Paper ID: 63245
student

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Interactive Presentations - IAF MATERIALS AND STRUCTURES SYMPOSIUM (IP)

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MULTIDIMENSIONAL ANALYSIS OF LUNAR SOIL AND LUNAR SOIL SIMULANTS

Abstract

Ever since the first geologic samples collected during Apollo 11 mission from the Moon, numerous efforts have been made in the research of lunar regolith. Study of rock and soil samples from the Moon yield valuable information regarding its geologic history. Aside of that, the comprehensive study of physical, mechanical, and geometrical properties of lunar soil is also a focus of study. Many efforts to simulate lunar soil characteristics with what's called Lunar Soil Simulants (LSSs).

The reality of humanity soon stepping in lunar soil is imminent. With that, feasible solutions in the matter of sustainable space development and settlement must emerge to accomplish this goal. The use of lunar regolith as a construction material comes as a natural first option for the first installments in the Moon. Because of this, an extensive knowledge on lunar soil is a necessary asset.

The study of lunar soil as a construction material comes with drawbacks. Lunar samples are limited in number and difficult to obtain. In addition, simulating lunar soil is difficult and expensive because its formation mechanism and geotechnical behavior are comprehensively different from those of the terrestrial soil.

We must come with solutions to assess these limitations with what's given, which is lunar soil and LSS data. In the field of multivariate analysis, PCA (Principal Component Analysis) provides a solution to find, given a data table with quantitative variables, a set of synthetic variables which approximate the behavior of the original data. There's already an analytical approach to describe lunar soil and LSS based on chemical composition data. A valuable contribution to this analysis comes with the addition of physical, mechanical, and geometrical data regarding the description of lunar regolith. Therefore, a PCA based analysis will be applied to visualize and characterize a low-dimensional representation of lunar soil data.