UNIVERSITI TEKNOLOGI MARA

PERFORMANCE COMPARISON OF ACTIVE SUSPENSION FOR RIDE COMFORT USING LINEAR QUADRATIC REGULATOR AND FUZZY LOGIC CONTROLLER

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ABSTRACT

The main purpose of a suspension is to reduce the vibration that occurs when driving on the road. However, this vibration still exists in passive suspension which contain high frequency causing reduced ride comfort and road handling. Besides that, the effects of using the passive suspension also cause damage to certain component of cars when passing through holes in the road and also when there is a high bump. To overcome this problem, a comparison has been made based on the performance between passive suspension, Linear Quadratic Regulator (LQR) and Fuzzy logic Controller (FLC) that use specific parameters based on previous studies. This investigation focus on 2 degree of freedom (DOF) quarter car suspension using the MATLAB / SIMULINK toolbox. Several road profiles were used and analysis based on car body displacement, car body acceleration, suspension travel and space rattle was carried out. The results of the analysis show that both controllers can reduce vibration. However, FLC provides the best performance compared to LQR.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Nowadays, cars are one of the most important transportation utilized to move from destination to destination. Car production is also increasingly tailored to the needs of consumers. Differences in design and model produced by the factory to ensure that consumers have a choice according to their interests, capabilities and safety features. Some people think that the speed of a car can satisfy driving satisfaction. However, high-speed cars without good driving skills and inability to control cars properly can cause accidents. Therefore, many changes are made by automotive engineers to improve driving comfort. Changes made does not only focus on engine and external design only, the suspension is also considered.

The main purpose of installing the suspension between the car body and wheel is to reduce the vibration rate resulting from the tires of the car moving on the road. Driving on uneven roads will produce vibrations on the tires and these vibrations will then transmit to the car body causing reduced drivability [1]. When a suspension is made available, the resulting vibration rate will decrease accordingly. However, it still does not meet the satisfaction long distance drive. Previous study show that, vibrations that exceeding 12Hz will have adverse effect on drivers and passengers. The resulting frequency of the tires is 4-6Hz. According to the study, driving over one hour has serious effect on the spine and body muscles [2].