



Contribution ID: 939

Type: **Poster Presentation**

## **Tue-Mo-Po2.12-01 [99]: Efficiency Improvement of Permanent Magnet BLDC with Halbach Magnet Array for Drone**

*Tuesday, September 24, 2019 8:45 AM (2 hours)*

### 1) Introduction

Currently, drones are used in various fields such as logistics, transportation and filming in the military field. However, there is a disadvantage that it is difficult to operate for a long time due to the battery limit of the drone. In order to overcome these disadvantages, studies have been conducted to improve the efficiency of the motor and to increase the power per weight.

### 2) Body

In this paper, a study was carried out to improve the efficiency of permanent magnet brushless DC motor (BLDC) of drone. In order to improve the efficiency of the motor, there are methods such as changing the load ratio of the motor or changing the grade of the permanent magnet material. Among them, when the halbach magnet array is applied, the leakage flux toward the outside of the rotor is decreased, and the use of core on the outside the rotor can be reduced. In addition, since the field magnetic flux increases, the influence on the armature reaction can be reduced, and the core loss of the motor can be decreased to improve the efficiency. Also, when the pole / slot combination of the motor is changed, the magnetomotive force (MMF) distribution varies depending on the winding factor. Therefore, efficiency can be improved by selecting pole / slot combinations with maximum MMF distribution. Therefore, in this paper, the distribution of the MMF according to the winding factor in BLDC motor has been analyzed. Also, the model with a halbach magnet array in existing BLDC motors was confirmed to have an effect of improving efficiency by using finite element analysis (FEA) and the electromagnetic characteristics of the motor were analyzed by adjusting the ratio of halbach magnet.

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**Session Classification:** Tue-Mo-Po2.12 - Motors VI