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Evaluation of Ride Performance through a Comparative Study of Switchable Damper and Active Suspension by Using Fuzzy and Linear Quadratic Regulator Controller's Strategies 10-05-01-0002

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In this work, the three-setting switchable damper (SD) is selected because of its cost-effectiveness compared with semi-active (SA) and active suspension systems. The present article aims to compare the control strategies of both Fuzzy Logic Control (FLC) and Linear Quadratic Regulator (LQR) for mechatronic three-setting SD and active suspensions in terms of ride comfort considering the switching dynamics nonlinearities of the SD. A four-degree-of-freedom half-car model is utilized for this study. The switchable inerter (SI) is included in these systems to investigate its effect on the ride performance. A comparison between the active suspension and three-setting SD suspension systems with and without SI is assessed. The optimal parameters for passive suspension are evaluated. Results showed that the fuzzy control strategy gives a better ride comfort than the LQR up to 6.9% and 14% for three-setting SD and active suspension systems, respectively. The SD or active suspension systems with SI using fuzzy control strategy gives a better ride performance compared with the same system without SI. Also, the addition of the SI not only improves the ride comfort but also improves the DTL, which in turn improves the road holding of the vehicle.

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