How to solve unicycle kinematics?

Kinematics of the unicycle mobile robot is

$$\dot{q} = \begin{pmatrix} \dot{x} \\ \dot{y} \\ \dot{\theta} \end{pmatrix} = \begin{pmatrix} \cos\theta \cdot u_1 \\ \sin\theta \cdot u_1 \\ u_2 \end{pmatrix},$$

where x, y, θ represent the pose of the robot (position and orientation), u_1 is the linear velocity control signal, u_2 is the angular velocity control signal.

In order to implement kinematic control, it is necessary to specify the kinematics in differential form.

$$\begin{cases} x_{\text{new}} = & x_{\text{old}} + \delta u_1 \cos(\theta) \\ y_{\text{new}} = & y_{\text{old}} + \delta u_1 \sin(\theta) \\ \theta_{\text{new}} = & \theta_{\text{old}} + \delta u_2 \end{cases}.$$

The value of δ has to be adequately small for the continuous movement.

PID control for path following

- `https://medium.com/@jaems33/understanding-robot-motion-pid-control-8931899c31df`

It can also be used for `GoToPose` type control (e.g. error - standard Euclidean norm of the difference between the robot's current position and the target position, and so on).