PERSONAL COMPUTER SIMULATION PROGRAM FOR STEP MOTOR DRIVE SYSTEMS

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RESEARCH REPORT

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ABSTRACT

A system of equations modeling a class of step motors known as the permanent magnet rotor step motor is presented. The model is implemented on a APPLE personal computer in a version of BASIC. Measurements are then made on an existing motor and input to the program for validation. A special test fixture is utilized to take performance data on the motor to facilitate comparisons with the predictions of the program. The comparisons show the model is indeed valid for design of step motor drive systems and emphasize the practical nature of using personal computers and simulations for design.

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TABLE OF CONTENTS

		Page
INTRODUCTION		1
Chapter		
I.	DESCRIPTION OF THE MOTOR	3
II.	THE MATH MODEL	7
III.	MODEL PARAMETER MEASUREMENT	19
IV.	THE SIMULATION PROGRAM	22
V.	VALIDATION OF THE MODEL	26
VI.	CONCLUSION	36
Appendix		
A.	SIMULATION PROGRAM LISTING	37
B.	PLOTTING AND BINARY DISK STORAGE UTILITIES	47
C.	STEP MOTOR DATA SHEET	60
D.	TEST FIXTURE PROGRAM LISTING AND CIRCUIT DIAGRAM	62
BIBLIOGRAPHY		72

INTRODUCTION

This paper is the culmination of eighteen months of research and experiments on permanent-magnet step motors. These motors have become extremely popular over the last decade for a number of reasons, perhaps the most important one being that they can be easily interfaced to a digital computer which can issue "binary" commands to the motor. Once a position reference has been established, the motor can be stepped to a known position without any position feedback and with zero cumulative error provided the motor has been operated within specified limits.

Given the above facts and relatively inexpensive cost of open loop step motor drive systems, many have chosen step motors over other alternatives without a thorough understanding of the step motor itself. Even when the drive system has correctly been selected as a step motor, the selection of step times, gearing, load components, etc. is often done on a trial and error basis after the rest of the drive system has already been implemented and the step motor installed. The results can be not only disappointing but sometimes catastrophic if tolerances or aging components load the motor to the point where it misses a step and therefore stalls.

The programs and methods presented in this paper allow designers of these systems to make a few simple measurements on a particular motor and simulate the entire drive system on a personal computer before building any hardware. This allows design decisions and trade-offs at the most convenient part of the design cycle. The programs presented are general enough that various subroutines can easily be changed to meet a particular situation.