# Application of a Distribution of TMDs Located on Upper floors of Tall Buildings that are Tuned to their First Mode in Increasing Their Performance

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## Abstract

*This paper investigates an Application of a Distribution of TMDs Located on Upper floors of Tall Buildings that are Tuned to their First Mode in Increasing Their Performance. A number of 3D steel moment resisting frames with one level of eccentricities in orthogonal directions are considered. Two model of structures 15 story with rigid base are designed. We put TMD at the center of rigidity of the roof in first case. Then we put another one at lower story for each structure till about third of height. For example for 15 story structure, we put TMD at (15, 14-15, 13-14-15, 12-13-14-15) floors respectively. These models are subjected to a number of one-directional horizontal ground motions according to soil type. Extensive parametric studies carried out to investigate the performance of TMDs in controlling the nonlinear seismic- induced response of the structural models. Drift ratio, story accelerations and the maximum displacement of roof level for each structure are considered for comparison purposes. The OpenSees program is used for the required numerical analyses.*

**Keywords: Tuned mass dampers (TMD), 3-D structural models, Nonlinear behavior, Drift**

## 1. INTRODUCTION

The application of passive tuned mass damper (TMD) is an attractive option in reducing excessive floor vibrations. A TMD consists of a mass, spring, and dashpot, as shown in Fig. 1 , and is typically tuned to the natural frequency of the primary system [1]. When large levels of motion occur, the TMD counteracts the movements of the structural system. The terms m1, k1,c1, X1, represent the mass, stiffness, damping and displacement of the floor respectively, while m2, k2, c2, X2 represent the mass, stiffness, damping and displacement of the TMD and F(t) represent the excitation force. As the two mases move relative to each other, the passive damperis streched and compressed, reducing the vibrations of the of the structure through increasing its effective damoing TMD systems are typically effective over a narrow frequency band and must be tuned to a particular natural frequency. They are not effective if the structure has several closely spaced natural frequencies and may be increased the vibration iff they were off-tuned [2].