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JUDUL: **THE DEVELOPMENT OF SWITCHED-MODE POWER SUPPLY FOR DC MOTOR APPLICATION**

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THE DEVELOPMENT OF SWITCHED-MODE POWER SUPPLY FOR DC MOTOR APPLICATION

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This thesis is submitted as partial fulfillment of the requirements for the award of the Bachelor of Electrical Engineering (Hons.) (Power System)

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LIST OF SYMBOLS

C	-	Capacitor
D	-	Duty cycle
Dc	-	Direct Current
F	-	Frequency
G(s)	-	Transfer Function
I_a	-	Output Current
I_C	-	Capacitor Current
I_L	-	Inductor Current
I_s	-	Input Current
kHz	-	kilo Hertz
L	-	Inductor
mH	-	mili Henry
MHz	-	mega Hertz
MOSFET	-	Metal-Oxide-Semiconductor Field-Effect Transistor
ms	-	mili second
Q	-	Transistor
R	-	Resistor
rad/s	-	radians per second
t, T	-	time
V	-	Volt
V_o, V_a	-	Output Voltage
µs	-	micro second
µF	-	micro Farad
Ω	-	Ohm

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ABSTRACT

This project research is on detailed account on the control design for input tracking of a buck converter driven dc motor. Dc motor has good speed control respondence, wide speed control range. It is widely used in speed control systems which need high control requirements, such as rolling mill, double-hulled tanker, and high precision digital tools. One of the most common methods to drive a dc motor is by using PWM signals with respect to the motor input voltage. In some application dc motor require high power consumption when involves large amount of loads. Therefore the use of SMPS to supply the dc motor from ac power supply can provide the required power to the motor. SMPS can be developed by combining rectifier which convert ac-dc and buck converter which output can be supplied to the dc motor. In this research, the SMPS which supplies the dc motor is developed and the output of SMPS is controlled by using PWM.

ABSTRAK

Projek ini adalah untuk mengawal keluaran buck converter dengan signal PWM dan menggunakan motor dc untuk mengawal kelajuannya. Motor dc mempunyai kelajuan yang baik dalam julat yang besar. Ianya banyak digunakan dalam sistem kawalan kelajuan yang memerlukan kawalan yang tinggi seperti mill berputar dan peralatan digital yang memerlukan ketepatan tinggi. Salah satu kaedah popular untuk mengawal dc motor adalah dengan signal PWM. Dalam sesetengah aplikasi, motor arus terus memerlukan kuasa yang tinggi jika melibatkan beban yang tinggi. Oleh itu penggunaan SMPS untuk membekalkan motor a.t. terus dari bekalan arus terus boleh membekalkan kuasa yang tinggi kepada motor. SMPS boleh dibangunkan dengan menggabungkan proses rektifikasi voltage arus ulang alik kepada arus terus dan buck converter di mana keluarannya boleh disambung kepada motor arus terus. Dalam projek ini, SMPS untuk membekalkan kuasa kepada motor arus terus dibangunkan dan keluarannya dikawal dengan meggunakan PWM.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will explain the objective of the project, scope of the project, problem statement and the project background. In this introduction section the review of switched-mode power supply (SMPS), fullwave rectifier, dc-dc buck converter and pulse width modulation (PWM) control will be explain. At the end of chapter 1 the thesis outline is briefly describe.

1.2 Objective of the Project

The objectives of the project are as follows:

(i) To develop rectifier to rectify 230 V ac to 24 V dc

(ii) To develop buck converter which produces dc output voltage that varying from 0 V dc to 24 V dc

(iii) To control dc motor speed by varying PWM

1.3 Scope of the Project

This project is developed by using input of 240 V ac from TNB. Then PWM control technique is used to vary the output voltage of power supply. At the end of buck converter output dc voltage can be produce in the range of 0 –24 V. Then a dc motor is connected to the buck converter output to varying the speed

1.4 Problem Statement

Dc motor is widely used in speed control systems which need high control requirements, such as rolling mill, double-hulled tanker, and high precision digital tools. So, it is crucial to control the motor speed in order to achieve good production. One of the most common methods to drive a dc motor is by using PWM signals with respect to the motor input voltage.

1.5 Project Background

This section will describe the overview of switch mode power supply and the methodology to develop this project. The methodology will be described by using the block diagram.

1.5.1 Overview of Switch Mode Power Supply

Switch mode power supplies are high frequency dc to dc converters capable of stepping up and down the dc according to need. There are basically four types of switch mode power converter such as [1]:

(i) Buck Converter (Step Down Converter)

(ii) Boost Converter (Step up Converter)

(iii) Buck Boost Converter (step up/step down Converter)

(iv) Cuk Converter

The first three converters operate with the help of inductive power transfer principle, whereas, the Cuk converter operates with capacitive power transfer principle. In this project, the buck converter which is known as step down converter is mainly used.

1.5.2 Methodology of the Project

In the research of this project, the 240 V ac TNB power supply is first step down to produce lower ac voltage. Then the ac voltage is rectified using fullwave rectifier to produce pure dc voltage. This dc voltage is then feed as input of buck converter which is also acts as step down converter. The converter uses MOSFET as power switch in this project. The output voltage of the converter is then varied by using pulse width modulation control which varies the duty cycle of the switch. The basic block diagram of the project is shown in Figure 1.1.

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