

03MIQ – Automotive Control Systems

Simulation (CarSim-Simulink ABS) laboratory exercises #2

Note

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

Lab 2.1: 18 October 2021

This lecture aims to show how CarSim can be interfaced with Simulink. Students are required only to browse the *Simulink and LabVIEW Models* Datasets, execute them in Simulink firstly as they are and then changing some Simulink blocks parameters. Moreover it is a good exercise to understand how some signals (e.g. vehicle CoG velocity) can be added as CarSim block outputs.

Lab 2.2: 25 October 2021 (exam matter)

The aim of this exercise is to compare the closed loop behaviour of the braking system, equipped with the CarSim ABS control algorithm, with the activation/deactivation logic of the Kiencke Nielsen book ABS control algorithm.

Select menu *Dataset* → *Simulink and LabVIEW Models* subset → *Ext. ABS: Split Mu – Multi-Port SLX* (or *Ext. ABS: Split Mu – Multi-Port*, or *Ext. ABS: Split Mu*) and generate a copy of this dataset.

- In Simulink plot the time behaviour of the wheels accelerations and slips (if needed, add the variables as CarSim block output).
- Select one of the 4 wheels and plot together the time behaviours of the 5 wheel signals: speed, acceleration, brake pressure, slip and control mode, together with the vehicle velocity.
[This can be done easier in Matlab after saving the variables in the workspace]
- Check if the 5 signals behaviours are in some way “synchronized”.
- Infer, if possible, the acceleration value or interval for which the braking action is activated or deactivated. This value will be used in Lab 2.3.
- Repeat for the other 3 wheels.

Lab 2.3: 8 November 2021 (exam matter)

The aim of this exercise is to tune the design parameters of the Kiencke Nielsen ABS control algorithm exploiting the information achieved in the previous exercises.

Select menu *Dataset* → *Simulink and LabVIEW Models* subset → *Ext. ABS: Split Mu – Multi-Port SLX* and generate a copy of this dataset.

Add as output the wheels accelerations.

- In Simulink substitute the CarSim ABS control algorithm with the Kiencke Nielsen one implemented in Simulink file “ABS_KN_S.slx”, the parameter of which are set in the Matlab file “ABS_KN.m”.
- Tune the design parameters, that is to say the acceleration thresholds in order to obtain a correct behaviour of the control algorithm.

Next Lectures will follow