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Mémoire de Master

Design and Simulation of Mechanical behavior of an Automotive Suspension System

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Abstract

This work consists of studying the mechanical behavior of a suspension system by numerical analysis. The accomplishment of this work is based on using SolidWorks to design the mechanical system, using the calculation code by finite element ABAQUS for the numerical analyses and simulations. We have created a numerical analysis to study the structure under mechanical solicitations. This modeling makes it possible to visualize the system as a whole and to identify the various components such as the springs, the shock absorbers and the suspension arms. Once the 3D model is created, a numerical analysis is performed to determine the mechanical behavior of the suspension system under mechanical loads. It predicts the deformations, stresses and tensions inside the suspension system.

Résumé

Notre travail consiste à étudier le comportement mécanique d'un système de suspension par analyse numérique. La réalisation de ce travail repose sur l'utilisation de SolidWorks pour la conception du système mécanique, l'utilisation du code de calcul par éléments finis ABAQUS pour les analyses numériques et les simulations. Nous avons créé une analyse numérique pour étudier la structure sous sollicitations mécaniques. Cette modélisation permet de visualiser le système dans son ensemble et d'identifier les différents composants tels que les ressorts, les amortisseurs et les bras de suspension. Une fois le modèle 3D créé, une analyse numérique est effectuée pour déterminer le comportement mécanique du système de suspension sous charges mécaniques. Il prédit les déformations, les contraintes et les tensions à l'intérieur du système de suspension.

ملخص

لتصميم النظام الميكانيكي ، باستخدام كود الحساب بواسطة SolidWorks العددي ، ويستند إنجاز هذا العمل إلى استخدام للتحليلات العددية والمحاكاة. تحليل عددي لدراسة الهيكل تحت طلبات ميكانيكية ، هذا النمذجة ABAQUS العنصر المحدود يجعل من الممكن تصور النظام ككل وتحديد المكونات المختلفة مثل النوابيع وامتصاص الصدمات وأذرع التعليق ، وبمجرد إنشاء النموذج ثلاثي الأبعاد ، يتم إجراء التحليل العددي لتحديد السلوك الميكانيكي لنظام التعليق تحت الأحمال الميكانيكية ويتنبأ بالتشوهات والضغوط والتوترات داخل نظام التعليق

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General introduction

The suspension is an essential system in vehicles, designed to ensure a more comfortable, safe and stable ride. It allows to absorb the shocks and vibrations of the road, while keeping the wheels in contact with the ground. The main goal of the suspension is to maximize passenger comfort by reducing the effects of road irregularities. When driving on a bad roadway or encountering bumps and potholes, the suspension plays a crucial role in minimizing the impacts felt inside the vehicle. It acts as a shock absorber, absorbing the kinetic energy generated by road obstacles and limiting sudden movements of the vehicle.

The suspension also contributes to the stability and handling of the vehicle. By keeping the wheels in constant contact with the ground, it improves the grip of the tires, which allows better traction and better control of the vehicle, especially when cornering and emergency braking. A well-tuned and in good condition suspension promotes a safer and more predictable ride. There are different types of suspensions used in vehicles, such as coil spring suspensions, torsion bar suspensions, air suspensions and double wishbone suspensions. Each of these systems has specific advantages and characteristics in terms of comfort, load capacity and performance on different types of terrain.

- In order to make things clear and to make the reader understand our study, our work has been divided into three main parts:

- The first part contains an introduction, which is followed by some general information about suspension, and a presentation of the suspension components.

- In the second part, we have the theoretical part; it contains a presentation about ABAQUS software, finite elements method, and the steps of the simulation.

- The third part is the practical part; we will talk about the numerical study of system. This part also contains Von-Misses, and a dimensional study, with some numerical analyses of the components, and finally decent result.

We will end this work with a general conclusion.

In conclusion, the suspension plays a crucial role in the comfort, safety and stability of vehicles. It makes it possible to attenuate the jolts and vibrations of the road, to maintain an optimal grip of the tires and to offer a more pleasant driving for the occupants. A well-maintained suspension that is adapted to the driving conditions helps to improve the overall .