Paper No: PU-SOE- Mech - 15

Performance Analysis of MR damper Based Semi-Active Suspension System Using Optimally tuned Controllers

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Abstract

This study assesses the dynamic performance of the semi-active quarter car vehicle under random road conditions through a new approach. The monotube MR damper is modelled using non-parametric method based on the dynamic characteristics obtained from the experiments. This model is used as the variable damper in a semi-active suspension. In order to control the vibration caused under random road excitation, an optimal sliding mode controller (SMC) is utilised. Particle swarm optimisation (PSO) is coupled to identify the parameters of the SMC. Three optimal criteria are used for determining the best sliding mode controller parameters which are later used in estimating the ride comfort and road handling of a semi-active suspension system. A comparison between the SMC, Skyhook, Ground hook and PID controller suggests that the optimal parameters with SMC have better controllability than the PID controller. SMC has also provided better controllability than the PID controller at higher road roughness.

Keywords:

MR damper, semi-active suspension, PSO, sliding mode controller, PID