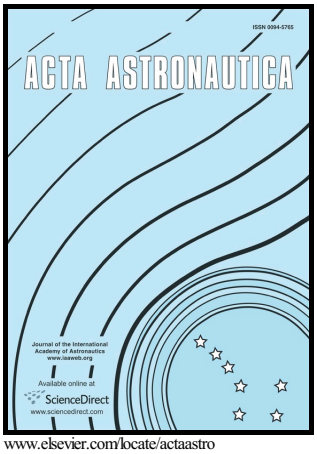
Recovery rate prediction in lunar regolith simulant drilling

Qiquan Quan, Chongbin Chen, Zongquan Deng, Junyue Tang, Shengyuan Jiang



www.elsevier.com/locate/actaastro

PII: S0094-5765(16)30902-X
DOI: http://dx.doi.org/10.1016/j.actaastro.2017.01.002
Reference: AA6152

To appear in: *Acta Astronautica*

Received date: 13 September 2016
Accepted date: 5 January 2017

Cite this article as: Qiquan Quan, Chongbin Chen, Zongquan Deng, Junyue Tang and Shengyuan Jiang, Recovery rate prediction in lunar regolith simulant drilling *Acta Astronautica,* http://dx.doi.org/10.1016/j.actaastro.2017.01.002

Recovery rate prediction in lunar regolith simulant drilling

Qiquan Quan*, Chongbin Chen*, Zongquan Deng, Junyue Tang, Shengyuan Jiang

State Key Laboratory of Robotics and System, Harbin Institute of Technology, No.92, Xidazhi Street, Nangang District, Harbin 150001, China

Abstract

Drilling and coring, as an effective way to acquire lunar regolith along the depth, is widely used in the field of planetary explorations. Because there is no relative sliding between the lunar regolith and the flexible tube, using the flexible tube coring method can acquire high recovery rate and keep the stratification of regolith samples. Very little work has been done to analyze the flexible tube coring process. A proper understanding of the coring process is necessary to develop the drilling strategy and verify whether the designed drill tool is appropriate. In this paper, two models are developed to analyze stress distribution in lunar regolith simulant during coring. Based on the developed models, a prediction method of recovery rate is developed to analyze the influence of the drilling parameters on the recovery rate. Comparison of the model calculation results with data of drilling and coring experiments demonstrated that the model based on the Terzaghi bearing theory can effectively predict the tendency when the recovery rate begins to decrease.

Keywords: Lunar regolith, Lunar regolith simulant, Drilling and coring, Flexible tube, Recovery rate

*Corresponding author. Tel.: +86 451 86413857.
Email addresses: quanqiquan@hit.edu.cn (Qiquan Quan), chongbin831@hotmail.com (Chongbin Chen)