. When the script is run successfully, the QBot and the Environment should be spawn in QLab and User LEDs on the virtual QBot will turn white, as shown in Figure 2.

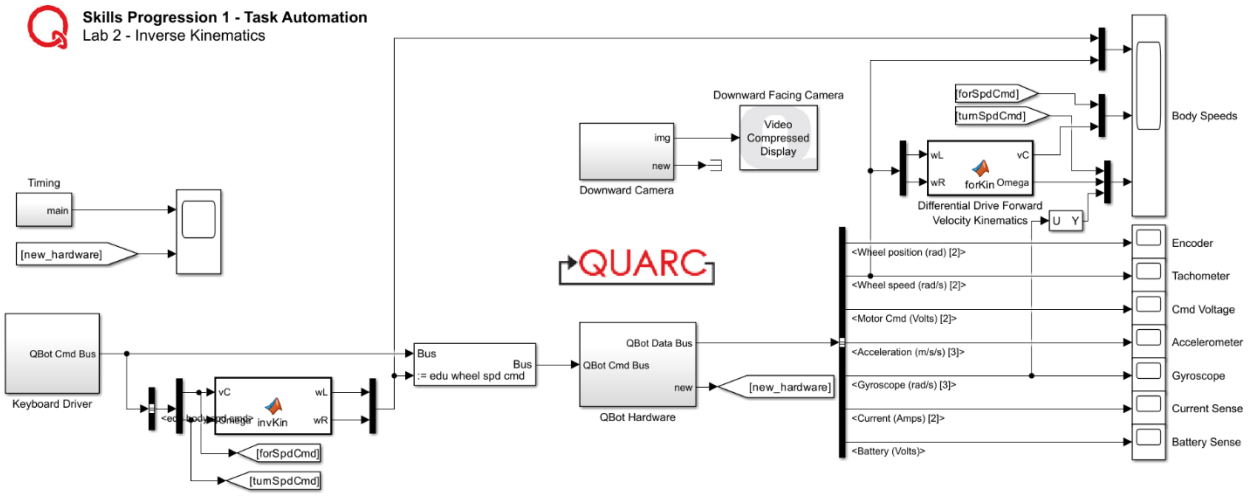

Figure 1. Inverse Kinematics Simulink Model

Figure 2. Successful set up of the Quanser Interactive Labs Workspace

Inverse Kinematics Formulation

1. Double click **MATLAB Function** block labeled ***forKin*** and verify that it is completed for you. If not, copy over the completed forward kinematics function from the previous lab.

2. When considering a pure forward velocity for a differential drive robot, what do you expect each wheel to do? How about when turning?

3. When commanding a positive turn velocity for the QBot (counterclockwise), which wheel should spin faster?

4. Open the **MATLAB Function** block labeled ***invKin***. This function is incomplete and must be compete before use. This function should take body speeds as input and output QBot wheel speeds in rad/s.

5. Based on the completed forward kinematics equations, derive the inverse kinematics equations, and complete ***invKin***.

6. Close the function, run the Simulink model, and drive the QBot around. Using the ***Body speeds*** scope, verify that the output from your inverse kinematics function (commanded wheel velocities) closely match those from the tachometer. Revise your function if needed.

7. Open the Body speeds scope. How closely do the commanded body velocities match the measured velocities through forward kinematics?

8. When you're satisfied with the output of your function, take a screenshot of the scope windows.

9. What is the key difference between this application and the drive mode in the Play lab?

10. What is the maximum forward or turn speed of the robot you can command? What wheel velocity command does this correspond to?

11. Stop the Simulink model when complete. Ensure that you save a copy of your completed files for review later.