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Flux-modulated permanent magnet (FMPM) motors have attracted considerable attention due to the predominant torque performance in low speed condition. Recently, the flux modulation principle is always to be developed in diverse PM motors. Intensive study results demonstrate that the harmonics in motor airgap are abundant, and they are essentially the deliverer during the process of the motor energy conversion, which is more important for the FMPM motors. Yet, it is noted that all the harmonics are not exactly playing a driving role for energy conversion. Actually, some of the working harmonics show the negative effects in motor operation. Hence, it can be inferred that analyzing the influence of harmonics on performance objectives and distinguishing its functional effects are necessary and meaningful for achieving high performance FMPM motors. In this paper, the concept of positive and negative harmonics is proposed. The harmonics having the same speed and direction with the Pw-th harmonic (Pw is the number of pole pairs of armature windings) are considered as the positive harmonics, while the opposite case is regarded as the negative harmonics. It is noted that the positive harmonic is beneficial to the improvement of motor performances, and the negative one has the opposite effect. In other words, the more positive harmonics in the FMPM motor, the better performance can be obtained. For extensive investigation, a dual-stator flux-modulated PM (DS-FMPM) motor is selected to analyze the influence of the positive harmonics on the motor performances, the harmonic characteristics of which can be changed by adjusting the relative position between the inner and outer stators. In this paper, three representative cases of the relative positions is studied, where the main magnetic field distribution are in parallel, in series and in hybrid. The electromagnetic performance and the positive airgap harmonics of the three cases are analyzed and compared in detail. Finally, the prototype machine is built to confirm the effectiveness of the design of positive airgap harmonics and the studied DS-FMPM motor.

Primary authors: Prof. ZHU, Xiaoyong (School of Electrical and Information Engineering); Mrs JIANG, Min (Jiangsu univeristy school of electrical and information engineering); XIANG, Zixuan; Mr CHEN, Wenru (Jiangsu univeristy school of electrical and informantion engineering); Mrs PU, Weiling (jiangsu univeristy school of electrical and information engineering); Mrs ZHOU, Xue (jiangsu university school of electrical and information engineering)

Presenter: Mrs JIANG, Min (Jiangsu univeristy school of electrical and information engineering)

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