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Vehicle Suspension System Technology and Design

Second Edition

Synthesis Lectures on Advances in Automotive Technology

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Preface

This book encompasses all essential aspects of suspension systems and provides an easy approach to their understanding and design. The book is intended specifically for undergraduate students and is accessible to anyone with an interest in learning about the foundations and design of suspension systems. This book uses a step-by-step approach using pictures, graphs, tables, and examples so that the reader may easily grasp difficult concepts.

After a short introduction, suspension systems and their components are discussed and reviewed in Chap. 1. The following chapter defines and examines suspension mechanisms and their geometrical features. In Chap. 3, suspension motions and ride models are derived to study vehicle ride comfort. This chapter ends with an analysis of suspension design factors and component sizing. Air suspension systems and their functionalities are reviewed and introduced in Chap. 4. The book ends with the development of adaptive suspension systems in Chap. 5.

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Introduction

When people consider purchasing a new vehicle, they normally think of horsepower, torque, 0 to 100 km/h acceleration, and fuel economy. However, they are likely unaware of an important factor: the engine's power or vehicle speed is utterly useless if the driver cannot control the vehicle. Certainly, many people may recognize the importance of suspension for ride comfort, but they are less aware of the complete range of vehicle suspension duties. In fact, in addition to ride comfort, the suspension system plays an important role in vehicle performance, stability, and safety. Accordingly, automotive engineers turn their attention to the suspension system, an area usually ignored by customers considering a purchase.

Historic horse-drawn carts had an early form of a suspension system, where the platform swung on iron chains attached to a wheeled frame on the carriage (Fig. 1). This system was the basis for all suspension systems until the end of the nineteenth century. Obadiah Elliot is known as the first person that used a spring in the suspension system of a vehicle, and Mors of Paris first fitted a suspension system with shock absorbers in 1901.

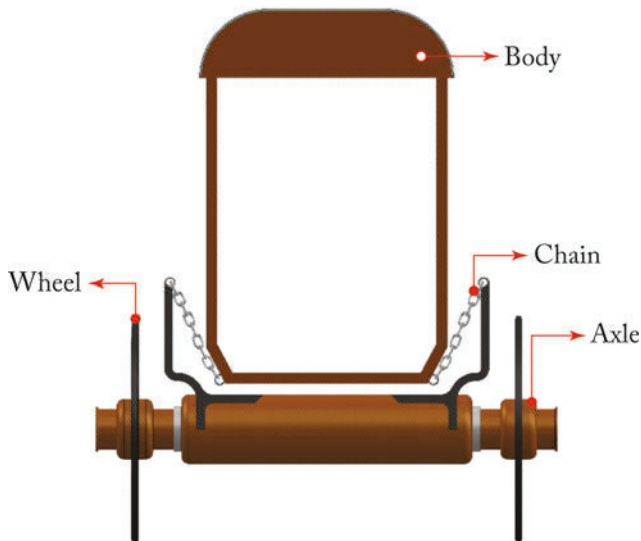


Fig. 1 Early form of suspension systems for horse-drawn carts

Today, there are many kinds of suspension systems with complex structures and elements, some of which will be discussed here.

This book begins with the definition of the suspension system and its function. It then goes on to describe the main components and desired features of suspension systems. This is followed by a classification of the different types of suspensions along with their advantages and disadvantages. Major suspension elements like springs, shock absorbers, and anti-roll bars are introduced. The design and analysis of a suspension mechanism along with its major parts are explained. There is also a section that reviews and discusses air suspension systems. Finally, the active and semi-active suspension systems, as well as some classic control techniques are introduced.

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