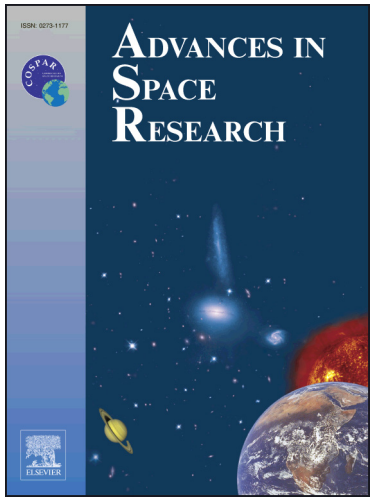

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Effect of Grain Size Distribution on Stress-Strain Behavior of Lunar Soil Simulants

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ABSTRACT

Geotechnical behavior of the lunar soils is important for engineering analyses regarding various aspects of the future extraterrestrial settlement plans including lunar exploration and construction. Many lunar soil simulants had been produced so far, in order to resemble lunar soils and conduct such analyses. The goal of this study is to investigate how and to what extent the variations in the grain size distribution of different lunar soil simulants affect their shear strength and volume change behaviors, both of which are quite important for constitutive modelling and geotechnical design. Static simple shear tests were conducted on four lunar soil simulants that were reproduced in terms of original gradation characteristics. The results indicate that various gradational parameters, such as mean grain size, coefficient of uniformity and fines content influences the shear strength, the amount of volumetric dilatancy, and the rate of dilatancy of simulant specimens in different levels when they were compared at the same density or void ratio. The possible reasons behind such different levels of influence were also discussed by focusing on the initial fabric of specimens achieved before shearing and the interaction between silt and sand matrices in the simulants.

Keywords: Lunar soil simulants, Simple shear test, Shear strength, Internal friction angle, Dilatancy, Soil fabric