THE SIMULATION OF SINGLE PHASE INDUCTION MOTOR (SPIM) OPERATION USING INSULATED-GATE-BIPOLAR TRANSISTORS (IGBT) AC/DC/AC CONVERTER

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ABSTRACT

This paper describes a generalized simulation model of a single-phase induction motor (SPIM) using SIMULINK software package of MATLAB. An analysis of SPIM performance using power electronics application is studied. The installation of power electronics can save energy consumption of electrical apparatus with more efficient use of electricity. Insulated-Gate Bipolar Transistor (IGBT) was used as a switching device for both rectifier and inverter part. The IGBT has low switching times as well as low power losses and thus can make better performance. Sinusoidal Pulse Width Modulation (SPWM) technique was used to switch on or off the IGBTs in both converter circuits. The switching frequency in the PWM generator for IGBTs was adjusted and determined. Speed performance of the SPIM using AC/DC/AC converter and directly connected to AC supply was observed. The percentages of Total Harmonic Distortion (THD) of the input and output current that comply with IEEE 519-1982 were obtained after adjusting filter value and the switching frequency.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Many systems and applications require a reliable and low power machine[1]. One of the most useful and applied machine is a single phase induction motor (SPIM)[1]. In applications where a three phase supply is not available, the single-phase induction motor with two unbalanced windings is one of the most widely use.

In order to have better performance of single phase induction motor, power electronics circuit was employed and connected between AC supply and single phase induction motor. The power electronics circuit involves a combination of three major areas which are electronics, power and control. In board terms, the function of power electronics is to process and control electrical energy by supplying voltage and current in a form that is optimally suited to the load. In other word, power electronics deals with the use of electronics in the controlling and exchanging large amounts of electrical power. Design of power electronics equipment involves an interaction between voltage source and load, and utilizes small-signal electronic control circuits as well as power semiconductor devices. Therefore, power electronic draws as well as depends upon all other areas of electrical engineering [14].

Power electronics circuits are also called as power converters. The converter uses a matrix of power semiconductor switches to convert electrical power at high efficiency. The converter system comprises switches, reactive components, L, C, and transformers. These converters or controllers are generally classified into the following five broad categories: