شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

بعض الوثائـــــــق الاصليـــــة تالفـــة

بالرسالة صفحات لم ترد بالاصل

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Department of Electrical Power and Machines

High Efficiency Speed Control for DC Motor Using Optimal and Adaptive Neural Network Controllers

A thesis

Submitted in fulfilment for the Requirement
of the Degree of Doctor of Philosophy

By
Sanaa Mohamed Ibrahim Amer
Power Electronics and Energy Conversion Dept.
Electronics Research Institute

Supervised By

Prof.Dr.Ahmed A.El-Sattar
Elect. Power & Machines Dept.
Faculty of engineering
Ain Shams University

Prof. Dr. Said Wahsh
Head of Power Electronics
and Energy Conversion Dept.
Electronics Research Institute

Prof. Dr. Aziza M. Zaki
Power Electronics and Energy.
Conversion Dept
Electronics Research Institute

Dr. Hussein M. Mashaly
Elect. Power & Machines Dept
Faculty of engineering
Ain Shams University

Cairo 1998

APPROVAL SHEET

for thesis with Title

High Efficiency Speed Control for DC Motor Using Optimal and Adaptive Neural Network Controllers

for the degree of doctor of philosophy

presented by

Sanaa Mohamed Ibrahim Amer

Approved by:

Name, Title & Affiliation **Signature**

1. **Prof. Dr.Mohamed Ashraf Madkour** M. A. Madkour
   System and Computer Engineering Dept.
   Faculty of engineering- Al -Azhar University

2. **Prof. Dr. Ahmed Deyaa El-Koshairy** A. D. El-Koshairy
   Electrical Power and Machines Dept.
   Faculty of engineering - Ain Shams University

3. **Prof. Dr. Ahmed Abd El-Sattar Abd El-Fattah** A. A. El Sa
   Electrical Power and Machines Department
   Faculty of engineering - Ain Shams University

4. **Prof. Dr. Aziza Mahmoud Zaki** Aziza Zaki
   Power Electronics and Energy Conversion Dept.
   Electronics Research Institute

STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Doctor of philosophy in Electrical Engineering.

The work included in this thesis is carried out by the author in the department of Power Electronics and Energy Conversion, Electronics Research Institute.

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

Date:

Signature: Sanaa Mohamed

Name: Sanaa Mohamed Ibrahim Amer

C.V

Name of researcher: Sanaa Mohamed Ibrahim Amer

Date of birth: 9/11/1957

Place of birth: Cairo

B.sc. in Electrical Engineering, May 1980,

from: Ain Shams University

M.Sc. in Electrical Engineering, 1991,

from: Ain Shams University

Signature:

Date:

ACKNOWLEDGEMENTS

The author wishes to express deeply her gratitude and appreciation to her supervisors

Prof. Dr. A.A.El-Sattar: for his guidance and encouragement during the preparation of this research work.

Prof. Dr. Said Wahsh: for providing all facilities in the laboratory during the course of this thesis and for his guidance, encouragement during the preparation of this research work.

Prof. Dr. Aziza M.Zaki: for her dynamic encouragement and her capable supervision and the extensive time she devoted to this work and her help in the experimental part also and valuable suggestions during the preparation of this research work and for her great help during the thesis writing.

Dr. Hussain M. Mashaly: for his guidance, encouragement and valuable suggestions during the preparation of this research work and for his help in the experimental part also.

My thanks are extended to the Electrical Power and Machine Department, Faculty of Engineering, Ain Shams University.

Thanks are also extended to all the staff of the power Electronics Department, Electronics Research Institute.

Acknowledgement is dedicated to Eng. Mahmoud Salem for helping the author during the experimental part.

Acknowledgement is dedicated to Eng. Ahmed Mansour for helping the author in the thesis editing.

ABSTRACT

A separately-excited dc motor drive system has been used in the industrial field when a wide range and high accurate speed control is necessary. The majority of the installed electric machines operate at two thirds or less of their nominal load. Consequently, need for efficiency improvement is significant. The profit from energy savings is considerable. The energy saving in electric motors is achieved by either designing an energy-efficient motor, or driving the conventional motor under high-efficiency conditions. The ratio of the armature current and the field current that gives the maximum efficiency is analytically derived. Two control techniques adopted in this thesis for high efficiency speed control of the dc motor. First, the improved optimal regulator theory is applied to the system. The MATLAB SIMULINK software package is utilized for simulating the system performance. Efficiency improvement is achieved specially at light load conditions with adequate transient response.

As the research in artificial neural networks has been recently active and gives more opportunities for control applications, a second method which uses a neurocontroller to obtain the high efficiency operation is adopted. Armature speed control using adaptive neural network is presented, both by simulation and experimental implementation, as a step to generalize the study for high efficiency operation. Robust and adequate steady state and transient performance are achieved.

The high efficiency neural network controller is simulated and experimentally implemented using microcomputer with data acquisition card (PC 30 AT).

A neural network software program is developed to adjust the ratio of the field and armature currents for the purpose of obtaining high efficiency.

Comparison between theoretical and experimental results are carried out and good agreement is observed.

The obtained simulation and experimental results show adequate and robust dynamic performance of the system.