MT25 Conference 2017 - Timetable, Abstracts, Orals and Posters



Contribution ID: 724

Type: Poster Presentation of 1h45m

Irreversible Demagnetization Analysis with Respect to Winding Connection and Current Ripple in Brushless DC Motor

Tuesday 29 August 2017 13:15 (1h 45m)

The Brushless DC (BLDC) motor is widely applied in various fields, such as tractions, communication devices, and home appliances, by virtue of its high-power density, wide operating range, high efficiency and simple drive system. Two kinds of BLDC motors, "Y-connection, 2-phase excitation system" and "∆-connection, 3-phase excitation system", have many differences. A major difference is the requisite flat-top width of the phase input current, 120° for Y-connection and 60° for ∆-connection. This flat-top width of phase input current of each winding connection results in the difference of the excitation sequence. Meanwhile, the irreversible demagnetization is a major drawback in the Permanent Magnet (PM) motor. Once this has happened, the motor performance will be degraded to an extreme degree, since the Back-Electromotive Force (BEMF) and the output power are reduced. The main causes of irreversible demagnetization are temperature increase, armature reaction, and inverse magnetic fields. This paper conducts the characteristic analysis of irreversible demagnetization in a BLDC motor according to the winding connection, wye and delta. The comparison of irreversible demagnetization about each winding connection is conducted by observation of demagnetization ratio according to winding connection. In addition, their irreversible demagnetization analysis has been performed considering ideal current source analysis and voltage source analysis with 6-step control for consideration of current ripple caused by coil inductance. Consequently, the Δ -connection BLDC motor is more vulnerable than the Y-connection, since the peak value of the input phase current in the Δ -connection BLDC motor is higher than that of the Y-connection, while the RMS values of the input currents are equal. This is because the BEMF and input current waveform differ, according to the winding connection. Also, the demagnetization characteristics of both Y-connection and Δ-connection BLDC motors depend on a coil inductance which affects electrical time constant.

Submitters Country

Republic of Korea

Authors: SEO, Myung-Ki (Sungkyunkwan University); Prof. JUNG, Sang-Yong (Sungkyunkwan Univ)
Co-authors: LEE, Tae-Yong (Sungkyunkwn Univ); Prof. KIM, Yong-Jae (Chosun University)
Presenter: SEO, Myung-Ki (Sungkyunkwan University)
Session Classification: Tue-Af-Po2.06

Track Classification: E1 - Motors