

I. INTRODUCTION

1.1. Background

In recent years, vibrations become one of interesting and challenging topic in the civil engineering world. The method to control the vibrations that vibrate in the structure has been proposed by civil engineers. The main purpose is to reduce the vibrations that as the result from wind and earthquake to maintain the safety of the building.

The methods to control the structure are divided into three types based on the need of energy to produce the force for the control. Control of the structure is divided into active control, passive control and active hybrid control (semi active). Active control requires electrical current to produce the force for a tool operation, while passive control using the potential energy that raised by the response structure to generate control forces. The influence of active control is that the dynamic characteristics of the structure can adapt to dynamic loads that arise, while excess passive control is due to its simplicity in design, installation, and especially in maintenance. One of passive control systems consists of tuned mass damping, energy dissipation.

Tuned mass damper (TMD) is a device consisting of a mass, a spring, and damper that is attached to a structure in order to reduce the dynamic response of the structure. The frequency of the damper is tuned to a particular structural frequency so that when that frequency is excited, the damper will resonate out of phase with the structural motion. Energy is dissipated by the damper inertia force acting on the structure.

Recently many researcher developing the system of TMD (Tuned Mass Damper) with various properties. Genetic Algorithm (GA) was founded by John Holland and his friends on early 1970 in New York (Holland,1975). The basic techniques of the GAs are designed to simulate processes in natural systems necessary for evolution, especially those follow the principles first laid down by Charles Darwin of "survival of the fittest". GAs simulate the survival of the fittest among individuals over consecutive generation for solving a problem. To continue the genetic analogy these individuals are likened to chromosomes and the variables are analogous to genes. Thus a chromosome (solution) is composed of several genes (variables). A fitness score is assigned to each solution representing the abilities of an individual to 'compete'. The individual with the optimal (or generally near optimal) fitness score is sought. The GA aims to use selective 'breeding' (with mutation or recombination) of the solutions to produce 'offspring' better than the parents by combining information from the chromosomes.

The numerical optimization technique is used to compute the optimum values of TMD parameters that will minimize the maximum displacement of the structure. In this method, the values of the optimum frequency ratio and optimum damping ratio for the TMD system are defined as the values that will reduce the maximum displacement of the structure to a minimum value when subjected to a specific earthquake time-acceleration history. The developing of properties (objective function) for optimization tuned mass damper will be proposed in this research with using a MATLAB computer program.

1.2. Problem statement

According to the background in this research study about the ‘Optimization of Tuned Mass Damper’, the author wants to find optimum value of the stiffness of the damping (k_d) and damping system (c_d).

1.3. Problem limitation

The limitation in this research are:

1. The author only optimizes the value of damping stiffness and damping system with by using Real Genetic Algorithm.
2. The program to determine the optimum value with the genetic algorithm is using MATLAB R2013a.

1.4. Originality

The topic about “Optimization of Tuned Mass Damper to Minimize the Displacement” has never been used on any other final project before.

1.5. Objective and benefits

Objectives to be achieved in this research are:

1. To find the optimum value of k_d and c_d for tuned mass damper.
2. To give the information about Genetic Algorithm can be one solution for solving optimization problem.