PERFORMING NEW MATERIAL FOR LOWER CONTROL ARM PRODUCT VEHICLE USING FINITE ELEMENT ANALYSIS METHOD

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BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY (AUTOMOTIVE TECHNOLOGY) WITH HONOURS

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Faculty of Mechanical and Manufacturing Engineering Technology

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A thesis submitted
in fulfillment of the requirements for the degree of
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DECLARATION

I declare that this Choose an item. entitled Performing new material for lower control arm product vehicle using Finite element analysis method is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : Anas

Name : *MUHAMMAD ANAS FARID BIN MASRI*

Date : JUNE 2022

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours.

Signature : 

Supervisor Name : *DR. ROSIDAH BINTI JAAFAR*

Date : JUNE 2022

DEDICATION

Let me begin by thanking to Allah SWT for providing me with the time, space, energy and resources necesssary to finish the work at hand. In addition, i must aknowledge the unwavering assistance of my loved once and fellow students. A special thanks goes out to DR Rosidah Binti Jaafar for allof his support and advice during this project. Students in this epidemic countries will undoubtedly find it difficult to deal with their studies because of the physical and emotional strain. As a result of their help, i was able to finish my Bachelor's degree project.

ABSTRACT

The vehicle's performance may be affected by the material used for the lower control arms. In the development of the lower control arm, the most important consideration is the material that can handle the force. A better material than what is now available for the lower control arm is needed to establish whether or not a better material can be employed. Steel is the most commonly utilised material because of its higher maximum stress and displacement capacity, according to a literature review. Drawing the lower control arm from the real lower control arm's measurements in SolidWorks is possible. There are also two alternative materials available for the lower control arm to test data results and analysis. It will display two unique forms of content. After all materials have been set up, a simulation may be conducted from the programme to analyse the lower control arm and offer data and analysis.

ABSTRAK

Prestasi kenderaan mungkin terjejas oleh bahan yang digunakan untuk lengan kawalan bawah. Dalam pembangunan lengan kawalan bawah, pertimbangan yang paling penting ialah bahan yang boleh mengendalikan daya. Bahan yang lebih baik daripada yang kini tersedia untuk bahagian kawalan bawah diperlukan untuk menentukan sama ada bahan yang lebih baik boleh digunakan atau tidak. Keluli ialah bahan yang paling biasa digunakan kerana tekanan maksimum dan kapasiti anjakannya yang lebih tinggi, menurut kajian literatur. Melukis lengan kawalan bawah daripada ukuran lengan kawalan bawah sebenar dalam SolidWorks adalah mungkin. Terdapat juga dua bahan alternatif yang tersedia untuk bahagian kawalan bawah untuk menguji keputusan dan analisis data. Ia akan memaparkan dua bentuk kandungan yang unik. Selepas semua bahan telah disediakan, simulasi boleh dijalankan daripada program untuk menganalisis bahagian kawalan bawah dan menawarkan data dan analisis

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LIST OF SYMBOLS AND ABBREVIATIONS

CAD	-	Computer-aided design
3D	-	3-Dimension
σ	-	Stress
P	-	Applied force
A	-	Area
ε	-	Strain
E	-	elongation
L	-	Length
N	-	Newton
m	-	Mass
g	-	gravity
M	-	Mega
Pa	-	Pascal

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CHAPTER 1

INTRODUCTION

1.1 Background

The lower control arm is a component of the vehicle that together with the steering knuckle, is attached to the frame. Its primary function is to maintain the vehicle's stability by enabling the chassis and the wheels to move in concert with one another when the vehicle is in motion. To put it simply, each front and rear wheel on every vehicle needs a set of lower control arms to function properly. These arms help the vehicle maintain a smooth movement while it is being driven on the road. Lower arm control is also one of the essential components of a suspension system. It is responsible for acting as the direction connection points between the front wheel assemblies and the frame of the vehicle. Another part of the lower control arm, the ball joints and bushings make up this part's construction.

However, the terms "lower control arm" and "vehicle's suspension system" may not be typical household terms for vehicle owners. This is because some vehicle owners truly do not care about this part. However, lower control arms are essential components of a vehicle's suspension system. If this component is missing, the car may experience difficulty when being driven, and the experience of driving will not be as pleasant or satisfying. In today's world, technological advancement can be seen in every aspect, product, and design. The lower control arm is another component that needs to be improved so that driving control can become more effective. It is necessary to adjust some of its qualities and redesign the

lower arm control in order to provide the greatest products, which will assist riders in performing better.

