View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Universiti Teknikal Malaysia Melaka (UTeM) Repository

# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## DRIVING COMFORT STUDIES THROUGHT DIFFERENT SUSPENSION COIL SPRING TYPE: STANDARD VS MODIFIED SETTING

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

**AMIRUL DANIAL BIN RAHMAT**

**B071510724**

**941019-07-5139**

FACULTY OF MECHANICAL AND MANUFACTURING ENGINEERING TECHNOLOGY

2018

© Universiti Teknikal Malaysia Melaka

# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DRIVING COMFORT STUDIES THROUGHT DIFFERENT SUSPENSION COIL SPRING TYPE: STANDARD VS MODIFIED SETTING

Sesi Pengajian: 2018

Saya **AMIRUL DANIAL BIN RAHMAT** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

☐ SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam



© Universiti Teknikal Malaysia Melaka

AKTA RAHSIA RASMI 1972.

☐ TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

☒ TIDAK TERHAD

Yang benar,

.....

AMIRUL DANIAL BIN RAHMAT

Alamat Tetap:

NO 1699 JALAN KENARI 3,

TAMAN KENARI ,

09000 KULIM KEDAH.

Tarikh:

Disahkan oleh penyelia:

.....

AHMAD ZAINAL TAUFIK BIN ZAINAL ARIFFIN

Cop Rasmi Penyelia

Tarikh:

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini



© Universiti Teknikal Malaysia Melaka

## DECLARATION

I hereby, declared this report entitled DRIVING COMFORT STUDIES THROUGHT DIFFERENT SUSPENSION COIL SPRING TYPE: STANDARD VS MODIFIED SETTING is the results of my own research except as cited in references.

Signature: ……

Author : AMIRUL DANIAL BIN RAHMAT

Date:



© Universiti Teknikal Malaysia Melaka

## APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

Signature: …….

Supervisor : AHMAD ZAINAL TAUFIK BIN ZAINAL ARIFFIN

Signature: …….

Co-supervisor: OMAR BIN ASAROON



© Universiti Teknikal Malaysia Melaka

# ABSTRAK

Suspensi keseluruhan membenarkan perjalanan yang selesa semasa perjalanan di mana-mana permukaan jalan. Ia mesti menjaga tayar itu bersentuhan dengan jalan, tanpa mengira permukaan jalan. Spring, gandar, penyerap, rod lengan dan bola adalah bahagian penting dalam sistem penggantungan. Tajuk projek ini adalah untuk menentukan kajian keselesaan memandu melalui jenis penggantungan gegelung berlainan jenis, spring standard berlawanan dengan spring yang diubahsuai. Dalam projek ini mempunyai tiga kaedah untuk mendapatkan hasilnya, simulasi Matlab, ujian getaran dan terakhir adalah CATIA. Semua kaedah mesti lengkap dalam kajian ini kerana untuk membuktikan keselesaan memandu kenderaan dengan menggunakan kedua-dua jenis musim bunga ini. Hasil dari semua kaedah menunjukkan bahawa spring standard memberikan keselesaan yang lebih baik berbanding spring yang diubahsuai.



© Universiti Teknikal Malaysia Melaka

## ABSTRACT

The entire suspension allows a comfortable ride while travelling over any surface of the road. It must keep the tire in contact with the road, regardless of road surface. Springs, axles, absorbers, arm rod and ball joint is a fundamental part in suspension system. This project title is to define the driving comfort studies through different suspension coil spring type, standard versus modified. In this project has three method to get the result, Matlab simulation, vibration test and last is CATIA. All of the method must complete in this study because to prove the driving comfort of the vehicle by using this two type of spring. The outcome of the all method show that the standard spring are give a better comfort compare to the modified coil spring




© Universiti Teknikal Malaysia Melaka

**DEDICATION**

I would like to give special thanks for

My beloved parents

Rahmat Bin Don and Mariah Binti Mat Nor



© Universiti Teknikal Malaysia Melaka

## ACKNOWLEDGEMENTS

I would like to thank my main supervisor, Mr Ahmad Zainal Taufik Bin Zainal Ariffin and my second supervisor Mr Omar Bin Asaroon for their guidance, support and always encourage during my research and study for bachelor degree project at Universiti Teknikal Malaysia Melaka

Finally the almost thanks go to my parent, Rahmat Bin Don and Mariah Binti Mat Nor because of their prays besides give moral support and because all of them I have been brought me here.



