

Seismic Performance of Benchmark Building Installed with Semi-Active Dampers

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Abstract : The seismic performance of 20-storey benchmark building with semi-active dampers is investigated under various earthquake ground motions. The Semi-Active Variable Friction Dampers (SAVFD) and Magnetorheological Dampers (MR) are used in this study. A recently proposed predictive control algorithm is employed for SAVFD and a simple mechanical model based on a Bouc-Wen element with clipped optimal control algorithm is employed for MR damper. A parametric study is carried out to ascertain the optimum parameters of the semi-active controllers, which yields the minimum performance indices of controlled benchmark building. The effectiveness of dampers is studied in terms of the reduction in structural responses and performance criteria. To minimize the cost of the dampers, the optimal location of the damper, rather than providing the dampers at all floors, is also investigated. The semi-active dampers installed in benchmark building effectively reduces the earthquake-induced responses. Lesser number of dampers at appropriate locations also provides comparable response of benchmark building, thereby reducing cost of dampers significantly. The effectiveness of two semi-active devices in mitigating seismic responses is cross compared. Among two semi-active devices majority of the performance criteria of MR dampers are lower than SAVFD installed with benchmark building. Thus the performance of the MR dampers is far better than SAVFD in reducing displacement, drift, acceleration and base shear of mid to high-rise building against seismic forces.

Keywords : benchmark building, control strategy, input excitation, MR dampers, peak response, semi-active variable friction dampers

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