DESIGN AND FABRICATE FOR KNUCKLE RACING ELECTRIC CAR WITH HIGH PERFORMANCE AND REALIBILITY

MUHAMAD FARHAN BIN FADZILAH HUSANI

This report is presented in

Partial fulfillment of the requirement for the

Bachelor of Mechanical Engineering (Design and Innovation)

Faculty of Mechanical Engineering

Universiti Teknikal Malaysia Melaka

JUNE 2012

‘I/We* have read this thesis

And from my/our* opinion this thesis

Is sufficient in aspect of scope and quality for awarding

Bachelor of Mechanical Engineering (Automotive)’

Signatures : .....

Name of Supervisor I : En.Safarudin Ghazali Herawan

Date : .....

Signatures : .....

Name of Supervisor II : .....

Date : .....

**Line which is irrelevant*

DECLARATION

"I declare this report is on my own work except for summary and quotes that I have mentioned its sources"

Signatures : .....

Name of Author : .....

Date : .....

Especially for my father, Fadzilah Husani B Sirat and my mother,

Zahriah Bt Muhammad Ghazali

ACKNOWLEDGEMENT

Considerable gratitude and many thanks goes to those who have helped making this final year project possible, as well as those who have contribute to this project or my education profile.

Special Thanks To:

En.Safarudin Gazali Herawan

Dr.Muhamad Zahir B Hasan

Leopard Racing Team

Zahir Racing Team

Organizer of Formula Varsity 2010

Especially:

Faculty of Mechanical Engineering (UTeM)

ABSTRAK

Tujuan pengendalian projek ini adalah untuk memenuhi keperluan subjek BMCU 4982 dan BMCU 4984 atau lebih dikenali sebagai Projek Sarjana Muda. Tajuk yang telah di pilih ialah " Reka dan Fabrikasi Satu Mobil Sesendi Steering / Upright Yang Mempunyai Prestasi Dan Daya Keboleh Harapan Yang Tinggi Untuk kereta lumba racing elektrik ". Formula Varsiti adalah acara permotoran yang mana pesertanya terdiri daripada institut pengajian tinggi. Untuk tahun 2012, akan di perkenalkan satu kategori baru, iaitu konsep perlumbaan berunsurkan sumber elektrik. Selepas selesai fabrikasi kereta bagi acara tersebut, saya mendapati bahawa berat kenderaan mempengaruhi prestasi kereta tersebut. Dengan adanya projek ini, saya berharap agar ianya akan menyumbang kepada memaksimakan prestasi kereta tersebut. Objektif projek ini adalah untuk mengurangkan berat knuckle/upright dan mengurangkan alat untuk knuckle/upright tersebut. Hal ini kerana, rekaan knuckle/upright kereta tersebut bagi masa sekarang memerlukan braket caliper. Dengan rekaan baru, penggunaan braket caliper boleh dimansuhkan. Projek ini akan melalui skops seperti, rekaan detail dengan menggunakan program CAD, analisis bagi rekaan dan fabrikasi rekaan. Saya berharap agar projek ini mampu menyumbang kepada penambahbaikan untuk Pasukan Formula Varsiti Universiti Teknikal Malaysia Melaka yang akan datang.

ABSTRACT

The purpose of this project is for the completion of BMCU 4982 and BMCU 4984 subject or also known as Final Year project. The title that I have chosen for this project is: "Design and Fabrication For Knuckle Racing Electric Car With High Performance And Realibility". Formula Varsity is a motorsport event that is held by Universiti Teknikal Malaysia Melaka (UTeM) in which the participants are for higher learning institution. In addition, categories of electric racing car will be introduced in 2012.After finishing fabricating the race car for the event, I've founded that the mass of the car does affect the performance of the car. Thus, with this project I hope that it can contribute into solving the problem or maximizing the car performance. The aim of this project is to minimize the upright/knuckle weight and to reduce its part. By doing such, it can contribute in reducing the unsprung mass of the car thus it can increase the ride comfort, and decrease the force absorb by the shock absorber. The current design of the upright/knuckle needed to use a caliper bracket in order to mount the brake caliper. With a new design, we can eliminate the use of the caliper bracket. The study of this project undergoes scopes such as, detail design, analysis of the design and fabrication of the upright. Finally, I hope this project can contribute to future improvement for UTeM formula Varsity race team.

