Control of Mobile Robots - Laboratory 5
Feedback linearization approaches for trajectory tracking
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Exercise 1

Create a ROS package representing a trajectory tracking controller for a unicycle robot, modelled through its kinematic model. At this stage, the package should include only the first part of the controller, i.e., the feedback linearisation controller.
In the same node performing the control action include the generation of the reference velocity for point P.
Verify the correctness of the controller simulating the controller and the unicycle kinematic model, and using step velocity inputs (checking that the response on the x and y coordinates of point P is a ramp).

Exercise 2

Create a ROS package representing a trajectory tracking controller for a bicycle robot, modelled through its kinematic model. At this stage, the package should include only the first part of the controller, i.e., the feedback linearisation controller.
In the same node performing the control action include the generation of the reference velocity for point P.
Verify the correctness of the controller simulating the controller and the bicycle kinematic model, and using step velocity inputs (checking that the response on the x and y coordinates of point P is a ramp).

Hint: do not forget that the linearisation law is singular when $v = 0$.

Exercise 3

Using the feedback linearised unicycle kinematic model developed in Exercise 1 perform the following test.
Start the robot:

- from position $(0, 0)$;
- with velocity $v_{x_P} = v_{y_P} = \bar{v}\sqrt{2}$, where $\bar{v}$ is an arbitrary positive constant velocity;
- with the following headings: $\theta_1 = 0$ deg, $\theta_2 = 90$ deg, $\theta_3 = 180$ deg, $\theta_4 = 270$ deg.

How does the robot behave for different initial headings?