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

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

Mr. NamSuk Cho
Unmanned Exploration Laboratory (UEL), Korea, Republic of

STUDY OF MESH-TYPE HOLES AND GROUSER STRUCTURES FOR SMALL LUNAR ROVER WHEEL DESIGN

Abstract

The lunar environment presents unique challenges for the design and performance of rover wheels due to factors such as reduced gravity, the impressionability of lunar soil, and limitations in motor power and wheel diameters. While previous lunar rovers, like the Lunar Roving Vehicle and Lunokhod rovers, were of heavier classes, newer designs, such as the Yutu series by China, are lighter, weighing around or below 100 kg. This study investigates various rover wheel designs and their performance in simulated lunar surface environments, focusing on addressing issues such as decreased efficiency due to lunar soil accumulation and inadequate traction on dusty terrain. Previous research has shown that lunar wheels accumulate soil inside their structure, reducing efficiency over time. To mitigate this, a perforated or mesh structure has been adopted for the wheelbase. Additionally, the absence of protrusion points on rover wheels results in slippage on dusty terrain. To address this, grouser protrusions have been added to increase surface area contact with the soil and improve traction. Using 3D printed polymer plastic wheel models, this study conducted experiments on simulated lunar soil environments on ground testbeds. Six different wheelbase and grouser protrusion variations were investigated, employing both quantitative analysis of distance covered per power used and time taken, as well as qualitative assessments of slippage and sinking into the testbed environment. The study concludes with an analysis of the proposed grouser and perforation structure for rover wheels, while also considering other factors that could influence performance, such as wheel width, the number of wheels, wheel supporting structures, and surface slope. This comprehensive investigation provides insights into optimizing rover wheel designs for improved performance and durability in extraterrestrial environments.