Sharif University of Technology
Civil Engineering Department

Master of Science Thesis
Earthquake Engineering

Evaluation of a Proposed Torsional TMD in Controlling the Seismic Response of Asymmetric 3-D Steel Structural Models

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Abstract:

This paper presents a new arrangement of Tuned Mass Dampers (TMDs) for response control of torsionally coupled 3-D building systems under bi-directional seismic inputs. In buildings with symmetric plan, two dampers, optimally designed, can be effectively used along each of the principal directions of the structural models to reduce their lateral displacement. The aim of this study is to explore the application of a torsional TMD to suppress the torsional response of the structures. The so-called Torsional TMD is consisted of two masses that are connected to each other by means of a rigid link. The pair of masses can rotate around the center point of the rigid link which is located on the center of stiffness of the structural plan with pre-determined torsional damping and stiffness. The torsional TMD can be tuned to the first torsional mode of the asymmetric building to reduce its rotational response. The criteria considered for evaluating the performance of the proposed TMDs arrangement are the maximum inter-story drift, rotation of the structure and the number of connections with nonlinear behavior. As the results show, the proposed arrangement considerably increases the efficiency of TMDs in controlling the seismic response of asymmetric structures with dominant rotational modes. Moreover, the rotation of floors that have noticeable effects on the total displacement of the exterior columns can be reduced effectively using the torsional TMD. The performance of the proposed torsional TMD would even be better for structural models with larger eccentricities.

KEYWORDS: TORSIONAL TUNED MASS DAMPERS, ASYMMETRIC 3-D STRUCTURES, TORSIONAL MODE, SEISMIC RESPONSE CONTROL