

**TO STUDY THE THERMAL PERFORMANCE OF A TWO-
PHASE SR MOTOR WITH STATOR PHASE ASYMMETRY
USING 3-D FINITE-ELEMENT APPROACH**

MOHAMMED AMIZZUAN BIN AMLI

**FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
MALAYSIA**

ACKNOWLEDGEMENT

I would like to express my appreciation to those who had sincerely without hesitation helped to make this thesis a possible success. I also would like to express my sincere, thank you to my project supervisor, Pm. Dr. Chan Sei for her never-ending assistance, support, advice and guidance upon completing this thesis.

Last but not least, I would like to express my deepest gratitude to my father, Amli Bin Jonet, my mother, and my family for their sacrifice, love and support me throughout the duration of my study.

ABSTRACT

This paper investigates on the thermal performance of a two-phase switched reluctance motor (SR motor) with stator phase asymmetry by using 3-D finite element (FE) methods. The 3-D FE analysis provide a time-sequence of temperature profile for the motor. The final equilibrium condition gives the maximum temperature rise of the motor operating at rated condition. Results are found to be accordance to the initial criteria.

TABLE OF CONTENT

Title	Page
Declaration	i
Acknowledgement	ii
Abstract	iii
List Of Figure	vii
List Of Table	ix
Chapter 1 INTRODUCTION	
1.1 Background Of Study	1
1.2 Objective Of Study	2
Chapter 2 LITERATURE REVIEW	
2.1 SRM	3
2.2 Two-Phase SR Motor With Stator Phase Asymmetry	6
2.2.1 Aligned And Unaligned Position	8
2.3 Operation Of SRM	10
2.4 Thermal Consideration	13
2.4.1 Stator Copper Losses	13
2.4.1.1 Approximate Evaluation Of T_r	16
2.4.1.2 Approximate Evaluation Of T_f	17
2.4.2 Core Losses	17
2.5 Advantages And Disadvantages Of Switched Reluctance Motor	18
2.5.1 Advantages	18
2.5.2 Disadvantages	20
2.6 Heat Transfer	21
2.6.1 Introduction	21
2.6.2 Conduction	22
2.6.3 Convection	25

CHAPTER 1

INTRODUCTION

1.0 BACKGROUND OF STUDY

The Switched-Reluctance (SR) motor is made of steel and copper. Both the rotor and stator have a steel core of laminated metal silica steel and salient poles. The winding around the pole of the stator are diametrically connected, two and two, as phase winding. The motor winding are made as phase pole windings and are mounted on each of the pole pieces on the stator. This makes the motor very robust and suitable for harsh environment. Because of the high efficiency of this SR motor (which is good for the motor), at low speed, almost no losses in the rotor are generated. Most losses is only occur in stator, since the rotor only consists of steel, and primarily generated in motor winding, which means that the motor is easy to cool and is suitable for operating at high temperatures. Because of this advantage the Switched-Reluctance (SR) motor is recently being acknowledged in the machinery industries. Some of the advantages include simplicity of the motor design, low cost factor, brushless (high reliability), variable speed and torque, high efficiency and easy to cool. Due to these advantages, SR technology has attracted attention globally and many applications from household appliances to high performance applications were introduced. SR technology can be found in washing machine, food processors, vacuum cleaners, power tools, fans and others. Since motors are widely used in equipment and industrial processes, there exist a potential to replace the conventional A.C and D.C motors in most application.