FLUX-LINKAGES CHARACTERISTICS OF SWITCH RELUCTANCE MOTOR

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ABSTRACT

This thesis focuses on the measurement of the flux-linkage/current characteristics of a switched-reluctance (SR) fan motor. The flux-linkage/current characteristic is an important requirement in the modeling of SR motor. Idealization of the flux-linkage characteristics will result in a model, which cannot predict the performance of the machine with sufficient accuracy. It is therefore necessary to determine flux-linkage characteristics as accurately as possible. The determination of flux-linkage/current characteristics of SR motor in this thesis is based on the technique proposed by Cossar and Miller. The measurement method involves energizing the motor winding with the rotor locked in an appropriate position using a rectangular voltage pulse and acquiring the instantaneous motor voltage and current through a complete switching cycle. The (V-IR) waveform is then integrated to obtain the flux linkage waveform. If there is a vertical offset in flux linkage waveform, then R is adjusted and the new (V-IR) waveform integrated again. The final flux-linkage waveform having no vertical offset is then re-plotted against the motor current to get the flux-linkage versus current (ψ-I) curve. The measured flux-linkage/current curves of the motor correlated fairly well with that obtained by finite element analysis.

TABLE OF CONTENTS

CHAPTER 1

PRINCIPLE OPERATION OF SRM

1.1 INTRODUCTION

A reluctance motor is depends on reluctance torque for its operation. Reluctance torque is the torque induced in an iron object in the presence of an external magnetic field, which causes the object to line up with the external magnetic field. This torque occur because the external field induces an internal magnetic field in the iron of the object, and a torque appears between the two fields, twisting the object around to line up with the external field. In order for a reluctance torque to be produced in an object, it must be elongated along axes at angles corresponding to the angles between adjacent poles of the external magnetic field. It has a stationary part, the stator, which consists of a number of windings on an iron core. The moving part, the rotor, consists only of iron, often in the form of laminated sheets pressed on to the rotor axle. The lack of magnets, windings, and slip rings or brushes in the rotor makes the motor itself robust and relatively easy to manufacture.

The switched reluctance motor has been proposed for variable speed applications. The reinvention has been possible due to the advent of inexpensive, high-power switching devices. Even though this machine is a type of synchronous machine, it has certain novel features. It has wound field coils of a dc motor for its stator windings and has no coils or magnets on its rotor. Both the stator and rotor have salient poles; hence the machine is referred to as a doubly salient machine[1]. Such a typical machine is shown in Figure 1.

The rotor is aligned whenever diametrically opposite stator poles are excited. In a magnetic circuit, the rotating member prefers to come to the minimum reluctance position at the instance of excitation. While two rotor poles are aligned to the two-stator poles, another set of rotor poles is out of alignment with respect to a different set of stator poles. Then, this set of stator poles is excited to bring the rotor poles into alignment. Likewise, by sequentially switching the currents into the stator windings, the rotor is rotated. The movement of the rotor, hence the production of torque and power, involves