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## Effect of suspension spring stiffness on vehicle dynamics

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**Abstract:** Vehicle suspension systems and suspension working space are of great interest to designers and researchers of road vehicles. This paper deals with an investigation into the influence of suspension spring stiffness on vehicle dynamics. A mathematical model of a quarter vehicle for twin spring, passive and active suspension systems is developed. These systems are compared in terms of their relative performance capabilities. The vehicle itself is treated as a rigid body undergoing vertical motions. Also, a longitudinal half vehicle model for passive suspension is used to investigate the effect of front and rear spring stiffness on the vehicle dynamics. A chassis dynamometer was used to perform the experimental work. The predicted results were compared with experimental measurements. The experimental and theoretical results obtained indicate that the mathematical model produces optimistic results for the vertical direction of body acceleration and suspension working space. The effect of using active suspension elements to obtain improved ride is discussed. The results obtained give a solution to the vehicle dynamics problem and show optimum values of spring stiffness and damping coefficient.

**Keywords:** heavy vehicles, suspension spring stiffness, suspension, vehicle dynamics.

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### 1 Introduction

An ideal suspension system is required to isolate the vehicle body from road irregularities and transmit the vehicle control forces of steering, braking and traction between the body and the ground. Large manufacturers have accumulated a vast pool of