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LIST OF SYMBOLS

Θ1= angle (degree)

Θ2= angle (degree)

Θ3= angle (degree)

Σ = Sigma

Π= 3.45

τ = Torsional shear (MPa)

LIST OF ABBREVATION

RC= Remote Control

F1= Formula One

FSAE= Formula Society Automotive Engineering

CNC = Computer Numerical Control

SAE= Society Automotive Engineering

UTeM= Universiti Teknikal Malaysia Melaka

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CHAPTER 1

INTRODUCTION

1.0 FORMULA VARSITY

Universiti Teknikal Malaysia Melaka (UTeM) Formula Varsity is an international student racing competition that challenges students to design, manufacture and race their single seat open-wheel formula style racing car in real track condition. This event is inspired by similar student racing event such as formula student and formula SAE. The events have provided a platform for Malaysian student to practice their knowledge in engineering through motorsport event. The event hope to foster the tie and collaboration between all Malaysian and international higher education institutions especially among the students as well as

to help create the needed competent human capitals for our country automotive industries.[20]

The UTeM formula Varsity 2010 team consists of 11 member crews that are appointed for the car fabrication. After completion, several problems were founded that affected the performance of the car, one of it was the weight of the car. This project has been dedicated to reducing the upright component weight as it helps to improve the performance of the car upright or knuckle is stated as a linkage or a bracket to the parts of suspension arms, Transmission parts and brake parts. Figure 1.1 shows the several of part for suspension assembly included upright or knuckle.

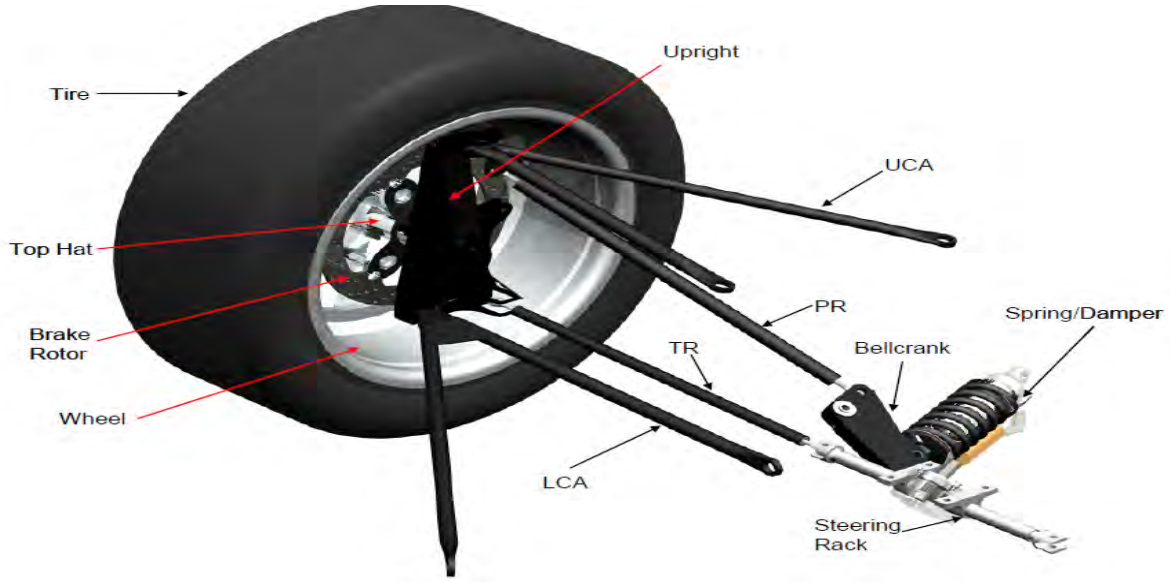

Figure 1.1: Suspension Assembly [29]

Where:

UCA : Upper control arm

LCA : Lower control arm

TR : Tie Rod

PR : Push Rod

1.1.1 OBJECTIVE

In this project, there are several objectives that I have identified:

i. To obtain steering upright or knuckle lightweight design compatible with the concept of race.

ii. Form a new steering upright or knuckle has a high resistance properties and high performance.

