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On-line Auto Tuning of Parameters considering Magnetic Saturation for Synchronous Reluctance Motor

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The synchronous motor with magnetic saliency has difference inductances between d- and q-axes. This inherent saliency brings the motor with additional reluctance torque which improves maximum torque, and also it brings the flux weakening characteristics which enables wide-range constant power operation. To make best use of the saliency in motor control, it is most important to know the correct values of inductances. However, the inductances are nonlinear function of stator currents due to flux saturation effect on iron cores, and this is common case in practical application because efficient magnetic system is operated near by magnetically saturated region [1][2]. The variation of stator resistance and permanent magnet with temperature also make the motor control difficult. Thus the identification of the motor parameters is required in all operating points with consideration of magnetic flux saturation [3]. This paper presents a method of on-line parameter identification of d- and q-axes inductances. The proposed method uses adaptive estimator running in a closed loop control of the motor. The identified parameters are used for achieving robust torque control of the motor. The identified parameters by the proposed method are compared with the simulation and the experimental results to demonstrate the effectiveness of the presented method. The presented method is equally applicable for a synchronous reluctance motor and interior permanent magnet motor.

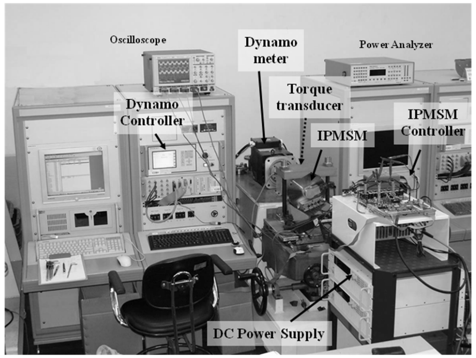

Fig. 1. Experimental equipment.

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BQ14

The Optimal Design of Switched Reluctance Motor having Inherently Fluctuating Torque

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Gradient-based nonlinear optimization methods are inefficient in applications where expensive function evaluations are required and in applications where objective and constraint functions are noisy due to modeling and cumulative numerical inaccuracy. Moreover, it is difficult to be integrated with commercial analysis software, and they cannot be employed when only experimental analysis results are available. In this research an effective optimization method based on a response surface modeling has been used to overcome aforementioned difficulties. This method approximates objective and constraint functions to quadratic functions within the reasonable design space and sequentially optimizes the approximate optimization problems in the context of the design space adjustment strategy [1]. The approximate optimization based on a response surface modeling has been applied to the optimum design of the Switched Reluctance Motor. The electrical and geometrical design parameters have been adopted as design variables to reduce torque ripple causing noise and vibration [2], t. The geometric design variables are relative to the salient pole shape such as stator and rotor pole arc. The electric design variables are relative to drive circuit such as turn-on angle, and turn-off angle. The accuracy of the analysis tool has been verified by comparing the phase current of experiment. Fig. 1 shows the analyzed torque waveform. The torque ripple is reduced from initial 73.8% to 38.5% by optimizing the geometric pole arcs and by optimizing the electric switching angles.

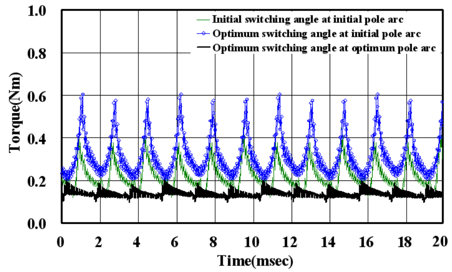

Fig. 1. Instantaneous torque ripple waveform.

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