Determination of the Stability of Microtunnel Opening in Lunar Regolith and Low Gravity Conditions

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ABSTRACT

A large body of research has been currently underway to achieve the goal of lunar colonisation. Human activities on the moon will require development of underground space and infrastructure. One of the first target to attain a lunar habitat is to secure water. Therefore, the knowledge of stability of opening in lunar regolith excavated by micortunnelling or drilling is a prerequisite to the success of the entire project. This study analyses the stability of underground opening in lunar regolith and optimise the opening size under low gravity and moonquake conditions by using discrete element method (DEM) modelling technique. First, numerical samples are generated by considering the properties of lunar regolith such as density, porosity, strength, and modulus. Then, DEM models are validated and calibrated against experimental results for luncar regolith simulants from literature. Finally detailed parametric and sensitivity studies are conducted to determine maximum possible opening sizes at different depths under the consideration of moonquake. The findings of this study will give an insight into how to effectively and safely make excavations on the moon.

Keywords:

Lunar regolith, Microtunnel, excavation, stability, moonquake