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Effect of Vertical and Horizontal Vibrations, Vessel Size and Layer Height on the Fluidization of Lunar Regolith

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Abstract

In the coming years with such a major focus being applied to the further exploration and eventual habitation of the Moon and Mars, it has never been more important to further the understanding of how to manipulate the resources abundantly available on these planets. Along these lines, this project aims to develop novel ways of handling the regolith that makes up the lunar soil by use of "vibrations". The final objective is the definition and validation of a new approach able to overcome well-known drawbacks related to these materials due to their extremely abrasive and reactive nature, which makes their manipulation and transport particularly difficult, especially in the low gravity lunar environment. Through the application of vibrations with various orientations to small samples of lunar regolith simulant, the solid granular material can be forced to display a fluidlike convective behavior, forming structures such as self-sustaining heaps. The effect that varying the height of the bed of lunar regolith simulant has on the mode and rate of convection exhibited by the bed is investigated while the size of the vessel containing the bed is also varied to assess the influence of this additional parameter. Some recent experimental findings are critically discussed in relation to the resulting (enhanced) ability to manipulate and transport lunar regolith.