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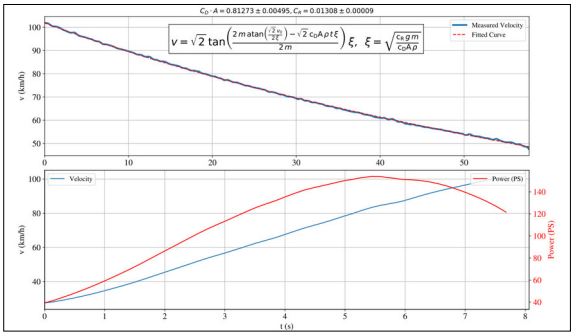
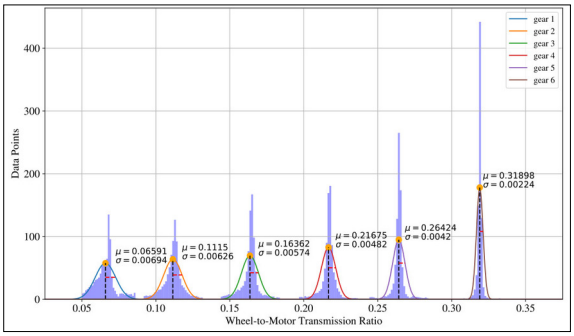
Examiner	Prof. Dr. Guido Schuster
Subject Area	Digital Signal Processing
Project Partner	Insoric AG, Stein am Rhein, Schaffhausen

Automotive Power Measurement



(1) Fitted equation on coasting data to compute the cars' physical coefficients, (2) Power and speed during acceleration
Own presentment

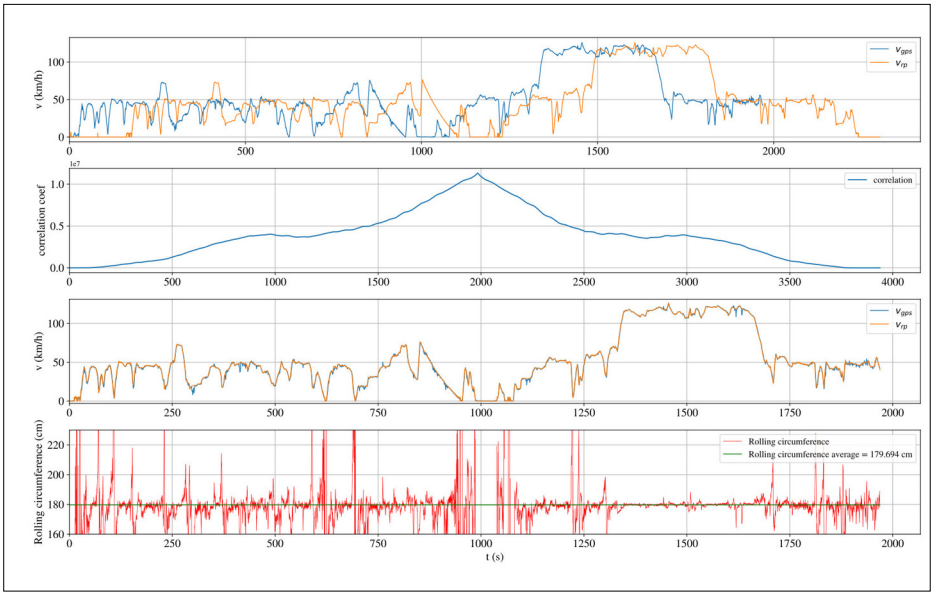


Wheel-to-motor transmission ratio of the detected gears
Own presentment

Objective: Insoric AG, with its RealPower system, has established itself in the domain of power-measurement for cars. The RealPower module, which gets applied on the side of the axle, logs its rotational frequency. With this data, the generated power of the car as well as its torque can be computed. Furthermore, an additional GPS logger, also developed by Insoric, shall expand the system. Unfortunately, tests have shown that these two measurements slightly vary. Additionally, the user has to input a lot of additional data of the car, like the diameter of the tire, the used gear and so on.
In order to eliminate said difference, this project was initiated. Another motive was to deliver an analytical approach showing the propagation of uncertainty from inaccurately measured speed to the computed power. Eventually, the amount of data one must input should be minimized.

Approach: Due to different sampling frequencies, the data streams had to be aligned. To achieve that, different approaches were adopted - for example by correlating them as it can be seen in the third figure. In a next step, the rolling circumference of the tires could be computed. A differential equation was fitted onto the measured data to compute the rolling-resistance and drag- coefficients of the car. Next to the two existing modules, an on-board diagnostic system (OBD-2) interface to the cars' intern vehicle-bus was used to get the engine's rpm. Then, to detect the gears and their ratios, a Gaussian Mixture Model was applied.

Result: The written software is capable of computing the rolling circumference as well as its expansion. Moreover, it can automatically detect all used gears and their ratios. In summary, the error between the two systems could be eliminated and the parameters to be entered reduced. Finally, the propagation of uncertainty could be solved, both numerically and analytically.



(1) Uncorrelated data streams of velocity from RealPower- and GPS-module, (2) Correlation of data streams, (3) Aligned data, (4) Calculated rolling circumference of the tire
Own presentment