

MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
Yasir Mohd Mustafah



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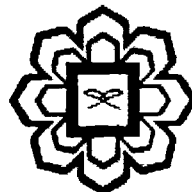
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EDITOR

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Chapter 41

Active suspension system: Part 1 - Mathematical Modelling

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41.1 Introduction

Suspension system's task is to absorb the vibration caused by road disturbance and keep the vehicle body unaffected by the vibration. It achieves that by keeping a constant distance between the chassis and wheel. Three ways to implement suspension system are available: passive, active and semi active. Passive suspension system depends on springs and absorbers while the active uses a feedback control system with actuators and sensors. In this chapter, a mathematical modelling of semi active suspension was done using Transfer function and state-space approaches. They were derived based on the governing equation of motion obtained from a quarter car model of such system.

Suspension in automobile is a term which refers to the system of springs, dampers and other components that attaches the suspended portion of the vehicle to the wheels. Its objectives are to increase tires holding to road surface thereby improving steering stability, handling and ensure the comfort of the passengers. In terms of controller implementation, suspension system can be categorized into passive system and active system. Semi-active suspension system is often regarded as a subcategory of active system. However, it's given great consideration since our main target is to design such system. Passive suspension, shown in Fig. 41.1, is easy to install, maintain and operate. However, it gives different responses over range of road input frequencies which makes it unpredictable in such circumstances.

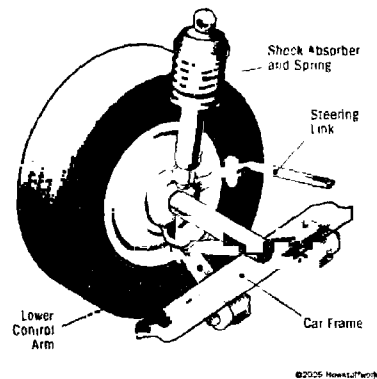


Fig. 41.1: a typical passive suspension system.

The use of feedback control loop in suspension system improves the performance over a wide range of road bumps frequencies. In active suspension, the passive means are replaced with high accuracy actuators that can be adjusted to suit various situations. Unfortunately, it has disadvantages of high cost, added complications and need for power in order to turn on which puts vehicle's body and passengers in danger. Though it delivers similar performance, semi-active system surpasses active one with regard to size and power required. It works as