AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ELECT. POWER & MACHINES DEPT.

FUZZY LOGIC CONTROL OF ELECTRIC MOTORS FOR DRIVING THE ASTRONOMICAL TELESCOPES

BY Eng.
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A Thesis

Submitted in partial fulfillment of the requirements for the degree of
Master of Science
in Electrical Engineering

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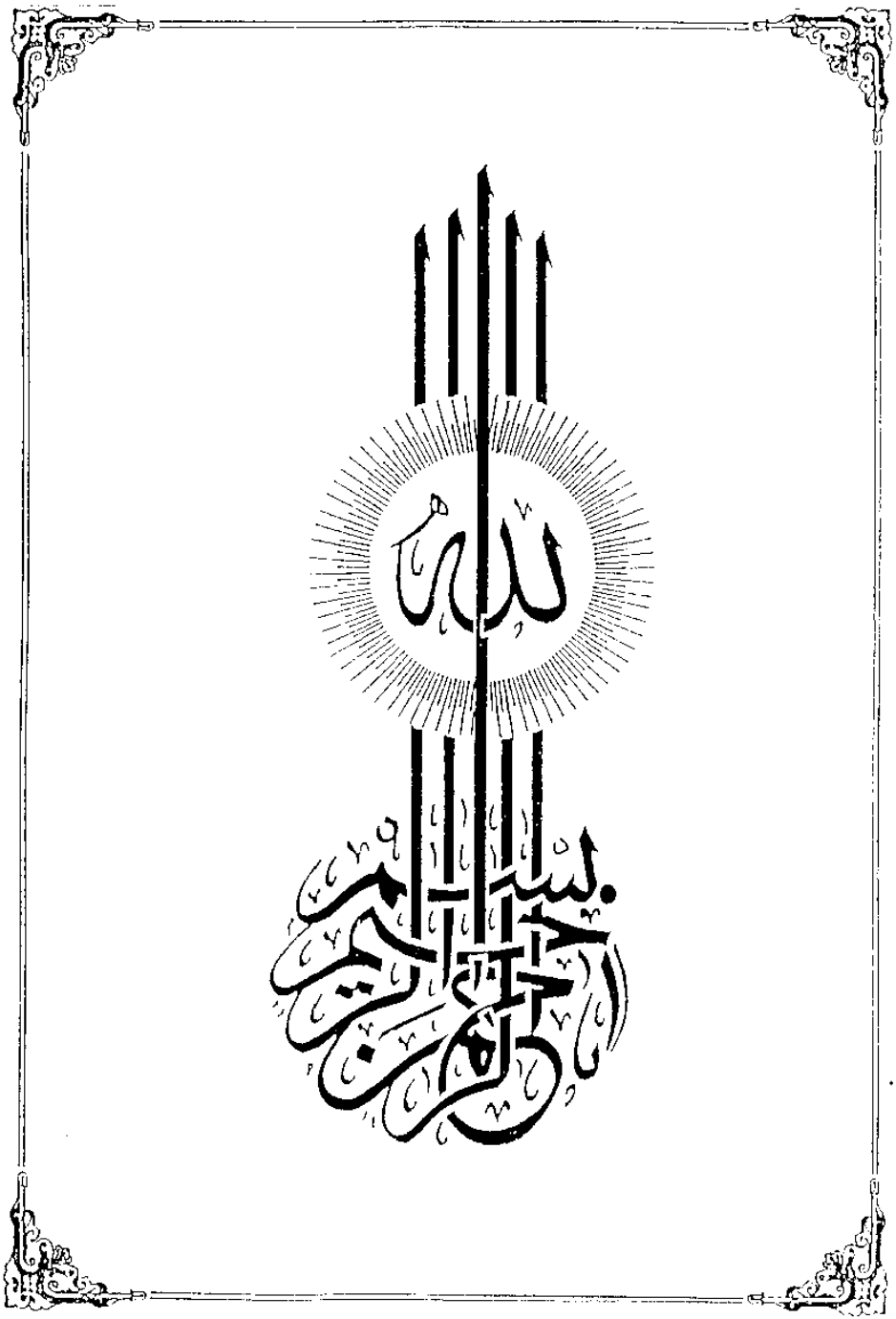

APPROVAL SHEET

for thesis with title

Fuzzy Logic Control of Electric Motors for Driving The Astronomical Telescopes

for the degree of Master of Science

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To my parents whom taught me how to read and write,
and to my lovely wife.

ABSTRACT

A computer can provide two main performance improvements for a telescope. The primary improvement is increased accuracy in pointing. The second improvement is a shorter time required to move the telescope from one object to another.

The purpose of this work is to study the dynamic equations for the 14" Celestron telescope and how to control its movement in both directions. The mathematical model of such a telescope is highly nonlinear coupled equations. However, the accuracy requirements in telescope system exceed those of other industrial plants. Fuzzy Logic Controller (FLC) provides means to deal with nonlinear functions. A fuzzy logic controller was designed to simulate the performance of a two-link model of astronomical telescope. The proposed FLC utilizes the position deviation from the desired value (e_Θ), and its rate of change (e'_Θ) to regulate the armature voltage of the DC motor drive. The final action of this controller is equivalent to a variable gain controller by using an expert look-up table. This work presents the derivation of the mathematical model of 14" Celestron telescope and computer simulation of its motion. The FLC contains two groups of fuzzy sets. The first is devoted for (e_Θ) and (e'_Θ). The second fuzzy sets group deals with the control signal to the DC motor drive. The simulation results are compared with the conventional PD Controller.

The main object is controlling the 74″ telescope. So, the author visited South African Astronomical Observatory (SAAO) for a period of two months-leave, started on February, 1997. This visit was organized via a scientific agreement between National Research Institute of Astronomy and Geophysics (NRIAG) and SAAO observatory. SAAO has identical telescope to that of Kottamia observatory. The experimental work which was designed and constructed to move the 74″ telescope are completed in Electronics laboratory of (SAAO).

Key words : *Fuzzy Logic Controller, PD Controller, and Astronomical Telescopes.*

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Abdel-Fattah A. Attia

CURRICULUM VITAE

PERSONAL DETAILS

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QUALIFICATION

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EXPERIENCE AND ACTIVITY

1. Have experience in using software programs such as windows, lotus, Grapher, FORTRAN, BASIC and C Languages.
2. Have experience in fields of :
    - Maintenance of Motors and Generators.
    - Computer Interfacing.
    - Relay Circuit Design.
    - Telescope Drive and Encoder Systems.
    - Computer Programming (GNU-C).
    - Circuit Construction.
    - Maintenance of Printers.

* Shared in ESYA 94

* I visited South African Astronomical Observatory, South Africa for two months to training on control system of their telescope, started at Feb., 1997.

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STATEMENT

This thesis is submitted to Ain Shams University in partial fulfillment of M.Sc. in Electrical Engineering.

The included work in this thesis was carried out by the author at Electrical Power and Machines Department , Ain Shams University. No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

Abdel-Fattah A. Attia