

CONTROL METHOD WITH DISTRIBUTION OF PHASES WINDINGS FOR SWITCHED RELUCTANCE MOTOR

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Abstract: *This paper presents control method with distribution of phases windings applied to 6-phases 12/10 switched reluctance motor (SRM). The proposed distribution of the phase's windings with control method allows getting short flux path instead of long flux path. This decreases the current required to establish the flux in the airgap. Control method relies on excited two phases for every rotor position, thus contributing to the improvement of torque. Circuit-coupled time stepping finite element analysis was used to obtain the magnetization characteristics for dynamical modeling applications.*

Key words: *Switched reluctance motor, Control method, Dynamical modeling, Finite element method, Coupled circuits, Time stepping.*

1. Introduction

Switched reluctance motor (SRM) has many advantages over other types of motors used in a growing number of applications in various industries because the development of the power electric and control technology [1-7]. The feature's monopoly of SRM such as lack of any coil or permanent magnet on the rotor, simple structure and high reliability, make it a suitable candidate for operation in variable speed, harsh or sensitive conditions.

The difficulties of the SRM design are mainly attributed to the following reasons [6-13]:

- a. High magnetic and control nonlinearities.
- b. Many flexible design parameters, including those that high torque ripples affect vibrations and acoustic noises.
- c. Interdependence on the design of the converter and control parameters.
- d. Variable-speed operations.
- e. Thermal management bottleneck due to the concentrated coils.
- f. Difficulty of thermal rating manufacturing tolerance.

Many papers proposed for design and construction of novel SRM. Authors in [14] proposed a new two-phase 4/5 switched reluctance motor with short flux path, in [15] a novel 12/14 hybrid pole type bearingless switched reluctance motor with short flux path and no flux-reversal in the stator is proposed, authors in [16] described the design and modeling procedure of a novel five-phases segment type switched reluctance rotor (ST-SRM) under simultaneous two-phases (bipolar) excitation of windings. This paper proposes a configuration adequate to using a specified control method.

After a general introduction presented in section 1, section 2 explains the processes control of the distribution of the phase windings applied to a prototype 6-phases 12/10 switched reluctance motor. Section 3 presents finite element method analysis for defined aligned of flux distribution in different rotor position. Section 4 presents sample application by using dynamical modeling based time stepping finite element method (TSFEM). Finally, simulation results such as flux distribution in different positions, torque and current characteristics are analyzed and discussed.

1. SRM configuration based on proposed control method

The first step in building the model consists of specifying the geometry with distribution of phase's windings and circuit control for six phases winding 12/10 SRM. The structure and circuit control of SRM is shown in Figure 1. The Geometry 12/10 SRM with distribution of the phase windings is shown in figure 1.a.