There are many researchers and journals that comprise of suspension systems, various forms of suspension systems, and lower control arms. These systems can be found in vehicles. The lower control is subjected to a variety of stresses as a consequence of shifts in the gross weight of the vehicle, as well as impacts resulting from variations in the road surface and additional force. The current lower control arm is now heading in the correct direction thanks to the strength material that they have developed, but there is still room for improvement in terms of the material's strength so that it can produce more robust parts. It is made much simpler to carry out an analysis of the lower control arm by making use of the finite element approach. Combining two different kinds of material on the lower control arm is one way to boost the arm's strength, which is one of the strategies that can be used in the production of the design of the lower control to make it. Because of this, it is essential to carry out static.

1.2 Problem Statement

An advisory was given regarding the vehicle's lower control arm parts in the event that the vehicle's owner was unaware of the precautions and the root cause of the damaged lower control arm. There are a few different factors that contribute to the deterioration of the lower control arm. The driver of a certain vehicle who was going too fast will be responsible for any damage to the lower control arm. When the driver shifts into driving gear and then quickly presses the gas pedal, the lower control arm and the bushing elements of the vehicle will be subjected to a great deal of stress as a result. If this behaviour is carried out on a consistent basis, the system will be subjected to the knockabout effects of the consequences.

The damaged roads and uneven terrain were the next factor that contributed to the injury sustained by the lower arm. If the vehicles drive on this type of road regularly, the lower control arm is going to be subjected to a significant amount of wear and tear. Because of this, the lower control arm will become crooked, which could result in the steering becoming unstable. In the event that a rock or another substantial object strikes the lower control arm when it is located on the roadway, the metal will be fractured and bent as a result of the impact. The lower control arm is made of sturdy metal, but if it is struck with a significant impact like a serious accident, it might throw off the vehicle's alignment, causing it to be off-kilter.

Evidence from the lower control arm demonstrates that it is capable of withstanding any possible precaution due of the consequences of the functioning of the lower control arm. If the lower arm takes a substantial knock from something, such as the road or an object, you will need to replace it. The existing lower arm has solid findings and analysis based on the product analysis, but it is not functioning properly since it is under higher stress. It is necessary to mix it with additional materials in order for it to achieve outcomes that are superior to those of the current lower control arm.

1.3 Research Objective

The main aim of this research is to perform new material for lower control arm product vehicle using finite element method analysis. Specifically, the objectives are as follows:

a) To analyze of lower control arm material static analysis using simulation

b) To compare existing product with new product of static analysis lower control arm

1.4 Scope of Research

The scope of this research are as follows:

- To develop a comprehensive literature review of the lower control arm.
- Reseacrhes from literature review, this study proceeds to design the part using SOLIDWORK software. The parameters involving measurement, material selection and colour
- To come out with the results analysis for products with finite analysis method
- Comparison the lower control arm with two different material to see the improvement from existing material product to new material product

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter the aspect of literature review and the principle motive is to suggestively review and summaries prior research, numerous scientific works and determinations which have been enthusiastically carried out by different outstanding researchers in this field of study. Based on the literature review, the studies and process of studying will gather the desired information to produce the desired result of this project

2.2 Lower control arm mechanism

Because it provides a secure link between the wheel and the suspension, the lower control arm is an essential component in the suspension system of most automobiles. This enables the wheel and suspension to work in concert with one another. The lower control arm is a component of one of the suspension systems, and it can be found both in the front and in the back of the vehicle. It attach to the knuckle section, and the lower control arm is located in a similar fashion near the bottom of the vehicle, relatively close to the ground. The components contribute to the smooth operation of the vehicle, which is especially helpful when driving on an uneven surface. Two supplemental components have been added to the bottom control, and they contribute to the increased stability of that section. There are also ball joints and bushings to consider. Figure 2.1 shows the example of lower control arm

Figure 2.1 The example of lower control arm

Load measurements at component hardpoints are required to simulate vehicle durability when the vehicle is put through its paces on the proving site. When structural components, a lack of proving ground measurements or the high expense of creating them is a common issue.(Sharma et al., 2018) To satisfy the software's requirements for the lower control arm's durability, new materials will need to be designed. When determining how much the lower control arm can be enhanced, results and analysis play a very important role. In order to find out where the disparity is coming from, it is necessary to examine both the newly installed lower control arm and the one that was previously installed. After that, the project is finished by determining which approach was the most effective and then developing a strategy for how it can be improved in the future.

