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A Hybrid Damper and Its Application for Semi-Active Control of Vehicle Suspension System

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Summary

This paper presents a semi-active control of vehicle suspension system with a hybrid damper. This damper consists of a conventional oil damper and magnetorheological fluidic (MRF) accumulator, which comprises gas accumulator and MRF device. The shaft of MRF device, fitted to in series the side of gas accumulator, is connected with a floating piston that divided into gas chamber and oil chamber. During the oil damper piston motion, the floating piston also behaves in the same direction of piston and the pressure of gas chamber varies. MRF accumulator will provides a force to the damper through retarding the movement of the floating piston by changing the strength of magnetic field inside the MRF device. Then, this allows for enhancing the damping force output capability by adjusting the pressure drop between the compression chamber and the rebound chamber in oil damper. At first, a mathematical model which described flow resistance models is formulated to characterize the performance of the hybrid damper. With optimization method in MATLAB and experimental results of the hybrid damper, the coefficients of the model are determined. Finally, a scaled quarter car model is set up including the model of the hybrid damper and a semi-active control strategy is adopted to control the vibration of suspension system. Simulation results show that with the semi-active control the vibration of suspension system is well controlled.

keywords: magneto-rheological fluid, vehicle suspension, oil damper, gas accumulator, semi-active control.