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سامية محمد مصطفى

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جامعة عين شمس

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قسم

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بالرسالة صفحات لم ترد بالأصل

CAIRO UNIVERSITY

FACULTY OF ENGINEERING

ELECTRICAL POWER & MACHINES DEPARTMENT

MICROCOMPUTER CONTROLLED TORQUE IN DC. DRIVES

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

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IN ELECTRICAL ENGINEERING

BY

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UNDER SUPERVISION OF

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ABSTRACT

Many applications, such as diesel - electric locomotives or all-electric automobiles, and steel plant, require fast torque control.

The object of this thesis is to control the torque of DC separately excited motor fed from single phase half controlled converter, using microcomputer.

There are many techniques to determine torque, using either direct or indirect methods. The biggest problem of the direct method using a torque- meter with , (e.g., strain gauges built into a wheatstone bridge) is that measuring device must be placed between the motor, and the load respectively.

This thesis avoid this difficulty by using the indirect method, particularly by measuring some quantities of the DC. machine itself, such as voltage, current, and speed, which are easier to determine experimentally. since any mechanical impact on the installation is avoided, this technique is clearly advantageous in practice.

The thesis presents the system configuration and gives an explanation of the architecture and features of the system.

The thesis deals with the simulation of the systems using the TUTSIM dynamic simulation program which is capable of simulating the control system with a digital controller in the loop.

A built in parameter estimation routine is employed to achieve control parameter optimization, PI. control of the system is presented.

The implementation of microcomputer based - torque control of DC. separately excited motor with P and PI controllers is presented. Experimental results and typical oscillographs of the drive characteristics are provided.

This thesis consists of five chapters described briefly as follows :

Chapter (1) Presents the literature review, and introduces the motor transfer function

Chapter (2) presents the system description and explains the practical circuits.

Chapter (3) Presents the simulation of the system using the TUTSIM simulation program, and gives the method to obtain the controller parameters.

Chapter (4) Introduces the programming of the interface card, the flowchart of the software program and gives the practical results including the on-line plots of the motor speed, armature current, and shaft torque versus time.

Chapter (5) Presents the general conclusion of this thesis and also the proposed future work.

LIST OF SYMBOLS

e_a applied armature voltage

e_g back EMF or generated voltage

R_a Armature winding resistance

L_a armature inductance

i_a armature current

$K_a \varphi$ Back EMF and torque const

$$= \frac{V_{rated} - I_a R_a}{\omega_{rated}}$$

T_d developed torque

J moment of inertia

T_L load torque

β Friction Coefficient

τ_a = La / Ra electrical time const

τ_m = J / β mechanical time const

i_f field current

$$C_1 = \frac{R_1}{R_a + R_1}$$

C_2, C_3, C_4 Constants

B flux density

V_b brush voltage drop

N motor speed

α firing angle

γ temperature coefficient.

ϕ flux

T_{sh}	motor shaft torque
ΔP	power loss
P_{el}	electrical input power
P_{mech}	mechanical output power
P_{em}	electromagnetic power
KP	proportional gain.
Ki	integral gain.
e	error signal
ΔP_{fric}	friction loss
ΔP_{iron}	iron loss
ΔP_{ohm}	ohmic loss
ΔP_{add}	additional load - dependent loss
ΔP_{h}	hysteresis loss
ΔP_{e}	eddy current loss
T_{i}	integral time constant
T_{D}	derivative time constant