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PERFORMANCE ASSESSMENT OF TUNED LIQUID DAMPER WITH FIXED BAFFLE IN A 5-STORY BENCHMARK BUILDING UNDER FAR AND NEAR-FIELD EARTHQUAKES

Mazyar FAHIMI FARZAM
Assistant Professor, Department of Civil Engineering, Faculty of Engineering, University of Maragheh, Maragheh, Iran
m.farzam@maragheh.ac.ir
Babak ALINEJAD
Assistant Professor, Department of Civil Engineering, Faculty of Engineering, University of Maragheh, Maragheh, Iran
alinejad.science@gmail.com
Rasool MAROOFIAZAR
Assistant Professor, Department of Mechanical Engineering, Faculty of Engineering, University of Maragheh, Maragheh, Iran
maroofiazar@maragheh.ac.ir
Hajar KAZEMI SORMOLI
M.Sc. Graduate, Department of Civil Engineering, Faculty of Engineering, University of Maragheh, Maragheh, Iran
h.kazemi.s@stu.maragheh.ac.ir

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Different control techniques are developed to decrease structural responses and to improve the structural dynamic behavior against dynamic lateral loads. One of the well-established methods for protecting structures against external excitations is using control systems categorized as passive, active, semi-active and hybrid control (El-Khoury & Adeli, 2013). The Tuned Liquid Damper (TLD) is one of the passive control systems. Pandey et al. (2019) introduced a new type of TLD that had flexible installation on structure, and reduced the roof acceleration. A 5-story benchmark building was used by Enayati and Zahraei (2018). They studied the performance of this benchmark model using a TLD with some installed rotatable baffles.

This paper investigates the seismic performance of the 5-story benchmark building under four earthquake records where a Passive Tuned Liquid Damper (PTLD) with fixed baffle is connected rigidly to the roof of the building. The benchmark building and the selected records are approved by IASC (International Association for Structural Control). Dimensions of PTLD are optimized, and the interaction between structure and fluid is considered. Furthermore, the influence of the fixed baffle is investigated. Models are simulated in ANSYS software. Figure 1 shows ANSYS Workbench simulating process which uses two-way fluid-solid interaction model including Fluid Flow (Fluent) and the Transient Structural systems linked with System Coupling. In addition, the fluid sloshing responses in two different cases (i.e., without and with baffle) are shown in Figure 2 at fifth second of response history analysis under two different earthquakes.

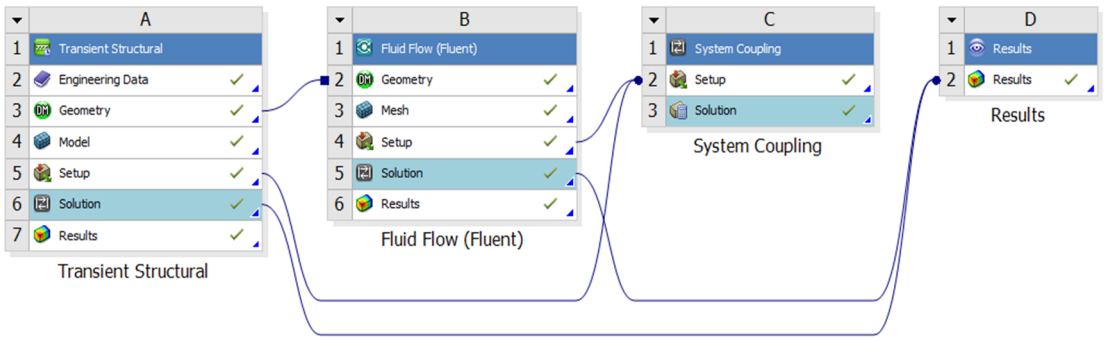

Figure 1. ANSYS Workbench.

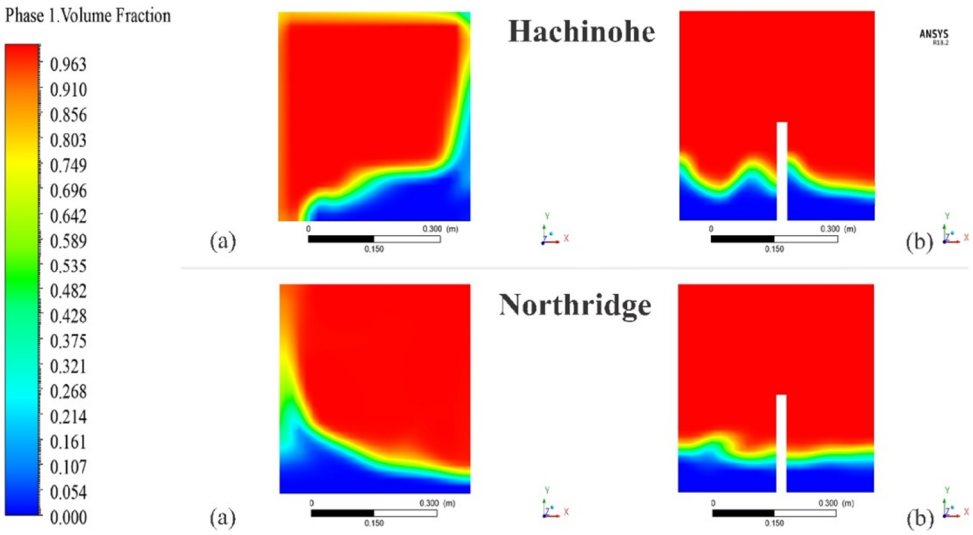

Figure 2. ANSYS simulation model of the fluid sloshing inside the tank at fifth second of response history analysis: (a) without baffle; (b) with baffle.

Averagely, the reduction of the controlled building roof displacements without baffle and with baffle under near-field excitations are 5.16% and 5.9%, respectively. Moreover, the corresponding response under far-field excitations are reduced about 3.18% and 4%, respectively. Results show that PTLD with fixed baffle enhances the structural behavior in comparison to controlled structures without baffle and uncontrolled structures. Also, the PTLD indicates the rather superior performance under near-field than far-field excitations to decrease structural responses.

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