Simulation and test analysis study of vehicle steer By-Wire control system

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ABSTRACT

The purpose of this research is to establish the vehicle handling motion dynamic simulation model from object-oriented dynamic simulation program for the test and control study of vehicle Steer-By-Wire (SBW) system. The vehicle lateral motion response, including the lateral acceleration and yaw rate response, during the vehicle handling motion were simulated by the established program under different wheel steer angle and vehicle speed input conditions. The result can be used to evaluate the vehicle stability control system performance analysis reference. The dynamic modules for wheel dynamic、slip angle、 vehicle longitudinal、 lateral motion and the corresponding steer motor dynamic model were established first to simulate and analysis the vehicle steer response. The related vehicle design and control parameters of the SBW system can be adjusted quickly and safely to evaluate and improve the vehicle handling stability performance. The simulation results were compared and validated by commercial vehicle dynamic simulation program CarSim which showed quite reasonable closed match under different operating conditions. The vehicle dynamic handling simulation program model output were connected to the SBW system steer motor control driver module through CAN Bus and the computer controlled interface in Hardware-in-Loop (HIL) environment to realize the real-time control target. By HIL approach, the vehicle lateral handling motion can be integrated analyzed and modified with powertrain system so that the tractive and brake effects on the handling response can be studied and recorded. The methodologies established in this study provides important information for vehicle stability system designer reference to enhance the vehicle SBW system performance, reduce the time and expanse of research and development for SBW system, so that the vehicle accident during handling motion can be reduced while the accident avoidance technology improved.

Keywords : Vehicle Lateral Stability Control, Vehicle Handling Simulation, CAN Bus teer-By-Wire (SBW) System, Hardware-in-Loop

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