PERFORMANCE SIMULATION OF A SWITCHED RELUCTANCE MOTOR USING MATLAB

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ABSTRACT

This paper presents a simulation program for switched reluctance motor (SRM) using Matlab. The program is intended to be used a reference program for comparing with other approximate modeling techniques. Due to the non-linear magnetic characteristics of SR motor, there is no closed-form relation available for predicting the current and torque of this type of motor. The usual approach is to employ a model based on extensive non-linear flux-linkage/current (Ψ-ι) data at various rotor positions θ obtained either by measurement or finite element analysis. The current at the other Ψ-θ positions is obtained either by splice or polynomial interpolation. This type of model has generally been considered as the benchmark model in recent years. Since this model requires extensive and expensive data, it is always appropriate for routine design analysis. However, it can be valuable in verifying a final design prototype. Based on the developed simulation program, simulation studies are performed and compared to measure motor phase current either for hysteresis or voltage control strategies to validate the program.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Electric machines can be broadly classified into two categories on the basis of how they produce torque - electromagnetically or by variable reluctance. In the first category, motion is produced by the interaction of two magnetic fields, one generated by the stator and the other by the rotor. Two magnetic fields, mutually coupled, produce an electromagnetic torque tending to bring the fields into alignment. The same phenomenon causes opposite poles of bar magnets to attract and like poles to repel. The vast majority of motors in commercial use today operate on this principle. These motors, which include DC and induction motors, are differentiated based on their geometries and how the magnetic fields are generated. Some of the familiar ways of generating these fields are through energized windings, with permanent magnets, and through induced electrical currents.

In the second category, motion is produced as a result of the variable reluctance in the air gap between the rotor and the stator. When a stator winding is energized, producing a single magnetic field, reluctance torque is produced by the tendency of the rotor to move to its minimum reluctance position. This phenomenon is analogous to the force that attracts iron or steel to permanent magnets. In those cases, reluctance is minimized when the magnet and metal come into physical contact. As far as motors that operate on this principle, the switched reluctance motor (SRM) falls into this class of machines.

The SRM is perhaps the simplest, and most robust motor available [1]. The stator consists of salient poles with excitation windings on them, and the rotor has salient poles with no windings [6]. Rotor conductors are not required because