IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

Author: Mr. TaeYoung Lee
Hanyang University, Korea, Republic of

# DEVELOPMENT AND APPLICATION OF AN AXIAL FLUX PERMANENT MAGNET MOTOR FOR LUNAR ROVERS IN SPACE ENVIRONMENTS

**Abstract**

This paper introduces the development and application of an Axial Flux Permanent Magnet (AFPM) motor tailored for lunar rover missions, aiming to ensure stable and reliable propulsion systems in the extreme lunar surface environment. Designing an AFPM motor with suitable features for space environments and effective heat management is crucial for mission success. AFPM motors offer advantages such as high efficiency, high power density, compact size and weight, durability, and minimal susceptibility to external magnetic fields, making them an ideal choice for space exploration missions. To apply AFPM technology to lunar rovers, we describe the design and manufacturing processes, including the production of a ground-level prototype for testing purposes. This involves analyzing motor specifications, determining optimal geometric structures, and magnetic designs considering operational conditions specific to lunar missions. Additionally, we optimize motor stability and efficiency by accounting for lunar gravity and surrounding environmental effects. During the manufacturing process, appropriate materials and manufacturing techniques are selected to meet the requirements and special demands of space environments. Temperature fluctuations, vacuum conditions, and dust environments on the lunar surface can adversely affect motor performance and lifespan. Therefore, this paper presents research on the development of AFPM motors for lunar rover applications and investigates rover propulsion in space environments. Moreover, it is noted that AFPM motors exhibit approximately six times higher stall torque compared to conventional Brushless Direct Current (BLDC) motors, a significant achievement in terms of energy efficiency and performance enhancement. Through this research, we anticipate contributing to the establishment of stable and efficient systems for lunar exploration missions.