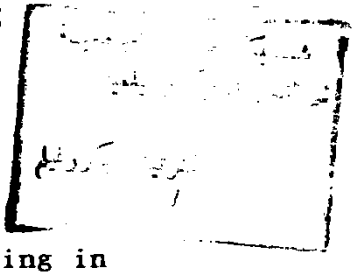
GTO PWM INVERTER FOR CONTROLLING THREE PHASE INDUCTION MOTORS



A THESIS

Submitted to the Faculty of Engineering in

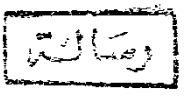
Partial Fulfillment of the Requirements

for the Degree of

Master of Science

In the Department of Electrical Power and Machines

Ain-Shams University



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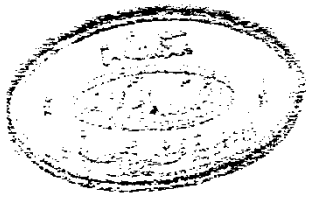

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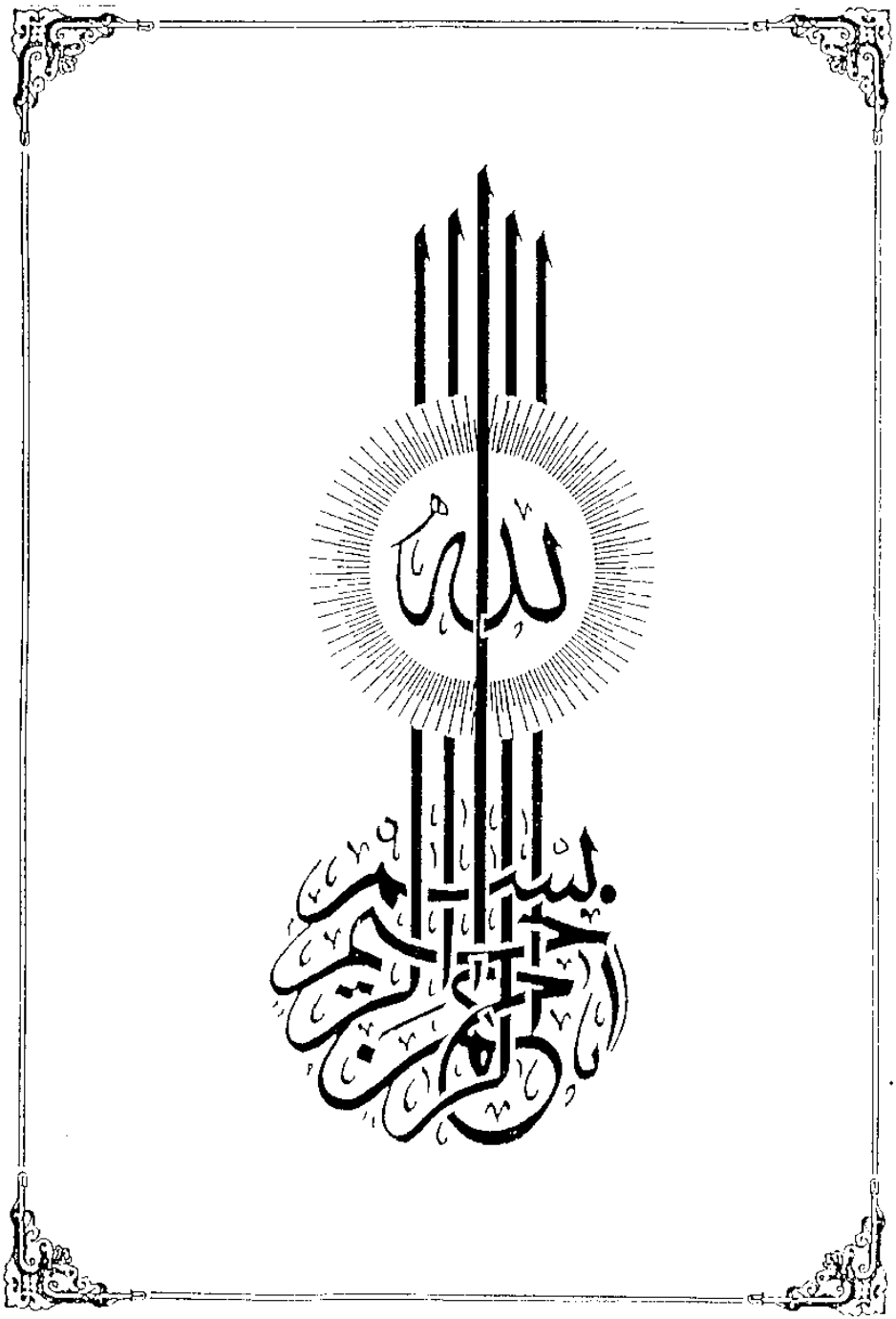

STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Electrical Power and Machines.

The work included in this thesis was carried out by the author in the Department of Electrical Power and Machines.

No part of this thesis has been submitted for a degree or qualification at any other university or institution.

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AIN-SHAMS UNIVERSITY

"GTO PWM INVERTER FOR Controlling 3-Phase Induction Motors"

Student: S. H. Arafa, Supervisors: Prof. H. S. Khalil
Prof. M. El-Bakry
Dr. S. A. Shehata

M. sc. Thesis presented to Elec. Power and Machines Department

ABSTRACT

The main purpose of this thesis is to design and implement a 3-phase PWM power inverter circuit that can be used to obtain an output voltage with controllable magnitude and frequency to control the speed of induction machines. The complete circuit contains the rectifier, the filter, and the bridge inverter. All these components are constructed. The power inverter uses Gate Turn off Thyristors (GTO) as power switches, which are quite suitable for power applications. The pulse width modulation (PWM) principle is used because of its well known advantages.

New drive and control circuits are developed to be used with the GTO power inverter. The drive circuit produces continuous uniform switching pulses with appropriate specifications for switching the GTO from the unconduction to the conduction state and vice versa. The circuit is simple and uses a smaller number of ICs than many other well known isolated GTO drive circuits. It incorporates good isolation, and self protection against overvoltage and overcurrent. A digital control circuit is also developed that generates three phase sine or square waves and a triangular wave with high

degree of accuracy and in perfect synchronization. It uses mainly two EPROMs (Erasable Programmable Read Only Memory), one for storing the amplitudes of the 3-phase sine wave or square wave, and the other for storing the amplitudes of the triangular wave. All amplitudes are stored in an 8-bit unsigned magnitude format. These amplitudes are read by time sharing technique. The circuit excludes the need for sign correction circuits. The drive and control circuits were tested experimentally. The experimental results show that the drive circuit is stable and reliable for both resistive and inductive loads. Also, the experimental results proved the ideal performance of the control circuit. Typical experimental set ups were used to test the GTO as well as the designed inverter circuit. These include the simple DC chopper, single phase inverter, and the 3-phase bridge inverter. All these circuits were loaded with resistive, and inductive loads. In addition, the 3-phase inverter circuit was loaded by a 3-phase induction motor load. Several current and voltage results were recorded and presented in this thesis.

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