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EXPERIMENTAL INVESTIGATION OF STRUCTURE DYNAMIC RESPONSE WITH SINGLE DEGREE OF FREEDOM WITH A TUNED LIQUID DAMPER EQUIPPED BY A BAFFLE

Hossein SHAD
Assistant Professor, Hakim Sabzevari University, Sabzevar, Iran
shad1@hsu.ac.ir
Hossein BAKHSHI
Associate Professor, Hakim Sabzevari University, Sabzevar, Iran
h.bakhshi @hsu.ac.ir
Hassan SAGHI
Associate Professor, Hakim Sabzevari University, Sabzevar, Iran
h.saghi@hsu.ac.ir
Zaher REZAIE
M.Sc. Student, Hakim Sabzevari University, Sabzevar, Iran
rezayi.zaher@gmail.com
Mehrollah RAKHSHANIMEHR
Assistant Professor, alzahra University, Tehran, Iran
m.rakhshanimehr@alzahra.ac.ir

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Improving the behavior of structures by reducing the impact of side loads is one of the new issues in the science of structural engineering that is based on reducing the impact of energy on the structure through its depreciation. In recent decades, numerous studies have been conducted to control vibrations of structures by the use of modern control systems in structures exposed to dynamic loads. There is a method for passively controlling vibrations of structures in which oscillations and turbulence, which is generally water, are used in one or more tanks mounted on the roof of the structure, to control the vibrations of the structure under dynamic loads, and hence It is called a tuned liquid damper system because it is economically more economical than other control systems. In order to optimally design these systems, their frequency must be adjusted based on the frequency of the main modes (modes of the structure). Accurate tuning of the TLD system to the structure and earthquake is one of the most important parameters in the design that improper tuning reduces TLD efficiency. Therefore, TLD characteristics such as fluid height, tank length, and fluid mass ratio should be adjusted to match the fluid turbulence frequency within the damper with the vibration frequency of the structure.

In recent decades, researchers have incorporated additives into the TLDs that have increased the damping of structures by controlling fluid turbulence in the tank. The positive results of this research encouraged the scientific community to install and study a variety of barriers (baffles, plates, roughness, etc.) inside these dampers. In this study, a simple rectangular tank (TLD) with T-shaped baffles (Figure 1) and adjustable with varying degree of fluid depth closure with baffle positioning positioned above the container and containing fluid compared to TLD Located on the roof of a single degree of freedom (SDOF) structure under dynamic excitation and free vibration, the effects of fluid depth closure changes on the assumed TLD on the structural response reduction are evaluated. All of the processes mentioned are experimentally.

The modified TLDs were made using vertical baffles (Figure 1-b). Vertical baffles are mounted in the middle of the tank's length from the top of the tank to the bottom of the water surface. Vertical baffle height (d) and horizontal baffle length (l) were changed to create ranges of changes in the ratio of vertical (Vj) and horizontal (li) closures, with the index j representing the percentage of closures. And the value of this closure ratio is obtained from Equations 1 and 2:

$$V_j = (d/h_0) \times 100 \quad (1)$$

$$l_i = (l/h_0) \times 100 \quad (2)$$

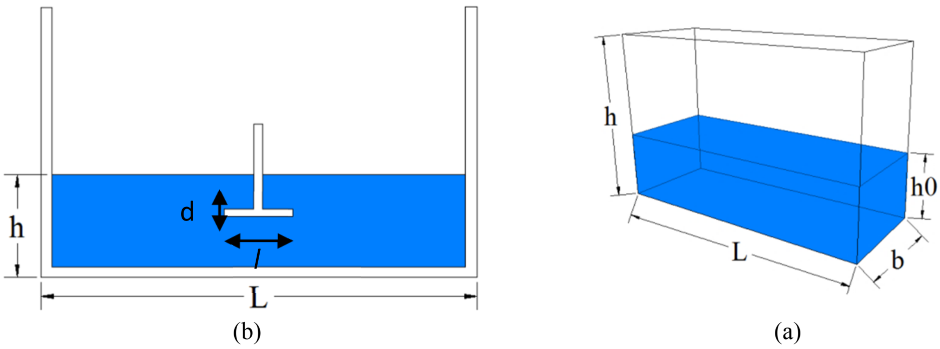

Figure 1. (a) TLD dimensions, (b) TLD modified with upper baffle mounted (Shad et al., 2016).

Experimental experiments performed in this study examined variations of j from 10% to 90% with a 10% increment rate (Shad et al., 2016) and i variations from 20% to 100% with a 20% increment rate.

The purpose of this study was to investigate the effect of optimum fluid depth closure on fluid frequency, increase of fluid damping in dampers parameters containing upper baffles, and reduction of dynamic response of structures. The results showed that 10% of fluid depth closure had the best effect on decreasing structural response.

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