1 INTRODUCTION

1.1 Background

One of the causes of failure in the structure is the dynamic loading acting to the structure. To minimize failures in a structure, the structural resistance to dynamic loading should be increased. One way to achieve this condition is by increasing structural damping. The damping properties is the most important parameter in the structure, which can suppress the vibration response due to the dynamic loading[1].

One of the most widely used methods to attenuate the structure vibration is Tuned Liquid Column Damper (TLCD). TLCD is an innovative absorber, were generates the movement of liquid column inside the U-shaped container to reduce the vibration of the structures[2]. TLCD is a damper with a passive control system. In passive control systems, there are no external energy sources needed to reduce the system vibration[3].

When TLCD is applied to the structure, the energy of the structure vibration is transferred to the TLCD by movements of the liquid inside TLCD container. Thus, system vibrational response is transformed into gravitational restoring force due to fluid motion inside TLCD, and the energy reduction is caused by the viscous of liquid that contact with the wall of TLCD container[4].

The application of TLCD is relatively easy to be performed and it does not change the design of a structure[5], so that, many studies prove that TLCD is effectively used as a damping structure, both experimentally and analytically. For the applications of TLCD, some parameters are needed. However, in previous studies, K. Min at all already develop the research about predicting head loss coefficient damping ratio of the TLCD with various blocking ratios by the head loss coefficient obtained experimentally[6]. Another study, A. Farshidianfar at all do the research to investigate optimal design parameters such as length ratio and mass ratio on the performance of the TLCD for controlling the responses of a structure are using the harmonic type of earthquake excitation[7].

Therefore, in this research, we purpose a simple way to determine TLCD parameters, such as natural frequency and damping ratio, seen from its response using pendulum vibration system.

1.2 Problem Formulation

This research delivers the technique of determining the natural frequency and damping ratio of TLCD for better design TLCD. Pendulum vibration system with TLCD can be used for the alternative absorber for the undamped structure.

1.3 Objectives

The objectives of this research are:

1. To conduct the experimental and simulation study in determining the natural frequency and damping ratio of TLCD using pendulum vibration system.
2. To determine TLCD parameters using acceleration response.
3. To validate the Pendulum-TLCD response using the calculated TLCD natural frequency and damping ratio.

1.4 Outcome

The outcome of this research is to help engineers in designing TLCD parameters, such as natural frequency and damping ratio.

1.5 Problem Scopes

There are two scopes of problem of the research:

1. The liquid used in this research is water.
2. The system is assumed linear, in material and geometry.

1.6 Report Outlines

The research report consists of five chapters. CHAPTER I describe the background, problem statement, objectives, outcomes, problem scope, and report outlines. Then, CHAPTER II explains the theories, related to the research. CHAPTER III explains the research methodology. CHAPTER IV describes the result of the research. And the last chapter, CHAPTER V is conclusion.