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Using MTMD to obtain Simultaneous Energy Absorption and Displacement Reduction in Concrete Moments Resisting Frames

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Abstract

Application of multiple tuned mass damper (MTMD) can be a useful passive control method in the improvement of structural seismic behavior. In this paper, the effect of MTMD in reducing the response of reinforced concrete moment resisting frames under earthquake excitation is discussed. For this purpose, the structural peak displacement and the dissipated energy in the main structural members of several concrete moment resisting frames with and without MTMD have been investigated, and the results are compared. Structural modeling is done by using OpenSees software. The non-linear analyze is performed for several reinforced concrete moment resisting frames under earthquake excitations and the influence of MTMD on the structural behavior is discussed. The results indicate that generally effect of this system is significant to improve the seismic response of the structure and this system can be applied to design of the new structures or seismic retrofit.

Keywords: Passive control system, Tuned mass damper, Reinforced concrete moment resisting frame, Energy dissipation in structure, Non-linear analyze.

1. Introduction

An important structural engineering problem today is controlling structures under earthquake loading. To provide an answer to this problem, researchers have proposed different control systems which can be classified into the following groups: 1) active control systems, 2) semi-active control systems, and 3) passive control systems.

The TMD[1] is one of the simplest and most reliable passive control instruments, comprising a lumped[2] mass, a spring, and a dashpot[3] which can move in the horizontal direction alone (a single-degree-of-freedom damper). Since all the system characteristics remain constant during vibrations, this system is referred to as "passive". It is observed from the response spectrum of the structure that structural damping is a determinant factor at resonance point and the points adjacent to it and can be most effective in reducing a structure's dynamic response. For this reason, identifying methods of increasing vibration energy damping capacity is of particular importance in Earthquake Engineering. The passive TMD control system is an appropriate method

[1] Tuned Mass Damper
[2] concentrated
[3] shock absorber