



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND ANALYSIS OF REAR WHEEL SYSTEM

FOR AN AGRICULTURAL VEHICLE

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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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:

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ABSTRAK

Projek ini menyediakan reka bentuk, fabrikasi dan analisa sistem pertanian roda belakang. Penambahbaikan pada sistem roda belakang jentera pertanian ini membolehkan kenderaan pertanian ini beralih untuk bergerak dengan lebih stabil dan mengurangkan kecenderungan untuk terlebih belokkan atau terbalik semasa gerakan yang agresif atau melalui lereng. Kestabilan kenderaan pertanian adalah perkara utama kerana prestasinya boleh dikendalikan pada permukaan yang tidak rata dan dengan beban. Dalam kerja ini, penambahbaikan kenderaan pertanian telah direka dengan menggunakan CATIA V5. Struktur sistem belakang jenteraan ini dianalisis dan diubah untuk kestabilan yang lebih baik. Analisis elemen tekanan dilakukan dengan menggunakan HYPERMESH untuk menganalisis struktur sistem komponen belakang kenderaan pertanian ini. Pengubahsuaian komponen sistem jentera pertanian ini dilakukan dengan memilih komponen-komponen terlebih dahulu. Komponen yang terpilih termasuk aci, barbola, gegancu, besi bersudut dan tayar yang mengikuti reka bentuk yang telah dirancang dan dianalisis. Sebagai kesimpulannya, penambahbaikan ini juga menambah cengkaman pada tayar, justure kenderaan pertanian ini boleh dikendalikan pada pelbagai jenis permukaan.

ABSTRACT

This project provides design, fabrication and analysis of the rear wheel agricultural system. The improvement on the rear wheel system allows this agricultural vehicle to turn for maneuvering with more stable and decrease the tendency to turn over or roll over during an aggressive maneuvering or through the slopes. The stability of the agricultural vehicle is a main priority due to its performance can conduct on the uneven surface and with loaded. In this work, the improvement of the agricultural vehicle was designed using CATIA V5. The structure of the rear agricultural system was analyzed and changed for better stability. The stress element analysis was done using the HYPERMESH to analyze the structural of the rear component system of the agricultural vehicle. The fabrication process was start with selecting materials in advance. The selected material consists of shaft, bearing, sprocket, chain, solid angle steel and tires for the rear agricultural system components was done by following the design that been purposed and analyzed. As conclusion, the improvement also increases the tires traction, by this the agricultural vehicle can perform well at variance terrain.

DEDICATION

I am dedicating this thesis to beloved people who have meant and continue to mean so much to me especially to my father Mr Rezduan bin Yusof, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother Madam Sharifah Jamilah binti Syed Othman, who taught me that even the largest task can be accomplished if it is done one step at a time. Furthermore, I would like to dedicate to Mr Adnan bin Katijan who is guidance my thesis and to the other lecturer who taught me in UTeM, thank you for everything. To all my team mate and class mate, thank you for sharing and spread knowledge through my journey education in UTeM. May Allah SWT. bestow your sustenance upon all the sincerity given in completing this project.

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LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
l	-	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
T_e	-	Engine torque
T_c	-	Clutch torque
T_d	-	Torque differential
T_g	-	Gearbox torque output

T_{rw}	-	Torque right wheel
T_{lw}	-	Torque left wheel
i_o	-	Final drive ratio
i_x	-	Gearbox ratio engaged
F_d	-	Final drive
Nm	-	Newton meter

LIST OF ABBREVIATIONS

PCA Principal Component Analysis

LIST OF PUBLICATIONS

CHAPTER 1

INTRODUCTION

1.1 Research Background

This project in overall describes how the agricultural vehicle be modified according to the scope that is set by the researcher. In PSM 1 progress, there was three chapter covered. Chapter one is about the introduction of the project. Chapter two is a literature review. This chapter is concern about the past study and analysis of system component that could be used in this project. For chapter three, is about the ideas that be a guideline for the methodology of the project.

Palm oil creation has blasted in the course of the most recent decade, bringing about an extension of the worldwide oil palm planting zone from 10 to 17 Million hectares in the vicinity of 2000 and 2012. Recently, a tremendous improvement from Malaysia and Indonesia in oil palm companies (Pirker, Mosnier et al. 2016). Palm oil production has boomed over the last decades driven by increasing use as frying oil, as an ingredient in processed food and non-edible products (detergents and cosmetics), and more recently in biodiesel productions (Pirker, Mosnier et al. 2016).

The farm machinery is a major investment in the farming system. Tractors are a fundamental source of power in farming, where they are used in most of the farm operations all over the season (Al-Suhaibani and Wahby 2017). Kubota and tractor are mostly vehicles that are used for bringing out the bunches of palm from oil palm plantation. This type of vehicle needs to through various terrain which is involved with paved roads.

However, the multi-purpose agricultural vehicle has been introduced to an improved total of bunches of palm oil bringing out from the plantation. This vehicle can through small streets where a large agricultural vehicle such as lorries, Kubota, and tractors cannot through it. It operated with two rear wheels for the driven and one front wheel for maneuverer. By integrating the new drivetrain vehicle system, this vehicle can reach the small route and easy to handle.

1.2 Problem Statement

The multi-purpose agricultural vehicle has been extensively used and has certainly assisted smallholder and consortium plantation. But its use is also limited if the vehicle is forced to carry heavy loads and through the rugged and severe road surfaces with 3-wheel drive makes the vehicle easily overturned.

1.3 Objective

1. Design rear wheel system of an agricultural vehicle.
2. Analysis component of rear wheel system of an agricultural vehicle.
3. Fabricate rear wheel of system agricultural vehicle.

1.4 Scope of work

1. Fabricate the additional rear wheels of an agricultural vehicle.
2. Fabricate the set of sprocket and chain to the axle of an agricultural vehicle.
3. Perform the structure analysis.