DESIGN AND ANALYSIS ON BRAKE DISC SKIMMING MACHINE HOLDER WITH TRANSFER GEAR

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DESIGN AND ANALYSIS ON BRAKE DISC SKIMMING MACHINE HOLDER WITH TRANSFER GEAR

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This thesis is submitted in partial fulfilment

of the requirement for the

Degree of Bachelor in Mechanical Engineering (Design and Innovation)

Faculty of Mechanical Engineering
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JUNE 2017

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DECLARATION

"I hereby declare that the work in this report is my own except for summaries and quotation which have been accordingly acknowledge"

Signature :.....

Author :.....

Date :.....

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APPROVAL

"I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of Bachelor of Mechanical Engineering (Design and Innovation) (Honours)"

Signature :.....
Name of Supervisor :.....
Date :.....

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DEDICATION

I would like to dedicate my thesis to my beloved parents

Idris bin Adnan and Siti Sabariah bt Sulaiman

for their endless support.

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ACKNOWLEDGEMENT

I am grateful and would like to express my sincere gratitude to my supervisor, Mr. Febrian bin Idral for giving guidance and encouragement to complete this report. I also sincerely thanks for time spend, constant support and guidance in making this report. Besides, I would like to acknowledge with much appreciation to the crucial role of the lecturer and assistant engineer of UTeM for giving full support and assistance in this project.

Special thanks for my parents for their support and sacrifice throughout my life. I deeply appreciate for their devotion and faith in my ability to attain my goals. Lastly, my appreciation goes to my colleagues, I would like to acknowledge their comment and suggestion for the successful accomplishment of this report.

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ABSTRACT

Skimming is the process to resurface brake disc to make sure the effectiveness of the brake system nevertheless it is also one of safety factor in transportation. Hence, part of the brake disc skimming machine that emphasized in this project is brake disc holder with transfer gear. As the skimming machine become one of the important in car's maintenance it is essential to considered how the machine are implement to the customer. The objective of this thesis is to design the holder and simulate the brake disc skimming machine holder also to analyze the performance of the skimming machine holder using CATIA software. The thesis describe the importance of the brake disc skimming and the consequence for neglecting the skimming process. Transfer gear will act as regulator depends on required shaft rotation whereas the holder will tighten the grip of brake disc so the brake disc will rotate without any interruption. Furthermore, the holder will prevent the brake disc from uneven rotation and avoid rough surface after skimming. Despite all that, the holder are being test whether the performance of the skimming process could have undergo for better performance than previously. It is important to study of both, holder and transfer gear, as it will give an impact to the skimming process. Finally the acquired result from CATIA analysis and simulation can be help on the skimming process. The result show how brake disc holder with transfer gear work together in order to make the machine works perfectly and better in result.

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ABSTRAK

Penyiringan adalah proses untuk mengembalikan permukaan brek cakera supaya keberkesanan sistem brek, dalam pada masa yang sama ia adalah salah satu faktor keselamatan dalam pengangkutan. Sebahagian daripada mesin penyiring brek cakera yang akan dibentangkan di dalam tesis ini adalah pemegang brek cakera bersama gear pemindahan. Mesin penyiring telah menjadi antara mesin yang penting dalam industri pengangkutan dan penyelenggaraan kereta, oleh demikian operasi mesin penyiring terhadap pelanggan harus diperincikan. Objektif tesis ini adalah mereka bentuk dan melakukan simulasi pemegang brek cakera mesin penyiring serta menganalisa keberkesanannya menggunakan perisian kejuruteraan bantuan komputer CATIA. Selain itu, tesis ini juga menekankan kepentigan dan akibat kepada pengguna jika mengabaikan penyelenggaraan brek cakera. Gear pemindahan yang digunakan berfungsi sebagai penyelaras kelajuan namun bergantung kepada putaran aci yang mana pemegang akan diadaptasi supaya brek cakera berputar tanpa gangguan. Tambahan pula, pemegang berfungsi mengelakkan brek cakera daripada mengalami ketidakstabilan dan menghasilkan permukaan kasar selepas proses penyiringan. Namun demikian, pemegang brek cakera mesin penyiring akan dinilai dari setiap aspek untuk perjalanan yang lebih sempurna dari sebelumnya. Kedua – dua pemegang dan juga gear pemindahan perlu dikaji kerana memberi impak yang besar kepada operasi penyiringan. Akhir sekali, keputusan analisa dan simulasi yang diperoleh dari perisian kejuruteraan komputer terbantu CATIA membantu dalam proses penyiringan. Hasilnya menunjukkan pemegang brek cakera bersama gear pemindahan untuk keputusan mesin yang berfugsi dengan lebih baik.

