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QBot Platform

Inverse Kinematics

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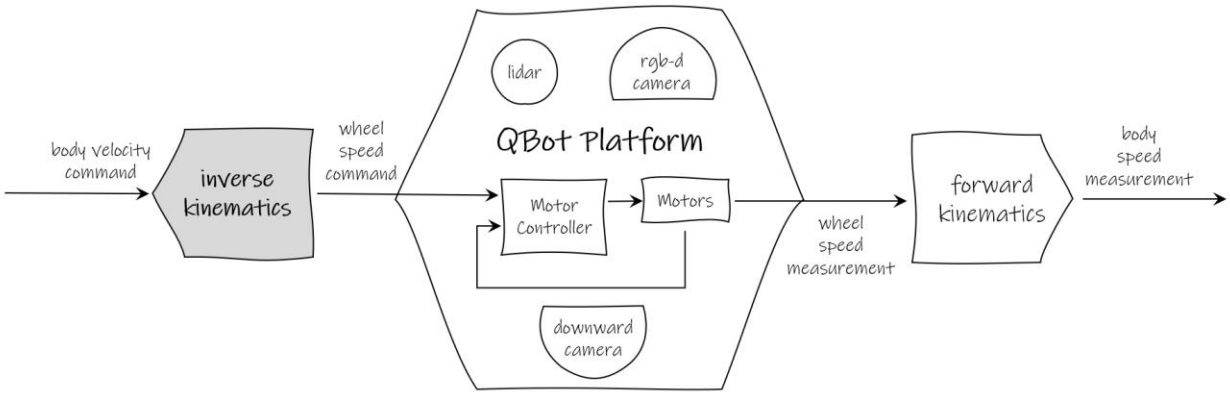
QBot Platform – Application Guide

Inverse Kinematics

Why explore inverse kinematics?

While forward kinematics allowed us to map joint movements to high level robot motion, it is in fact high level robot motion we desire to control in the first place. Typical applications in robotics all output a standardized velocity command, comprising of linear and rotational body velocities. A formulation to realize the associated wheel speeds is the inverse of forward kinematics and will complete a basic picture of robot control in differential/arcade mode.



Arcade/Differential Drive

While differential drive robots built with two actuated wheels will eventually require wheel velocity commands, it is desirable to envision and request motion for the robot body instead. In this lab, you will command linear and rotational velocities for the QBot Platform, referred to as Arcade or Differential Drive mode for the robot. This mode trains you to intuitively control the robot's motion in the longitudinal (front or back) and rotational (turn about the vertical axis) to move the robot around. In the context of most applications, for example, line following, the robot must turn left or right to stay on top of a line while moving forward at a steady rate. This application output is naturally in a body frame.

Inverse Kinematics

Since we already developed equations to map the wheel velocities to the body speeds, it is a matter of geometrically inverting the equations to find the corresponding inverse kinematics formulations, which you will also develop in this lab and use to drive the robot in arcade mode.

Before you begin

Please review the following before beginning this lab,

1. Ensure you have completed the following labs in your language of choice,
    a. **Play** lab from Skills Progression 0
    b. **Forward Kinematics** lab from Skills Progression 1
2. Ensure that you have read the following concept reviews,
    a. Position Kinematics
    b. Differential Kinematics