Design of ABCF Control Scheme for Full Vehicle Nonlinear Active Suspension System with Passenger Seat

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Abstract

Suspension systems are essential parts in vehicles because of their usefulness for riding comfort and safety of passengers. Suspension system is used to isolate the road disturbance experienced by the tires from being transmitted to the passengers. The main objective of this paper is to propose a new intelligent control scheme based on using fuzzy logic and artificial bee colony (ABC) optimization algorithm to improve the performance of suspension systems. Effects of the nonlinearities forces that exist in damper, spring and actuator have been considered in this paper. The forces between the body of the vehicle and tires are generated using nonlinear active suspension systems. Also, the parametric uncertainty in the spring, damper and actuator has been taken into account; therefore, robust control scheme should be utilized. This necessitates a very fast and accurate controller to meet as many control objectives as possible. This paper deals with fuzzy technique to design a robust control scheme. The parameters of membership functions of fuzzy controllers have been tuned by using ABC optimization algorithm. The advantage of proposed controller is that it can handle the nonlinearities faster than other conventional controllers. The proposed control scheme attempts to minimize the vibration on each corner of the vehicle by feeding suitable forces to suspension system when passing on rough road. The comparison between passive and active suspension systems with the proposed ABCF control scheme is studied in order to illustrate the effectiveness of ABCF control scheme in terms of improving the ride comfort and safety of traveling passengers.

Keywords