SINGLE PHASE INDUCTION MOTOR CONTROL USING PWM TECHNIQUE

Thesis is presented in partial fulfilment for the award of the
Bachelor of Engineering (Hons) Electrical
UNIVERSITI TEKNOLOGI MARA

NUR AFZAN BINTI MUSTAPHA

2008596143

FACULTY OF ELECTRICAL ENGINEERING

UNIVERSITI TEKNOLOGI MARA

40450 SHAH ALAM, SELANGOR

ACKNOWLEDGEMENT

Firstly, thank you the Almighty for giving me the strength and opportunity to do such an interesting research although the result was not as perfect as it should be. I would like to express a deep gratitude to my supervisor, Associate Professor Hj. Ishak Bin Hj. Ismail for his guidance and support to me in finishing the research.

The knowledge and importance information from previous research of others whose details are mentioned in reference section means a lot to me. Without their precious information, it was impossible for me to finish my research. Finally, I acknowledge gratefully the help and support from all the lecturers, friends and my parents who are directly or indirectly involved in this research.

ABSTRACT

This paper presents the process of controlling a single phase induction motor speed by using the Pulse Width Modulation (PWM) technique. The PWM pulse will control a single phase full bridge inverter fed to the motor. The pulse was generated digitally in 8-bit microcontroller PIC16F877A. The algorithm of producing the PWM pulse with symmetrical regular sampling technique has been shown.

The whole system consists of a microcontroller (PIC16F877A) circuit, optoisolator or isolation circuit, IGBT driver and inverter. Choosing IGBT as the switching device gives advantage such as lower switching and conduction losses. The IGBT driver was used to amplify the logic signal from microcontroller so that it has enough voltage to turn on and off the IGBTs. The voltage and the frequency can be changed simultaneously with the pulse width modulation technique.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Until recently, induction machines were used in applications for which adjustable speed is not required. Compared to dc motors, changing the speed of an induction motor demands elaborate and complex schemes. Before the power electronics era, and the pulse width modulation in particular, the speed control of induction machines was limited to highly inefficient methods with a narrow range of speed.

With the advances in solid-state devices and variable frequency power converters, different approaches to induction motor drive systems have emerged and developed that result in more sophisticated operations. Nowadays induction motor has been used in many applications at home such as fan, blower, hand tools, blenders and also for light load work in industry. All these equipments operate in variable speed. The efficiency of the induction machine can be improved when a proper solid-state converter is used [6].

1.2 SPEED CONTROL OF INDUCTION MOTORS

The researchers have tried various techniques such as varying: rotor resistance, number of pole, terminal voltage and supply frequency to vary the speed. It was discovered that by changing only a single parameter, the result was not so impressive and has some limitation in term of torque and speed.

1.2.1 Voltage/frequency control

It was known that the speed of induction motor depends on the rate of rotation of its magnetic fields or the synchronous speed, which is directly proportional to any change