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Transverse dynamic analysis of semi-active quarter car model controlled with an optimal conventional controller

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Abstract

In the present work, a monotube magneto-rheological damper is fabricated and its dynamic characteristics are evaluated at different input currents. The non-parametric approach is used to model the damper from experimental results. A quarter car semi-active vehicle is considered and the passive damper is replaced with a magneto-rheological damper using nonparametric model. Controlling of system is achieved by adopting the proportional integral derivative (PID) controller. The parameters of the PID controller are identified by coupling the PID with an optimisation algorithm by considering three optimal criteria. After obtaining the desirable optimal parameters of the PID controller, the dynamic response of the vehicle subjected to random road excitation is estimated and compared with the vehicle with passive damper. The results show that there is a reduction in the acceleration and vertical displacement of sprung mass in all classes of the road under optimal parameters conditions and thus leads to improved performance.

Keywords:

Semi-active suspension; quarter car; PID controller; MR damper; genetic algorithm; optimisation; monotube damper.

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