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A new approach in optimal semi-active control of structures

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Magneto rheological (MR) dampers, as one of the most promising semi-active control devices, have received significant attention in recent years. Up to now, researchers have proposed various semi-active control algorithms for optimal control of buildings equipped with MR dampers. Optimization based on uniform deformation theory (UDT) was first proposed as a novel method in field of optimum design of structures. In this paper, efficiency of uniform deformation theory has been evaluated in field of semi-active control of buildings equipped with MR dampers, and the effect of applying this theory on structural response mitigations has been investigated. A method has been proposed in this research, by using polynomial controller, for determining optimum control voltage of MR damper with the goal of uniform distribution of maximum inter-story drifts of structure. In order to evaluate the performance of the proposed method, this controller has been applied to control of a six-story non-linear shear frame. Particle swarm optimization (PSO) algorithm is utilized to find optimal coefficients of the polynomial controller by minimizing the standard deviation of maximum inter-story drifts of the structure for a set of three different earthquakes. The obtained results show that the proposed method has a successful performance in uniform distribution of maximum inter-story drifts. Moreover, the capability of the proposed controller has been compared with passive control in terms of reduction in the maximum inter-story drifts, displacements, absolute accelerations and control forces. The results indicate that the controller based on UDT has a better performance in structural response reductions, especially maximum inter-story drifts.

Biography

Reza Karami Mohammadi received a BSc degree in Civil Engineering and MSc and PhD degrees in Earthquake Engineering from Sharif University of Technology, Tehran, Iran, in 1983, 1989 and 2001, respectively. He is a faculty member with the Department of Civil Engineering, K N Toosi University of Technology, Tehran, since 2008. He is an experienced Civil Engineer with specializations in structural dynamics and earthquake engineering. He has been studying the effects of earthquakes on many residential, official and industrial buildings since 1996. He has more than 16 years of experience in seismic analysis and design of structures. He is a Registered Professional Engineer in Tehran, Iran.

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