Study of Hardware-In-Loop Fuzzy Logic Control Intelligent Vehicle Anti-Roll System

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ABSTRACT

The objective for this study is to establish an intelligent vehicle anti-roll fuzzy control system in the Hardware-in-Loop (HIL) environment. Different vehicle operating conditions were simulated to compare the vehicle anti-roll performance and effects of body center of gravity height and suspension active force variation with the vehicle speed to the roll rate were assessed. In order to achieve steady-state anti-roll stability of the body control purposes, different control systems were used to compare and validate with fuzzy control system output performance. In this study, object-oriented models and fuzzy control module were established to simulate the intelligent vehicle roll motion. Simulation includes the steering control and stability control, braking force distribution control, tire dynamic model, roll model and fuzzy control models. Different speeds and operating conditions were simulated to calculate the roll angles and its rate of intelligent vehicle anti-roll system to analysis the effects of control and design parameters. Anti-roll performance and control strategic planning of the fuzzy controller were validated and compared with previous PI controller results. Intelligent vehicle center of gravity and suspension active force control calculated from the fuzzy controller varied with different speed and steering input conditions which changes in according to path movement, can thus be more accurately corrected to ensure vehicle roll stability to meet the design requirements for driving conditions. The analysis method used in this study can quickly assess the anti-roll stability system of vehicles which are required for the performance evaluation in domestic production vehicles business. This study also enhances R&D capabilities of the domestic vehicles and technology in the active vehicle anti-roll stability system and body stability control system, which helps related engineers to improve performance and shorten the development time for domestic related industries to enter the ranks of advanced technology.

Keywords : Rollover、Roll-Stability Indicator、Vehicle Real-Time Dynamic Stability Control System、Dynamic Performance Hardware-in-Loop Simulation

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