03MIQ – Automotive Control Systems

Simulation (CarSim) laboratory exercises #1

Note
For some help on each exercise refer to the instructions given in the *CarSim Handbook (CarSimHB.pdf)*.

Lab 1.1: 4 October 2021

This first lecture aims to show how CarSim works and which aspect of the vehicle dynamics can be simulated. Students are required only to browse the *Datasets*, execute them as they are and then execute them again changing some simulation parameters.

IMPORTANT!
Before modifying the selected pre-defined *Dataset*, to preserve the original one, duplicate it:

- from menu *File* select *New Dataset Plus All Linked Datasets…*
- set the *Category* name (the personal one you like, for example *ACS Lab* or *your name*) and save.

Lab 1.2: 11 October 2021 (exam matter)

Select menu *Dataset* → *Brake Tests* subset → *Brake Distance Test (Force Input)* and generate a copy of this dataset, then:

- Add to CarSim plots, if not already present, the wheels longitudinal slip and the wheels angular acceleration plots.
- For different values of the friction coefficient μ, ranging from 1 to 0, with step 0.1:
  - evaluate the braking distance and the braking time and take note of the obtained numerical values;
  - check if the wheels block or not and evaluate the value of the slip during the braking phase;
  - guess which could be the numerical value of the threshold $-a_1$ used in ABS control algorithm presented in Kiencke Nielsen book. This value will be used in Lab 2.3.
- Plot the braking distance and the braking time versus the friction coefficient, for example using Matlab.
- Repeat the exercise increasing the vehicle mass by 10%, for μ ranging from 1 to 0.5 (or 0.1, if you have time), with step 0.1. How the braking distance and braking time change?

Next Lectures will follow