1.2 PROBLEM STATEMENT

1.2.1 Upright Weight

Refer at Figure 1.2, the upright is an unsprung mass, thus the shock absorber must control this load in bumps. It is important to minimize the weight as it can reduce the force acting on the shock absorber [8].

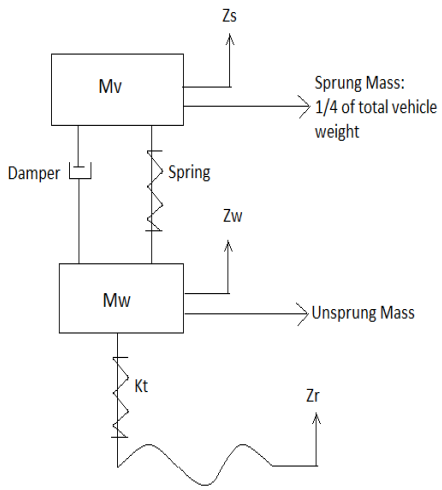

Figure 1.2: Quarter Car Suspension Model [10]

Where:

Mv: Sprung mass

Zs: Body vertical acceleration

Mw: Unsprung mass

Zw: Wheel vertical acceleration

Kt: Tire spring coefficient

Zr: Road profile

1.2.2 Upright Parts

The current upright designs have showed at Figure 1.3, uses a caliper bracket in order to mount the brake caliper. With a new upright design, the use of caliper bracket can be eliminated and it contributes to reducing number of parts

Figure 1.3: Current Upright design

1.1.2 SCOPES

Below, there is some scope that I have been reserved for the exercise and assists me in completing the project:

- To produce detail and 3 dimension design of the wheel upright component using CAD software based on 2010 UTeM Formula Varsity specification and regulation.
- To perform material selection and load analysis on the component
- To fabricate the upright component
- To measure the overall weight of the upright

CHAPTER 2

LITERATURE REVIEW

2.0 DESIGN REVIEW

2.0.1 Total Design Method

Before producing a detail drawing of the upright, we must first look for sources from previous example of upright that was build for race car. This is called market investigation. In order to produce the best possible design for the upright or knuckle, a method name “Total Design Method” has been followed [35]. Figure 2.1 show the flow chart and the steps in the method:

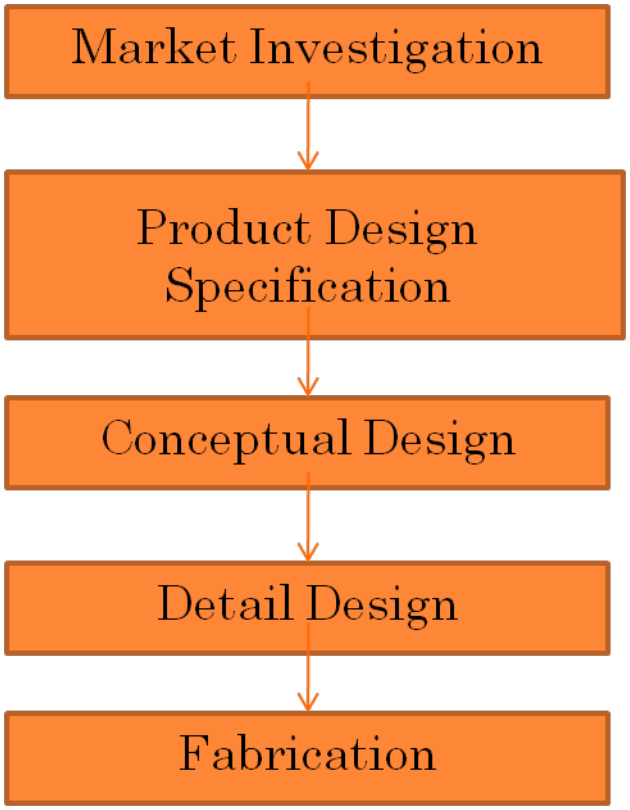

Figure 2.1: Design Core [36]