CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter presents the project background as the motivation and starting point for the progress in this project. The problem statement and objectives of this project are then discussed. The chapter ends with the scopes of the project.

1.1 Project Background

Suspension system is a mechanism that physically separates the vehicles body with it tires. It is one of the most important parts of a vehicle. The roles of suspension system are to support the vehicle weight, isolate the vehicle body from road disturbance and also maintain the traction force between the tire and the road surface (Acker et al., 1991). Common problem when designing a passive vehicle suspension system is the criteria of the system whether it is for road holding or the passenger comfort (Simon, 1998). When the passive suspension system design is focusing on increasing the passenger comfort, it's automatically will decrease the handling abilities of the vehicle. This is a complex problem to solve and researches for solving this problem have been doing since 30 years ago. With continuous research and emerging of technology, scientists and engineers managed to create new approach in designing the vehicle suspension system. Although, this project focusing more on to increase the comfort of the vehicles passenger, the handling abilities will not be compromised as the design is following the new approach of designing the vehicle suspension. Alleyne et al., (1993) conclude that they are four important parameters that are associated with the comfort of the vehicles passenger. The parameters are suspension deflection, body (sprung mass, m_s) displacement, body

(sprung mass, m_s) acceleration and tire assembly (unsprung mass, m_u) displacement. But the acceleration and displacement of vehicle's body (sprung mass, m_s) played the largest role in improving the comfort compared to other parameters (Alleyne et al., 1993). The approach of designing the vehicle suspension system for this project called semi-active suspension system that will be later fully explained in the next chapter.

1.2 Problem Statement

Passive suspension system is very common in the passenger's vehicles. The main problem for passive suspension system is it cannot give comfort to the passengers without sacrificing the traction force between the tire and the road. Figure 1.1 shows the relation of ride comfort and vehicle stability in a vehicle passive suspension system design. The passive suspension system performance also is variable subject to road profile and added passengers weight. It is because passive suspension system has fixed spring constant and damping coefficient thus its damping force is not adjustable. This project developed a vehicle suspension system that can adjust its damping force by replacing standard hydraulic damper with a continuously adjustable damper to overcome the problem. The main focus is to make the vehicle passenger feel more comfortable without sacrificing the vehicle handling abilities.

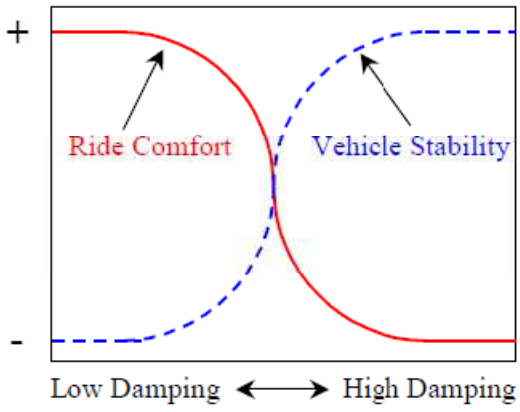

Figure 1.1: Passive Suspension Design Compromise

Source: Simon D.E (1998)

1.3 Objectives

There are three objectives of this project:

- To develop a two degree of freedom (2DOF) quarter car model passive suspension system.
- To develop Magneto Rheological (MR) damper using Bingham method.
- To develop modified skyhook controller to a semi-active quarter car suspension using MR damper.

1.4 Scopes

The scopes of this project are:

- Modeling two degree of freedom (2DOF) quarter car model passive suspension system block diagram in MATLAB.
- Modeling the modified skyhook controller block diagram in MATLAB.
- Modeling the Bingham Method MR damper block diagram in MATLAB.
- Connecting the block diagram and run the simulation.