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EFFICIENCY OF SEMI ACTIVE TUNED MASS DAMPER ON IMPROVING SEISMIC RESPONSE OF STEEL STRUCTURE IN CLOSE AND REMOTE REGION

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Lessons learned from many earthquakes suggest that the conventional seismic design codes have some shortcomings, which lead to many damages. Several attempts were made in recent years to correct these shortcomings and improve seismic response of structures. For example, more attempts have been made in the recent decade to reduce structural acceleration, instead of improving structural strength. These design approaches are known as seismic vibration control methods.

In this paper, the performance of 2D and 3D model of 7-story structure with Tuned Mass damper (TMD) and Semi-Active Tuned Mass Damper (STMD) was subjected to 20 accelerograms by ground-hook and Fuzzy logic controller was investigated to better understand the effect of close and remote region this 20 accelerograms is divided into two parts: 10 accelerograms in a remote region and 10 accelerograms in a close region with 5<M<7.

Assuming that the model was located on a highly seismic soil (Soil III) and all accelerograms modified according to the Seismic Code (Standard 2800) then dynamic analysis such as time-history with ETABS and OpenSees in order to achieve response spectrum and displacement of one node on top floor was performed and the results compared with each other for validation. Finally OpenSees used for decreasing displacement of the node that located at the top floor and turning passive system to semi-active control system by ground-hook and sky-hook control algorithm and variable damping (0% , 5% , 10% ,15%) was applied on each excitation and the results were extracted then model was optimized and optimum frequency and damping for decreasing root mean square (RMS) and maximum displacement (Max Disp) was obtained.

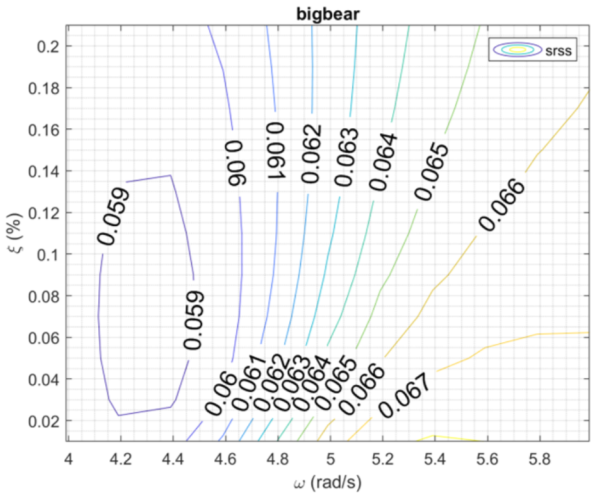

Figure 1. Optimization of TMD frequency based on RMS.

Also for better performance recognition of semi-active tuned mass dampers Fuzzy-logic controller used to estimate control force with high accuracy that way the Simulink was used for simulating structural performance with structural motion equation under each excitation. Then the displacement of top floor node in three parts (NO TMD, With TMD, WITH STMD) measured, and finally Fuzzy controller operator was assigned in order to semi-activate system at the end of Simulink program.

By comparing the two control algorithms and the results that we obtained, it was concluded that the ground-hook control algorithm did not perform well in remote region, and the difference between the node displacement at semi-active and passive system is about 2 to 3 percent; however, using the fuzzy controller provides more rational result in two region the displacement in the close region was reduced by 3% and in the remote region by 11% .

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