FINAL PROJECT

INVESTIGATION OF TUNED LIQUID COLUMN DAMPER FREQUENCY AND DAMPING RATIO WITH DIFFERENT NUMBER OF ORIFICE

Is Proposed as One of the Requirements to Finish Undergraduate Program

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ABSTRACT

In the 21st century, high-rise building is one factor as a solution for residence and offices. Then, high-rise buildings can accommodate a lot of people in a limited area. The height of high-rise buildings is directly proportional to their vulnerability to fluctuation forces like earthquakes and wind. Tuned liquid column damper (TLCD) systems are passive mass dampers that don't need external energy to suppress the vibration response. This type of damper can effectively decrease the structure response when the TLCD parameters such as natural frequency and damping ratio are selected.

In the research, the natural frequency and damping ratio of TLCD are determined using the pendulum type of TLCD. Experimental testing with pendulum type of TLCD is varied with the number of orifices and the volume of water inside. There are 4 types of TLCD with 2 holes orifice, 4 holes orifice, 6 holes orifice, and 8 holes orifice. Each type of TLCD is varied with 200 ml, 300 ml, 400 ml, and 500 ml of water inside. After the natural frequency and damping ratio were obtained, the optimum parameter is chosen. The simulation study based on optimum pendulum type of TLCD parameter was conducted with a two-story structure model to see performance of TLCD suppress vibration response. Then, to validate the result from the simulation, the experiment was conducted with the same parameter from the simulation.

The result shows the natural frequency and damping ratio of TLCD can be determined using the pendulum type of TLCD. The TLCD with 4 holes and 400 ml of water has the best parameter to suppress vibration response. From experiment and simulation results, this type of TLCD can dampen vibration of structure up to 87.3% and 67.09%, respectively.

Keywords: TLCD, orifice, natural frequency, damping ratio.