© Universiti Teknikal Malaysia Melaka

# TABLE OF CONTENTS





© Universiti Teknikal Malaysia Melaka

© Universiti Teknikal Malaysia Melaka

© Universiti Teknikal Malaysia Melaka

# LIST OF TABLES





© Universiti Teknikal Malaysia Melaka

# LIST OF FIGURES





© Universiti Teknikal Malaysia Melaka

© Universiti Teknikal Malaysia Melaka

© Universiti Teknikal Malaysia Melaka

# LIST OF APPENDICES

| APPENDIX | TITLE | PAGE |
|---|---|---|



© Universiti Teknikal Malaysia Melaka

# LIST OF SYMBOLS

| | | |
|---|---|---|
| **D, d** | - | Diameter |
| **F** | - | Force |
| **g** | - | Gravity = 9.81 m/s |
| **I** | - | Moment of inertia |
| **1** | - | Length |
| **m** | - | Mass |
| **N** | - | Rotational velocity |
| **P** | - | Pressure |
| **Q** | - | Volumetric flow-rate |
| **r** | - | Radius |
| **T** | - | Torque |
| **Re** | - | Reynold number |
| **V** | - | Velocity |
| **w** | - | Angular velocity |
| **x** | - | Displacement |
| **z** | - | Height |
| **q** | - | Angle |



© Universiti Teknikal Malaysia Melaka

# LIST OF ABBREVIATIONS

| | |
|---|---|
| **PCA** | Principal Component Analysis |
| CATIA | Computer aided three dimensional interaction application |
| ICR | Instantaneous Centre |



© Universiti Teknikal Malaysia Melaka

# LIST OF PUBLICATIONS



© Universiti Teknikal Malaysia Melaka

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

. The entire suspension is to observe the vehicle body from street stun and vibration in addition it is traded to the passenger and load. It must keep the tire in contact with the road, regardless of road surface. Springs, axles, absorbers, arm rod and ball joint is a fundamental part in suspension system.

The spring is adaptable part of suspension. Modern passenger vehicle typically utilize light coil spring. Light commercial vehicles have heavier spring than passenger vehicle, and can have coil springs at the front and leaf spring at the back. Each side of the vehicle wheels associated by strong or pillar, axles.

At the point the development of a wheel on one side of the vehicle is exchanged to the next wheel with independent suspension, the wheel can move independently of each other's which reduce body development. What's more, it is likewise keeps the other wheels being influenced by development of the wheel on the opposite side and decrease body development.



© Universiti Teknikal Malaysia Melaka

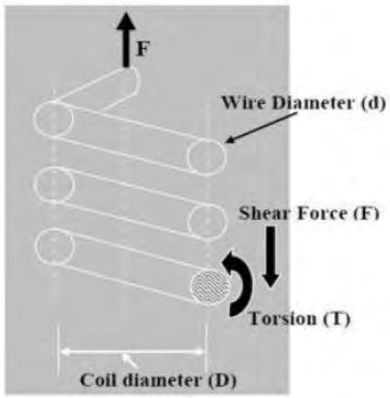


**Figure 1.1**: Coil spring

Coil springs are utilized on the front suspension of most modern light vehicle. At that point the spring go about as a elastic object use to store mechanical energy. They can bend, pulled or extended by some power and can come back to their unique shape when the power is discharged. A coil spring is produced using a single length of special wire, which is heated and twisted on a previous, to deliver the required shape. The load carrying ability of the spring depends on the diameter of the wire, the overall diameter of the spring, its shape, and the spacing of the coils. (Design and Analysis o f A Suspension Coil Spring For Automotive Vehicle, 2014)

## 1.2 Statement of the Purpose

The aim of this research is to study the different coil spring suspension and driving comfort between two coil of spring, standard coil spring and modified coil spring. The experiment is consist simulation and experimental like CATIA, MATLAB and the experimental was use the vibration test machine.



© Universiti Teknikal Malaysia Melaka

The experiment in the present project will be circulating about four major aspect in the coil spring, the first is the about material of the coil spring besides spring constant, maximum force, tensile strength and the elongation of the spring performance in various situation and how the coil spring is achieve the comfort ability to the driver and passenger when ride the vehicle.

The objectives of this research are as follows:

i. To conduct the simulation and experimental study of the coil spring and investigate the spring performance in various condition.
ii. To determine the best coil spring choose refer to the result when simulation and experimental in providing comfort ability and efficiency for the vehicle when ride.
iii. To analysed the design of coil spring by using CATIA

## 1.3 Problem Statement

There were several problems when constructing and comparing between two type of coils spring

a. The function and to get result of coils spring of vehicle from vibration generated by the different road surface and give comfort to the passenger and driver when ride the vehicle.
b. The suitable coil spring design selection can give a best strength when facing a different situation. In addition, the safety factor should be taken when a make a selection of coil spring for the vehicle.
c. Challenge in how to prove and get the true result when comparing the different coil springs.



© Universiti Teknikal Malaysia Melaka

## 1.4 Project scope

The project scopes are limited to below process and equipment used :

a. Make a detailed design of coil spring using 3D CATIA software based on the actual car dimension.
b. Select the best coil spring for comfort and less vibration when ride the vehicle
c. Replace the coils spring in the vehicle between two types of coils spring to get the result.



© Universiti Teknikal Malaysia Melaka