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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DRIVING COMFORT STUDIES THROUGH DIFFERENT FRONT COIL SPRING

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

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ABSTRAK

Sistem suspensi adalah salah satu sistem yang terdapat di dalam setiap kenderaan ringan mahupun berat. Tujuan utama penggunaan sistem suspensi ini adalah untuk memaksimumkan hubungan antara tayar dan permukaan jalan, menyediakan kestabilan semasa memandu dan memberi keselesaan kepada penumpang dan pemandu sesebuah kenderaan. Salah satu komponen utama yang terdapat di dalam sistem suspensi adalah spring. Tahap getaran yang terdapat pada spring kenderaan akan mempengaruhi keselesaan pemanduan sesebuah kenderaan. Oleh itu, sebuah tesis yang bertajuk Pengajian Keselesaan Memandu Melalui Spring Hadapan yang Berbeza telah dibukukan. Tujuan utama penghasilan tesis ini adalah untuk mengkaji tahap getaran di bahagian hadapan sesebuah kenderaan melalui dua jenis spring yang berbeza. Di dalam tesis ini akan menerangkan langkah-langkah ekperimen antaranya penganalisaan melalui MATLAB Simulink dan penggunaan mesin Ravaglioli. Bagi mendapatkan tahap getaran spring yang terbaik untuk digunakan hasil daripada eksperimen ini akan dibandingkan dan dianalisis.

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ABSTRACT

Suspension system is one of the systems that use in every lightweight vehicle. The main purpose of this suspension system is to maximize the relationship between the tires and the road surface, providing stability while driving, and providing comfort to passengers and drivers of a vehicle. One of the main components found in the suspension system is spring. The vibrational level found in the vehicle's spring will affect the safety of a car. Hence a thesis titled Driving Comfort Studies through Different Front Coil Spring has been done. The main purpose of this thesis is to study the degree of vibration at the front of a vehicle through two different types of spring. In this thesis will describe the experimental measures including analyzing through MATLAB Simulink and the use of Ravaglioli machines. Hence, to obtain the best spring vibration level to use in daily life, the results of this experiment will be compared and analyzed

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DEDICATION

This thesis is dedicated to my father, En. Musa Bin Abu Hassan who taught me that the best knowledge is what is learned for his sake. It is also dedicated to my mother, Pn. Norlisa Binti Adli who taught me that even the greatest task can be accomplished if one step at a time is completed.

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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

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LIST OF ABBREVIATIONS

PCA	Principal Component Analysis

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CHAPTER 1

INTRODUCTION

1.1 Background

In an automotive world, the power of a vehicle is measured by the amount of horsepower that it can produced and its acceleration rate. However, the power is only in vain if the suspension aspects of a vehicle are not concerned. This issue causes several engineers to turn their attention in upgrading the suspension system to produce a comfortable and stable vehicle. In any automobile, the comfort it will deliver is greatly tied to its suspension system. The duty of a vehicle suspension is to maximise the friction between the tires and the street surface, to produce steering stability with sensible handling and to ensure the comfort of the driver and passengers.

Karen *et al.*, 2012 expressed that vehicle ride comfort is playing an increasingly important role in customer selection and is an important factor in terms of competitiveness among manufacturers. The term "ride comfort" is expounded to absorption of the energy from road bumps and its dissipation without inflicting undue oscillation in vehicle (Sharma *et al.*, 2016). According to Karen *et al.*, 2012 ride comfort primarily depends on the aptitude of tires and the properties of the suspension system for absorbing the vibrations induced from road roughness.

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1.2 Research Background

For most common of vehicles, the coil spring played an important role in this system. The spring need to have a good and quality in material, high endurance, long life span and rugged to serve comfortability and safety in the suspension system of vehicle.

There has been loads of analysis on the purpose of coil springs. Paper of Vukelic *et al.*, 2016 can fill in as an introduction to vehicle suspension coil springs, their elementary stress distribution, material characteristic, assembling and causes for common failures. Besides, Zhu, Wang and Huang, 2014 had conducted a similar experimentation and investigated the premature failure of a helical coil spring caused by inherent material defects and corrosion. In addition, Murtaza and Akid, 2000 confirmed the results of previous researched by running an experiment to study the crack initiation and growth progress in Si-Mn spring steel. Meanwhile, looking to boost performance of springs, it is vital to grasp the action of spring material. Paper of Angelova *et al.*, 2016 gave in depth the defined of weariness conduct of spring steels DIN 17223C and 55Si7 followed by mathematical models of typical da/dN diagrams. Moreover, Izaham *et al.*, 2013 also had studied the physical testing on the spring in tension using a 10-tonne universal testing machine, UTM. Results made from the testing are spring constant, maximum force, elongation and tensile strength, are to be verified for their specification conformity.

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