

K N Spentzas and S A Kanarachos, Mechanical Engineering School, National Technical University of Athens, 15780 Athens, Greece

PERFORMANCE UNDER ROAD SPECTRA EXCITATION OF A VEHICLE'S NON-LINEAR HIBRID SUSPENSION SYSTEM DESIGNED BY NEURAL NETWORKS

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In the following paper, we investigate the performance under road spectrum excitation of a non-linear hybrid suspension system of vehicles that has been designed by use of neural networks. The design targets have been the minimization of the vertical acceleration imposed to passengers as well as the respect of all the design and construction constraints. The energy consumed by the actuator is minimized by use of a hybrid suspension system (behaves as a passive suspension system when the vertical acceleration imposed to the passengers is not exceeding a prescribed value and as an active one when it is exceeding). The neural network used is obtained by a Taylor approximation of the unknown non-linear control function. Due to the existence of numerous local minima of the neural network, we use an evolutionary algorithm to solve the resulting neural network problem. The performance of this design approach has been proved in the past for shock excitations by using a quarter-car model. In this paper its performance is established by using the same model and a road spectrum excitation. Evaluations of this design approach by use of half-car and full-car models will follow.

Keywords: vehicles suspension, vehicles hybrid suspension, energy consumption, neural networks, evolutionary optimisation methods

PERFORMANSE VOZILA, SA NELINEARNIM HIBRIDNIM SISTEMOM OSLANJANJA IZVEDENIM SA NEURONSKIM MREŽAMA, POD UTICAJEM POBUDE OD NERAVNINA PUTA

U ovom radu se razmatra ponašanje vozila koje ima hibridni sistem elastičnog oslanjanja konstruisan sa neuronskim mrežama. Cilj ovakvog načina konstruisanja jeste minimizacija vertikalnih ubrzanja sa aspekta udobnosti putnika kao i sa aspekta konstruktivnih veza. Energija koju preuzima aktuator se minimizira korišćenjem hibridnog sistema oslanjanja (on deluje kao pasivni sistem kada vertikalno ubrzanje ne prelazi dozvoljene vrednosti koje se prenose na putnika, a kao aktivne kada prelaze ove vrednosti). Neuronska mreža se koristi da bi se preko Tajlorovog reda aproksimirala nepoznata nelinearna kontrolna funkcija. Pobuđivanjem brojnih lokalnih minimuma neuronske mreže i korišćenjem algoritma evolucije, rešava se problem rezultujućeg odziva neuronske mreže. Sve ovo je implementirano na četvrtinski model vozila. U radu je izvršeno testiranje na pobudu od puta. Dalja istraživanja se predviđaju na modelu polovine vozila ili na celom vozilu.

Ključne reči: oslanjanje vozila, hibridno oslanjanje vozila, akumulacije energije, neuronske mreže, optimizacione metode evolucije.