Paper ID: 47281
oral
student

16th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Interactive Presentations - 16th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (IP)

Author: Mr. Mickaël LAÎNÉ
Tohoku University, Japan

Ms. Chihiro TAMAKOSHI
Tohoku University, Japan
Mr. Meven TOUBOULIC
Tohoku University, Japan
Dr. John Walker
ispace Technologies, Inc., Japan
Prof.Dr. Kazuya Yoshida
Tohoku University, Japan

INITIAL DESIGN CHARACTERISTICS, TESTING AND PERFORMANCE OPTIMISATION FOR A LUNAR EXPLORATION MICRO-ROVER PROTOTYPE.

Abstract

In the field of space and planetary missions, the use of robotic systems for exploration tasks has become quite common. The recent emergence of private ventures will increase the number of missions in the upcoming years, but the budget for each one will have to be considerably lower than that of government based projects. With the size of celestial bodies like the moon, sending a single rover has become inefficient for full surface exploration, mapping and resource prospecting. To achieve these objectives, two main fields require further research. Firstly, reducing single rover cost by making them smaller and simplifying their on-board equipment. Secondly, collaboration strategies for large groups of rovers should be devised and will enable faster surface exploration. We are currently working on a 1 kg, three-wheeled rover prototype called Koguma. This platform is first and foremost to demonstrate the potential of deploying small rovers for planetary exploration. The simple design and low manufacturing cost associated with it will enable the integration of a larger number of prototypes, opening up more possibilities of field testing the collaboration software.

The main concern surrounding this category of rovers is to determine the limits of their motion performances. In order to qualify for planetary missions, traversal capability over loose soils of various steepness has to be assessed. In this paper, we present the design characteristics of this initial prototype. Inherited from previous generations of two and three-wheeled rovers, we start by explaining the main motivations towards this model. From mass budget to dimensions, materials and system architecture, we will explain the ideas and reasoning behind our choices. We will then present the results surrounding initial performance tests on the Koguma platform. We conducted slope climbing and descending experiments using a orientation controllable sandbox. We perform a trade study over several wheel parameters to determine which are more influential towards locomotive performance. These are parameters such as radius, width, and grouser size for front and back wheel. Through this, we propose a first approach of design recommendations for the development of light, three-wheeled rovers.