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LIST OF ABBREVIATIONS

CATIA	Computer Aided Three - Dimensional Interactive Application
CEA	Complex Eigenvalue Analysis
DMU	Digital Mock-Up
FE	Finite Element
FEA	Finite Element Analysis
HOQ	House of Quality
PDS	Product Design Specification
RSM	Response Surface Methodology
V5R20	Version 5 Release date 2010
VAC	Voltage Alternating Current
VDC	Voltage Direct Current

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LIST OF SYMBOL

SYMBOL		DESCRIPTION
σ_{all}	=	Stress Allowable / Yield strength
σ_{max}	=	Stress Maximum / Von Misses Stress
π	=	Pi
F	=	Applied force
F.S	=	Factor of Safety
f	=	Frequency
hp	=	Horse power
N	=	Rotational speed
P	=	Power
r	=	Radius
T	=	Torque
D	=	Diameter
E	=	Modulus elasticity
L	=	Length
δ	=	Deflection
θ	=	Angular deflection
ω	=	Angular velocity

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Brake disc skimming machine are machine that perform a skimming process to resurface the brake disc. Mostly brake disc were being skim when braking system leads to poor braking performance or imbalance. Brake disc will have a friction problem such as excessive wear and surface damage of the brake components which leads to brake noise (Wang et al, 2016). Skimming machine are beneficial in prevent the brake pedal from pulsation, juddering, and noise. In addition, it will improve braking system performance on your vehicles and increase safety while driving.

Brake pedal pulsation results from uneven wear of brake disc. Wear process take place when there are two surface contact between brake disc and brake pad (Verma et al, 2014). Groove are one of the major problem that always occur if neglecting the expected service. The groove will occur when the brake pad are completely wear until make contact to brake disc surface. The damages to brake drum do a lot of harm to the braking performance and even the safety of automobiles (Zhou et al, 2008)

Nowadays, all the machine equipment are up to date and tally with the urban era. By that purpose, the skimming machine also need to be equipped with modern technologies and appealing design. In other words, new design that need to be develop are more profitable and beneficial.

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As a result, mostly this project will focus on holder of brake disc skimming machine. The holder need to have a firm grasp to hold the brake disc. So, the brake disc thickness removed are more accurate and smooth. The thickness of brake disc will not really affect as the skimming machine remove the thinnest surface of the brake disc.

1.2 Problem Statement

Brake disc skimming machine has become one of the important technology in automotive industry. However, skimming machine have a several problem regarding brake disc where the thickness remove at the surface are not accurate during skimming process. This problem mostly because of the holder is not attach tightly enough throughout the skimming process. Brake disc rotation will become unbalance due to the improper set up of the holder and could lead to disc thickness variation which mean the brake disc is not uniformly thick. In addition due to the loose installation of skimming machine holder, brake disc tend to vibrate and cause surface roughness. Hence, the design and analysis of the skimming machine holder need to be consider for a better result in skimming process.

1.3 Objectives

1.3.1 To design the holder for brake disc in skimming machine.

1.3.2 To analyze the performance of skimming machine holder application compare to previous design using finite element analysis in CATIA software.

