Control of Mobile Robots
Extended project work
A Gazebo car simulator, analysis and comparison with a single-track model
Prof. Luca Bascetta

Problem

Consider the "Rapid Autonomous Complex-Environment Competing Ackermann-steering Robot" project developed at MIT and, in particular, the RC race car Gazebo simulator.

The overall aim of the project is to analyse the model used to simulate the car (e.g., what are the bodies that are considered in the model of the car? what are their parameters? how are they modelled? which are the car commands? does the model include plugins that convert car commands to wheel torques?), and compare it with a single-track dynamic model developed using Boost Odeint library.

If the two models are in well accordance, the project can be concluded showing the results of the application of a trajectory tracking controller, based on a proportional controller with velocity feedforward and on a feedback linearising law developed on the bicycle kinematic model, to the Gazebo simulator.

The project should aim at preparing educational material for a student with limited experience in using ROS and coding in C++, attending the course Control of mobile robots. You can thus assume that the student has all the required competences on kinematic/dynamic modelling and control of mobile robots, and he/she is interested in increasing his/her ROS knowledge and in exploiting ROS tools to verify the competences acquired during lectures.

As a result of the project work you should prepare:

- a presentation of the work (it has to be prepared as it should be the presentation a teacher uses to introduce this laboratorial activity to students);
- a report describing the results of the work, including a short user manual explaining how to use the code (again, this report should be intended as a support for a student who would like to replicate the laboratory experience);
- well-organised and well-documented code.