



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DESIGN OF THE BRAKE SYSTEM FOR AGRICULTURE  
SMART MOVER BY USING TOTAL DESIGN TECHNIQUE**

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

by

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## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **DESIGN THE BRAKING SYSTEM FOR AGRICULTURE SMART MOVER USING TOTAL DESIGN TECHNIQUE**

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I hereby, declared this report entitled “Design the Braking System for Agriculture Smart Mover Using Total Design Technique” is the results of my own research except as cited in references.

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## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor Degree of Mechanical Engineering Technology (Automotive Technology) with Honours. The member of the supervisory is as follow:

.....  
(Mr. Ahmad Zainal Taufik bin Zainal Ariffin)

## **ABSTRAK**

Sistem brek adalah salah satu aspek penting bagi keselamatan bagi semua jenis kenderaan. Ia digunakan untuk menghentikan kenderaan atau mengurangkan kelajuan untuk mengelakkan kemalangan. Terdapat banyak jenis brek yang digunakan dalam kenderaan yang serba moden ini. Sebahagian daripada mereka mempunyai spesifikasi mereka mengikut kelajuan dan jenis kenderaan. Mengikut projek ini, Pemacu Pintar Pertanian yang diilhamkan daripada bentuk kereta sorong tidak mempunyai sistem keselamatan seperti brek. Kelajuan menjadi lebih tinggi sebaik sahaja enjin diletakkan di atasnya. Jadi projek ini adalah untuk merancang brek untuk dimasukkan ke dalam kenderaan pertanian. Projek ini menggunakan perisian CATIA untuk merekabentuk dan menganalisis struktur bahan yang digunakan.

## **ABSTRACT**

Brake system is one of the important aspects for the safety of any vehicle. It uses to stop a vehicle or reduce the speed to avoid the accident. There are many types of brake that use in modern vehicle. For some of them, it has their specification according to the speed and types of vehicle. According to this project, the Agriculture Smart Mover which is from the base of wheelbarrow does not have safety system such as brake. The speed becomes higher once the engine is put on it. So this project is to designing a brake to put in the agriculture vehicle. This project used CATIA software to design and analyses the structure of the material used.



## **DEDICATION**

First of all I would like to thanks to my beloved father, Encik Samsudin bin Abd Salam and my beloved mother, Puan Noormala bte Selamat who has raised me to be a good, useful, smart and successful person. They also teach me about life and did not stop support me with moral, financial and religion. They both are the people who believe my ability to have something what I have achieved today. To all my siblings, thanks for not making my life alone. Thank you for be my supportive people in my life.

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# LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

ABS	-	Anti-lock Braking System
CAE	-	Computer-Aided Engineering
CAD	-	Computer-Aided Design
CAM	-	Computer-Aided Manufacturing
CATIA	-	Computer-Aided 3-Dimension Interactive Application
cm	-	Centimetre
CO <sub>2</sub> -eq	-	Equivalent Carbon Dioxide
ESC	-	Electronic Stability Control
FTK	-	Fakulti Teknologi Kejuruteraan
HOQ	-	House of Quality
kg	-	Kilogram
Km/h	-	Kilometre per Hour
kN	-	Kilo Newton
MATLAB	-	Matrix Laboratory
mm	-	milimetre
MPa	-	Mega Pascal
N	-	Nitrogen
N <sub>2</sub> O	-	Nitrogen Oxide
PDF	-	Portable Document Format
PDS	-	Product Design Specification

PID	-	Proportional Integral Derivative
RM	-	Malaysia Ringgit
TCS	-	Traction Control System
UTeM	-	Universiti Teknikal Malaysia Melaka
2D	-	Two Dimension
3D	-	Three Dimension
$\Sigma$	-	Total

# **CHAPTER 1**

## **INTRODUCTION**

### **1.0 INTRODUCTION**

This section will briefing about the objective, problem statement and work scope of the project. This project is about improving a wheelbarrow with a system that ease the users especially in the palm oil industry. Wheelbarrow is much easier to use when there is has force or power such as engine or motor to move it. The vehicle that will be built in this project is called Agriculture Smart Mover. It can reduce time of collecting the palm oil fruit and save the energy of worker. The aim of this project is to design the brake system for Agriculture Smart Mover by using CATIA software. Brake system is very important to every moving vehicle because it is the most efficient medium to slow down or stop the vehicles.

### **1.1 PROBLEM STATEMENT**

Brake system is one of the important aspects for the safety of any vehicle. It uses to stop a vehicle or reduce the speed to avoid the accident. There are many types of brake that use in modern vehicle. For some of them, it has their specification according to the speed and types of vehicle. According to this project, the agriculture smart mover which is from the base of wheelbarrow does not have safety system such as brake. The speed becomes higher once the engine is put on it. So this project is to designing a brake to put in the agriculture vehicle.

Besides that, the design of the vehicle body should have an appearance to attract the people who see every parts of design in terms of creativity. Therefore, the wheelbarrow must have the criteria for the market.

Palm oil is one of the most important vegetable oils in the world and it is also the main export supplies in our country. The important role of this industry to the Malaysian's economy is not only because Malaysia depends greatly on oil palm for its foreign exchange earnings, but also because palm oil is used a development tool in poverty relief program for the past three decades. But, there are some types of problems that cannot be separated with the development of the palm oil industry as much use of labor to produce palm oil. Salaries of employees also increased its workforce in great numbers. There are many steps that have been taken by the farmers and entrepreneurs to implement a strategic plan to facilitate the work and transport of oil better.

