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CHARACTERIZING LUNAR SIMULANT BP-1 WITH EXPERIMENTAL AND SIMULATION FORCE  
COMPARISONS**Abstract**

This research centers on experimental and simulation techniques currently developed to compare the forces generated in the BP-1 lunar simulant with a discrete element method (DEM) simulation software. There is a gap in scientific knowledge when it comes to understanding vehicle mobility in granular media which may be encountered in extraterrestrial environments. This granular media is often composed of dust-sized fines which are most easily described as crushed rock. The most famous example of the problem this poses is when the Spirit Rover became stuck on the Martian surface due to encountering an unanticipated patch of soft soil. These problems are compounded when reduced gravity is introduced to the environment. While wheeled vehicles continue to be the preferred approach to planet-sized bodies and their gravity, the terramechanics of wheels on microgravity bodies such as asteroids or the Martian moons is uncertain. There is much we cannot know from Earth based experiments because the gravity-dependent compaction of the granular media has an effect on the forces against the mobilized body. Local stress concentrations which suddenly collapse contrast with the uniform, fluid-like flow observed in other granular medias on Earth. Features such as fissures appear in both BP-1 and on asteroids. DEM allows for adjustable parameters which can simulate these features and address the terramechanics challenges of such material. This experiment builds on the previous work of confirming the similarity of generated forces in experiments and with DEM simulation via screws in glass beads. With confirmation that we can achieve a reasonable approximation for screw flow patterns and force generation using a well-characterized granular media, we now continue similar experiments using the BP-1. This lunar mechanical simulant is subjected to geotechnical and civil engineering testing such as shear vane tests, angle of repose, and impactor and compression testing. The simulation model is compared to this testing with experiments using vertical impactors and force comparisons with screws are performed.