1.4 Scope of Project

1.4.1 Designing a brake disc holder for skimming machine using CATIA software.

1.4.2 Optimize the lathe skimming machine for brake disc to more compatible skimming machine.

1.4.3 Analyze the structure and simulation of Brake disc Skimming Machine Holder using CATIA software.

1.4.4 Modify the attachment of brake disc machine holder to the motor.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Automobile manufacturer considering that brake disc is an important aspect in safety while driving. It is dangerous if the customer not paying attention to brake disc services. In order to have proper brake system, the brake disc only need to be resurface also could prevent passenger from danger. Brake disc surface will form a groove or slot that will lead to poor brake system. All of this mostly occur because the brake pad are too thin until make contact with the brake disc. Then, the problem such as noise and unbalance disc thickness will occur.

2.2 Brake Disc

The brake disc actually are being analyze thoroughly before setup to the vehicle. During the analysis, there is several information that could explain the effect of brake disc. The brake pads often to have contact with brake pad however in a very long term it will make the brake pad run out. So, the brake pad will start rubbing off the disc and create an excessive temperature when braking. The brake disc shall have high and constant coefficient of friction because it is major influence for appropriate braking system. However depends material and considering sliding velocity, contact pressure and temperature (Yevtushenko et al, 2014).

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Another experimental that has been studies is the design optimization of brake disc. Purpose of this optimization is to deal with noise problem that existing while braking. By that, there are several test run on each brake disc in order to optimize into the desire design.

Figure 2.1: The simplified model of a brake system after gone through an optimization. (Lu et al, 2016).

Improvement that have been involved to deal with the uncertainties the response surface methodology (RSM) to replace the time consuming finite element (FE) simulation. The optimization is obtain based on reliability and confidence interval. Both are construct by using RSM, complex eigenvalue analysis (CEA) and hybrid uncertain analysis (Lu et al, 2016). Different parameters are present for optimization method and being reviewed and compared to optimize the design.

2.3 Brake Pad

Part that mostly influence brake disc in braking system is brake pad. Brake pad will produce heat during braking and will dissipated to the surrounding atmosphere. Though for long term use, the brake pad will worn out and lead to brake disc surface cracking and vibration. In addition high temperature applied will cause the overheating of other components. The brake pad will lose the grasp if consequently used under extreme condition. Hence, there is need for a better selection in geometrical design variable and improve the thermal performance. (Bagda et al, 2014).

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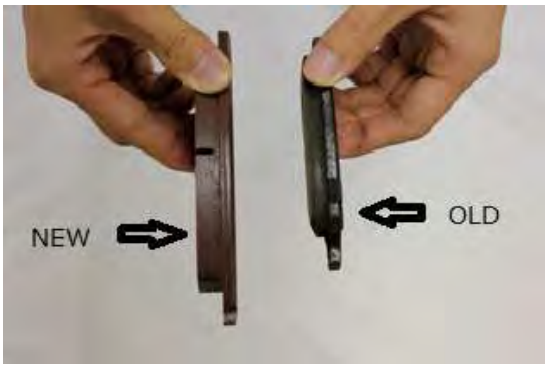

Figure 2.2: The difference of new and old brake bad that start to wear. (Source from Beforward, 2015).

The life time of brake pad can last up to 16000 to 80,000 kilometers depends on the quality of brake pads vehicle weight and driving condition (Beforward, 2015). Material of brake pad is made for ease on converting the kinetic energy of the vehicle into thermal energy by friction. However brake pad may lead to wear mechanism and formation. Braking condition should suitable with their type, morphology and hardness of brake disc (Verma et al, 2014). Thus the thickness of brake pad decreases also vehicle stopping power. Eventually the wear brake pad will rub off the surface of brake disc and cause groove or uneven surface.

2.3.1 Groove Mark

The important factor that could lead to the groove mark is that the thickness of the brake starts to wear off. This is because the friction generated by the brake pad rubbing against the brake disc and creates a lot of heat (Carley, 2011). The brake pad tends to become thinner and will be left with only the caliper with the backing plate.

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