CHAPTER I

INTRODUCTION

1.1 Background of the Study

Nowadays, improvements of driving safety and comfort are over lasting subjects for the vehicle design. It is not only a need but also as a challenge for automobile engineers to construct “best quality” of a car. Ride comfort problems mainly arise from vibrations of the vehicle, which may be induced by a variety of sources including road surfaces irregularities, aerodynamic forces, and vibrations of the engine and transmission. To overcome these problems are by designing a suspension system.

The main objectives of ideal suspension system are to isolate the car body from shock loading and vibration due to irregularities of the road surface without impairing the stability, steering or general handling qualities of the car. Due to these objective demands, suspension design has had to be something of a compromise, largely determined by the type of use for which the vehicle was designed.

An early design for automobile suspension systems focused on optimization for passive suspension system which that has disadvantages inadaptable to the road condition and its parameters are generally fixed. It reacts automatically to the loads applied to them at the road surface. However, there is no absolutely active control over these

reactions. On the other hand, an active suspension system is one in which the reactions to the applied loads are positively supplied by automatically controlled powered actuator. Typically, it consists of a spring, a shock absorber and a hydraulic actuator at each corner of the vehicle. Its role is to improve both driving comfort and road holding by appropriately transmitting and filtering all forces between the body of the vehicle and the road.

In engineering application, an active suspension is provided with a control system as well as Proportional Integral Derivative (PID) controller. PID controller is the most popular control system in this century, because of the effectiveness, easily implemented, and widely used. It is a Unity Feedback System that consists of three terms control algorithm, which is proportional control, integral control, and derivative control. In this study, the performance of PID control system will be analyzed in design of quarter-car suspension system.

1.2 Statement of the Problem

The problem is how to design a Proportional Integral Derivative (PID) controller for bus suspension system by using Matlab/Simulink Software.

1.3 Objective of the Study

Based on the background and statement of the problem in this final project, the object of this research is as follow:

1. To design a Proportional Integral Derivative (PID) controller for bus suspension system.
2. Modeling bus suspension system in Simulink program.
3. To simulate the performance of bus suspension system through the computer simulation works (Matlab Software).

1.4 Benefit of the Study

The primary benefit of this employed study is to have a better understanding about suspension control systems, and further demonstration of this technology's potential. Also, the work of study demonstrates that the techniques used for specific parts of the active suspension system of the design process can be integrated into an effective and coherent development method. The second benefit of this study is as a useful reference for advance research in the future.

1.5 Scope of the Study

The scope of work for this project is used as limitation which available to be discussed and analyzed. Limitations are as follows:

1. The bus suspension system is modeled as the quarter-car model.
2. The output variable of the system is only considered in the vertical motion of displacement.
3. The discussion of performances criteria of designed system including *rise-time, settling-time, overshoot,* and *steady-state error*.