According to Kale AR, The lower control arm is subjected to a significant amount of stress as a result of variations in gross weight, collisions caused by changes in road surface, and extra forces. A potential increase in tension may be experienced by the lower control arm, in addition to the developments in technology. When running, there is a significant

amount of strain placed on the arm. The lower control arm is susceptible to bending and breaking because of the complexity of the loads that it must support. Changes in the road's surface and other circumstances, such as braking and cornering, can cause loads such as this one to be carried by the vehicle. Because of this, the lower control arm is at a greater risk of bending and breaking as a result of its exposure to stress. (Kale AR*, 2018)

2.3 The Design of the lower control arm

Suspension system on most cars has two lower control arms at the front. For information, lower control arms come in two different shapes: "A" type or "L" type. According to Yu on the article, the lower control arm of the front suspension of the prototype vehicle was changed in order to cut down on the length of the design cycle and the costs associated with development. This design is based on the one that came first and has been improved in terms of both performance and weight. The analysis model for the lower control arm is initially developed to carry out free modal analysis. This construction is done using technology known as finite elements. (Yu et al., 2021)

2.3.1 "A" type design or "L" type design

One of the most prevalent designs for these kinds of automotive components, these have the appearance of a triangle and are used extensively. The lower control arms are shaped like a "A," with the boarder end attaching to the chassis of the vehicle and the narrow end connecting to the wheel assembly. In most cases, the narrow and will have a ball joint serving as the pivot point, and the border will have a bushing. Some of the control arms take the form of a "L." In a manner analogous to that of the "A" shaped design, they are attached to the steering knuckle at one end and have a ball joint at the other end on which they pivot. One alternative design for the control arm utilises a single shaft. It makes use of the same

connections as the other control arms, which are a ball joint at one end and bushings at the other end of the control arm. According to Pachapuri, a steering arm and an A- or L-shaped wishbone are the most common configurations at the knuckle end of the wishbone. A greater balance between handling and comfort can be achieved with an L-shaped arm, which is why it is commonly found on cars. (Pachapuri et al., 2021). Figure 2.2 shows the assembly view of lower control arm from the Pachapuri's article.

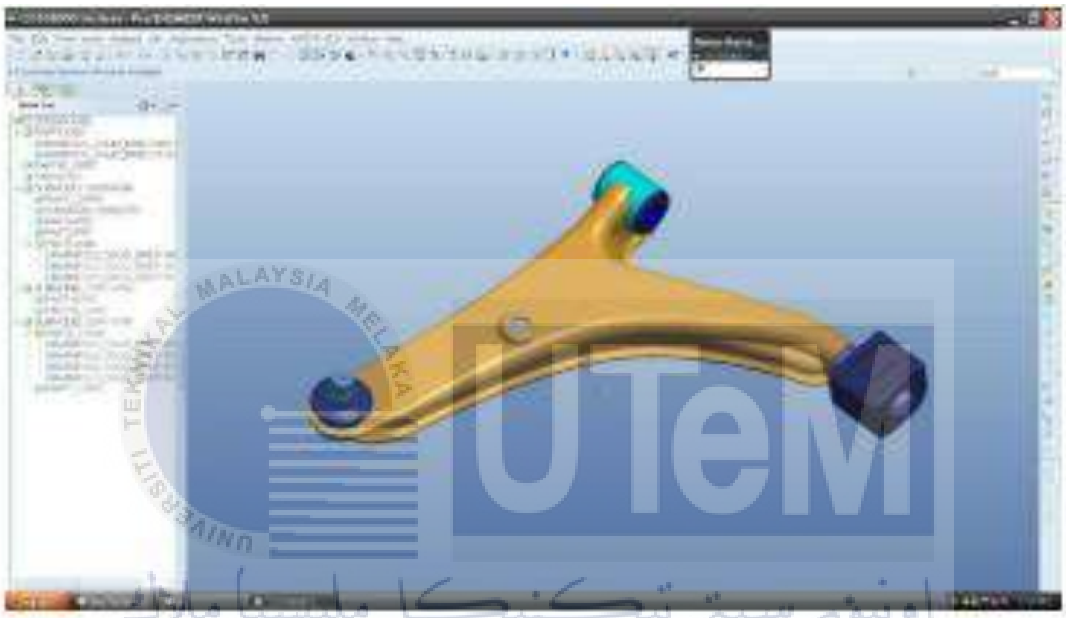

Figure 2.2 The assembly view of lower control arm (Pachapuri et al., 2021)

2.4 Material

The lower control arms of a vehicle are essential components of the vehicle. As has been demonstrated, these car parts make for a more comfortable ride for both the driver and the passengers. Because they attach the wheels to the frame, they are responsible for ensuring that the frame remains stable. When driving, having a control arm that is broken or bent is not ideal. This requires manufacturers to give careful consideration to the materials used for the lower control arm. Not only that, but they also follow the appropriate procedure for manufacturing. It is necessary to inspect the control arms in order to fulfil the various