Real-time application for EPS tuning in a driving simulator

Solé Àvila, Ricard

Award date:
2024

45 ECTS
DC 2024.031

EINDHOVEN UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

Graduation Project

Real-time application for EPS tuning in a driving simulator

Ricard Solé Àvila (1725939)

April 2024 (Two-year embargo)

Abstract

The work in this Master's thesis presents a real-time tool for tuning Electric Power Steering (EPS) parameters in a static driving simulator that can assist expert evaluators and engineers. The tool is designed to increase the usability of a static driving simulator by providing additional visual cues to compensate the lack of cabin motion.

The tool displays information related to the EPS parameters and the resulting steering-vehicle performance. Such information is visualized with cross-plots of driver steering input and EPS output or vehicle response. The tool provides expert drivers with continuous visual feedback based on the modified EPS parameters and allows to quickly change between EPS settings for back-to-back comparisons. The tool consists of a script and S-Function in MATLAB, and an Excel for the EPS tuning.

To assess the tool capability and usability, two expert test drivers from Toyota Motor Europe (TME) took part in a virtual EPS tuning. The virtual calibration of the EPS was done with and without the tool visualization. Both evaluators found great potential to benefit from the designed EPS tuning tool. The main tool advantages are (1) faster identification of the point of the EPS curve that drivers want to modify, (2) easier to constraint the steering inputs on a specific region of the EPS characteristic curve, and (3) quickly adaptable EPS settings during simulation runtime.

A preliminary study with the same two drivers was completed to assess the tool capability for steer feel evaluation. Two metrics where assessed: steering torque demand and the hysteresis width of the steering wheel torque (SWT) to the steering wheel angle (SWA). The study was based on a blind test of three different EPS settings for which they had to describe the differences between them. A total of 5 iterations was done for each metric.

The results indicate driver consistency to differentiate between EPS settings. Drivers could correctly describe the differences between EPS settings at least 4 out of 5 times. The allocation of both metrics to its subjective steering feel is considered successful and it can be used as a guide by drivers and engineers to reach the steering feel goal in virtual tuning.