UDC 621.313

CALCULATION OF MAGNETIC FIELD WINDING ON THE STATOR THE BRUSHLESS DC ELECTRIC MOTOR

A. ZHILTSOV, D. Sc. (Eng.)
V. LYKTEY, post-grad.

Analytical formulas for the calculation of the plane-parallel stationary magnetic field currents, which are arranged in the curved grooves of trapezoidal shape in the stator of the brushless DC electric motor, were derived.
Key words: *brushless DC electric motor, the magnetic field, stator winding.*

Analysis of magnetic field of brushless DC electric motor is an important part in the task of designing and informed choice of electromagnetic loads of electric motors. Previously has been developed a mathematical model of brushless DC electric motor with permanent magnet that allows use to calculate the characteristics of the magnetic field taking into account the heterogeneity of the magnetic properties of the material. Its implementation in the first phase is to calculate the stator field. In general event, this requires the use of numerical integration methods of the Biot-Savart-Laplace law, which leads to the error in the calculation of magnetic field components. In some cases, at a certain geometry stator winding brushless DC electric motor is allowed to obtain analytical expressions for the components of magnetic induction, which they create.

The purpose of research — calculation of the magnetic field currents in the stator winding in brushless electric motors with closet grooves under conditions adoption of planar magnetic field. We consider an electric motor with stator and rotor.

Design feature of the present electric motor is the presence of ferromagnetic thin jumper between the stator winding and the gap in the stator and rotor. In nominal mode, the motor ferromagnetic material from which it is made is included in the state of magnetic saturation. This is to a significant reduction in shunting the magnetic flux of the stator currents and permanent magnets these bridges, insight magnetic material which is close to the value of the magnetic permeability of air. This makes it necessary to take account of the nonlinear magnetic characteristics of the material in the calculation of the average motor torque provided by the design. Three-dimensional and two-dimensional mathematical model for calculating the characteristics of the magnetic field in Brushless DC electric motor with closed grooves taking into account nonlinear magnetic characteristics has been developed on the basis of method of secondary sources. The advantage of the method of secondary sources is narrowing the search area of unknown.

Findings

The calculation of the magnetic field currents in the stator winding in brushless electric motors with closet grooves is one of the stages of determining its characteristics. Therefore, on the basis the direct integration expressions for the components of the magnetic field created by the system of currents that are located in the grooves in the form of a curved trapeze, has been derived analytical formulas, which eliminates the error of numerical calculation of field currents in the stator winding in brushless electric motor.