AN APPROACH FOR THE CALCULATION OF END LEAKAGE FOR SR MOTORS

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Switched reluctance motors have very high power/volume density; only second to permanent magnet motors. As the permanent magnet prices are rising, there is a growing interest in other types of motors that offer similar performance from similar size. SR motors are certainly worth a revisit in view of this development, as they have very attractive properties.

Methods of analysing and designing SR motors have been well established in the past years. The analysis of such motors generally relies on flux-linkage-current-position curves of the motor. Present methods for predicting such curves are based on approximate solution of 2D magnetic circuit. However, especially when the core length of the motor is short, contribution of the flux fringing at the end of the core becomes important. The accuracy of the performance predictions seriously deteriorate if this effect is not taken into account, as illustrated in this paper.

The end leakage can be accurately accounted for via 3D numerical field solution. However, it is well known that this is time consuming and costly. Therefore, an analytical approach which provides an accurate solution is highly desirable. End leakage has two components. One of these is the end winding contribution. Empirical equations are developed for this purpose. The other component of end leakage is the flux completing its path by following a route in the axial direction. This paper introduces an approach for the prediction of this component of end-leakage flux.

To test the accuracy of this method, several test motors are considered. Their static torque characteristics are measured as well as the flux linkage under various current levels. Also torque-speed characteristics of these motors are measured.

Flux-linkage – position –current characteristics of the test motors are predicted using the method presented in the paper with and without end-leakage correction. It is found that the agreement with the measured curves is very good, when the end-leakage is accounted for.