Nowadays, demand for oil has increased drastically. The workers of the industry mostly have face the problem with time consuming and the require energy, especially in agriculture such as palm oil industry. Furthermore, there are palm oil worker that still using the old method to collect the palm oil fruit which is by using wheelbarrow. To move from one place to another, they need energy to push the wheelbarrow. This will affect the time to finish the work because of lack of energy. Therefore, this will increase the number of workers and also will lead into increasing cost.

## **1.2 OBJECTIVE**

The objectives of this project are as follows:

- i. To create a house of quality method to find the suitable brake that used for Agriculture Smart Mover.
- ii. To design and optimize the brake system for Agriculture Smart Mover by using CATIA.
- iii. To analyse the brake system using CATIA V5 Software.

## **1.3 WORKSCOPE**

There are two workscopes of this project. The first one is to choose the best and suitable design of the braking system for the Agriculture Smart Mover. The software used in designing is CATIA software. The second one is to analysis the efficiency of the brake system by using same software which is CATIA.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This section is about the review of the articles and journals that the author has been research about the project. Basically, there are three types of big topic that author has separated. They are about the history, definition and environment of brakes, palm oil plantation and wheelbarrow.

#### **2.1 Brake**

According to Jeremy Laukkonen (2017), “some auto brake systems can prevent collisions altogether, but most are designed to reduce the speed of the vehicle before it sparks”.

According to D. Andrikov in the article Design of Flat Wheel Braking Control System with Three Modes of Motion: Rolling, Sliding, Locking (2016), “the fundamental of brake work is to moderate or stop the development of the vehicle, bikes, trains or airplane. Physical braking process is the change of dynamic vitality into heat”.

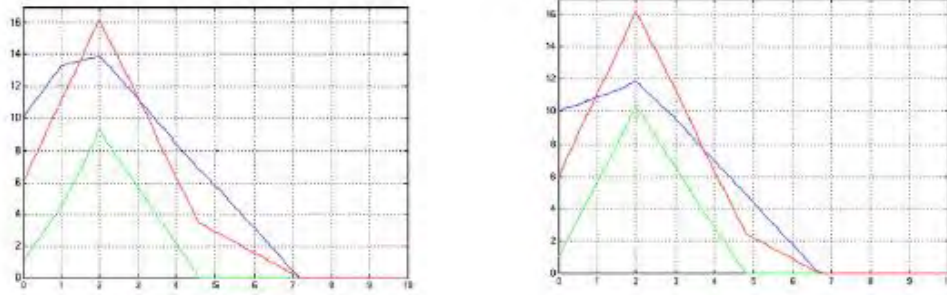
(Surblys & Sokolovskij, 2016) said “a stopping mechanism is a standout amongst the most critical dynamic wellbeing methods for a vehicle. Brakes are constantly being enhanced and supplemented with electronic frameworks that are useful in controlling the vehicle under braking. “

Brake is defined as a mechanical process that prevents motion by absorbing energy from a moving system. It is used for decelerating or stopping a moving vehicle, wheel, and axle or to prevent its motion by means of friction. Most brakes commonly convert the kinetic energy of moving object into heat energy by using the friction of pressing between two surfaces.

Next, the other method of energy conversion is working such as from electrical energy to kinetic energy and then to heat energy. The example of this brake is Eddy current brakes that use magnetic fields to convert the kinetic energy into electric current in the brake disc and then convert directly to heat energy. Other example of converting energy in the form of brake is regenerative braking that converts much of energy to electrical energy that can be stored for later use.

Basically, in the modern era of the technology, the brake system is improving day by day. All of this happen is because to provide the safety for the user and drivers. The combination between mechanical and electric electronics makes the brake system more powerful and more helpful to control the vehicle under braking. The system that are using the combinations are anti-lock braking system (ABS), traction control system (TCS), electronic stability control system (ESC) and so on.

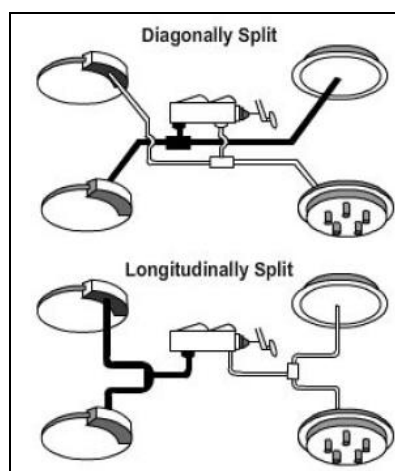
In order to continue the efficiency of the brake technology, the calculation can be finding from the analysis and design. The most popular and effective software to analyse the ABS system of brake is MATLAB software. There are two types of controller can be used which is braking with PID controller and braking without PID controller. The result of simulation is as shown in the figure below.



**Figure 2.1a: The simulation result without (left) and with (right) PID Controller**

Framework with PID controller in the slowing mechanism can diminish the braking distance (the separation from the beginning of braking to stop the vehicle). Along these lines, it makes a chance to evade a mishap or only a crisis circumstance that requires prompt ceasing of the vehicle. Use of PID will stop the auto viably, to keep away from encourage results of the mischance (Andrikov, Andrikov, & Mecapeu, 2017)

To complete the brake system, other component must combine together such as brake lever, cable, master pump, rail, vacuum, and many more. Basically, there are two types of brake that use which is by hydraulic and by cable. The hydraulic is more expensive than cable. The maintenance also is higher than cable. For the vehicle that has four wheels such as car and lorry, it has two system of brake hydraulic which is diagonal split system and front rear hydraulic split system.



**Figure 2.1b: Hydraulic Braking System**