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# HYBRID SELF-ORGANIZING FUZZY AND RADIAL BASIS-FUNCTION NEURAL-NETWORK CONTROLLER FOR ACTIVE SUSPENSION SYSTEMS

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Abstract. *This study developed a hybrid self-organizing fuzzy and radial basis-function neural-network controller (HSFRBNC) for active suspension systems. The HSFRBNC uses a radial basis function neural-network to adjust the learning rate and the weighting distribution of a self-organizing fuzzy controller (SOFC) in real time, as an alternative to obtain these parameters through trial and error. Therefore, using the HSFRBNC to control active suspension systems not only overcomes the difficulties of finding appropriate membership functions and fuzzy rules in the design of a fuzzy logic controller (FLC) but also solves the problem of determining suitable SOFC parameters. To evaluate the HSFRBNC applicability, the HSFRBNC was used to control an active suspension system and its control performance was determined. Experimental results indicated that the control performance of the HSFRBNC outperforms that of the SOFC, the FLC and the passive control in manipulating the active suspension system.*

**Keywords:** Active suspension system, Self-organizing fuzzy controller, Radial basis function neural-network, Ride comfort

1. **Introduction.** Suspension systems can be classified as passive, semi-active or active. Without considering the problems of economical cost and energy consumption, active suspension systems are more effective than other suspension systems at enhancing the handling capability and the ride comfort of cars. Therefore, active suspension system control has attracted the attention of numerous researchers and engineers, both in academia and in the automotive industry, with an interest in improving the handling and the ride quality of passenger vehicles.

Several controller designs have been developed for active suspension systems [1-3]. Active suspension systems generally exhibit both nonlinear and complex characteristics, so their mathematical models are difficult to accurately identify. Therefore, it is impractical to design model-based controllers for manipulating active suspension systems. In recent years, fuzzy logic control methods have been applied extensively to control engineering fields – no system model is required for the development of the controller. Thus, such methods have been appropriately employed to improve the systems' control performances by manipulating active suspension systems. Yoshimura et al. [4] applied a fuzzy reasoning, which was based on single-input rule modules, for active suspension system control. D'Amato and Viassolo [5] demonstrated a fuzzy control strategy for active suspension