Semi-active Logic Control Algorithm for MR Dampers Using Accelerations Feedback

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ABSTRACT

A tall building with a large podium structure under earthquake excitation may suffer from a whipping effect due to the sudden change of building lateral stiffness and mass at the top of the podium structure. A comprehensive experimental investigation was thus carried out to explore the possibility of using magnetorheological (MR) dampers to connect the podium structure to the tall building to prevent the whipping effect. The tall building was constructed as a slender 12-storey building model whereas the podium structure was built as a relatively stiff 3-storey building model. Three MR dampers together with three current controllers manufactured by the Lord Corporation, USA, were used to link the 3-storey building to the 12-storey building. The two building models connected by the MR damper manipulated by a semi-active logic control algorithm using accelerations were tested under the specified ground motion. Experimental investigations were performed in the Structural Dynamics Laboratory in the Hong Kong Polytechnic University. The experimental results show that the MR damper with the semi-active logic control algorithm could significantly mitigate the seismic whipping effect and reduce the seismic responses of both the tall building and podium structure.

Keywords: semi-active control, multilevel logic control, MR damper, seismic response.