INVESTIGATION OF TMD AND TLD PERFORMANCEUNDER EARTHQUAKE EXCITATION, THE CASE OF22-STORY RESIDENTAL BUILDING

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ABSTRACT

Earthquake is a phenomenon that has caused many financial damages and fatalities. Researchers have always tried to decrease the destructive effects of this phenomenon and have presented methods to control structure vulnerability during an earthquake. Passive energy dissipation (PED) devices are a group of structural protective systems which are widely accepted by the engineering community. The basic function of these devices when added to a structure is to absorb a portion of input energy due to earthquake or other dynamic excitations and, as a result, reducing energy dissipation demand on primary structural members. Tuned dampers are a group of passive control systems, which their applications in vibration control of 22-DOF building under seismic excitation is investiagated with the Matlab/Simulink toolbox.

INTRODUCTION

Passive energy dissipation (PED) devices are a group of structural protective systems which are widely accepted by the engineering community. Passive control systems based on the structural response control are divided in two groups. The first group is used to reduce structural response by conversion of kinetic energy to heat and the second one by regarding the increased mass of oscillators, transfer energy among vibrational modes. The second group includes dynamic vibration absorber such as tuned mass damper (TMD), tuned liquid column damper (TLD) (Iemura et al., 2005).

Tuned mass dampers have supports that act as well as a spring and a damper themselves. Since the frequency of these dampers is tuned to natural frequency of the structure, these instruments are called tuned dampers (TD). This dampers moves under the lateral load of the structure and uses the inertial force (Conner, 2000; Soong and Dargush ,1997). For damper`s better function, it is deployed in upper floors of the building and the damper needs less mass, when is in top floor (Imani, H. 1387).The mass rests on bearing that function as rollers and allow the mass to translate between the mass and the adjacent vertical support members which transmit the lateral “out-of-phase” force to the floor level, and then into the structural frame (Conner, 2000; Soong and Dargush ,1997).

A Tuned liquid damper (TLD) consists of a tank partially filled with liquid (preferably water). The various mechanisms of the energy dissipation are viscous action of the fluid, wave breaking, and contamination of the free surface with beads and container geometry and roughness (Yalla, 2001).