Design and Control for Torque Ripple Reduction of a 3-phase Switched Reluctance Motor

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Abstract

Switched reluctance motor (SRM) is widely used in special applications, and on the focus of many researchers, that it is becoming a proper alternative for conventional motors because of advantages like simple construction, no winding on rotor, high speed operation and high temperature handling capability [1]. On the other hand, significant torque ripple, vibration, and acoustic noise are the main drawbacks of the SRM to achieve high performance [1]. There are two categories to reduce and study these disadvantages, some methods use control and drive strategies to overcome torque ripple but in some others, motor geometric design is considered for torque ripple reduction. Control and drive strategies may reduce torque ripple, but the intrinsic structure of the motor such as saliency limits their efficiency [2].

To reduce the torque ripple of SRM, many papers have reported different torque control techniques. These techniques are indirect methods, like off-line or on-line current profile approaches, off-line flux linkage profile approach, or direct instantaneous torque control [1, 3]. In the geometric point of view of torque ripple reduction have several ways to optimize the geometric shapes of SRM. Some of these are designing of the stator pole face with a non-uniform air gap and attached pole shoe to the lateral face of the rotor pole, or designing of a notched tooth rotor to optimize the inductance profile [4], or used specially skewed poles [2].

To effectively reduce the torque ripple of switched reluctance motor, the electric control method and design of motor shape must be performed simultaneiosly. In this paper, the combination of the direct instantaneous torque control and specially skewed geometry is proposed to reduce the torque ripple of three-phase 6/4 SRM. The performance of motor is analyzed using voltage forced three-dimensional finite element method to detect the characteristics and compared with SRMs having conventional shape.

References

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