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Tue-Mo-Po2.12-03 [101]: Design and Analysis of a BLDC Motor with Halbach array magnets

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1. Introduction

The BLDC motors (Brushless DC Motors) have been used for different kinds of industries due to the high power density, low maintenance and simple design. BLDC motors are used in variety of applications such as home appliances, electric vehicles and aerospace applications. Recently, aerospace applications like drones raise a demand for a permanent magnet BLDC motor with high efficiency and more flight time. In order to make longer flight under the same battery, outer rotor BLDC motor which is being used in commercially available drones should have structure for improvement of power density.

2. Body

This paper presented design of outer rotor BLDC motor with halbach array magnets. Since halbach array magnets maximize the flux density in one direction, the proposed topology has structure that concentrates permanent magnet flux. Structural studies on halbach array magnets were carried out in consideration of permanent magnet shape, pole ratio and stator shape. In addition, according to the direction of magnetization and magnet arrangement, output characteristics were analyzed. Target motor which is for commercial use was selected to verify the superiority of the BLDC motor presented in this paper. The test was done to measure power density, efficiency and current density of the target motor. The design result was simulated with Finite Element Analysis (FEA) design-based software. Also, through comparison of output characteristics between the target motor and the design result, the superiority of the BLDC motor presented in this paper was verified.

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