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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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LUNAR DUST MITIGATION BY TRAVELLING ELECTROSTATIC WAVES

Abstract

Lunar dust is expected to be electrostatically charged due to solar UV irradiation and its exposure to the solar wind and cosmic rays. The charged dust particles hover above the surface of the moon and cover everything that they come into contact with. The dust particles are so fine and also very abrasive. From mission documents of the six Apollo missions that landed on the surface of the moon, dust related problems is categorized into nine main groups; vision obscuration, false instrument reading, lost of foot traction, dust coating and contamination, seal failures, clogging of mechanisms, abrasion of materials, thermal control problems, and inhalation and irritation risk. Thereby keeping dust away from electrical, mechanical and visual devices is a way to increase life expediency of the parts and be able to have longer mission duration.

Lack of atmosphere, high temperature fluctuation and limitation on material quantity that can be carried to the moon, restrict us to apply terrestrial approaches for sweeping dust away from surfaces. In this work the possibility of generating traveling electro-magnetic waves by "electric curtain" and using electrostatic and dielectrophoretic forces for dust removal is investigated. Electric curtain is a device consists of parallel electrodes connected to single or multi AC power source(s). It generates travelling electromagnetic waves so that particles within the generated field would move based on their polarity along or against the direction of the field. In the other hand the electro-magnetic field acts as a contactless conveyor which reduces the potential of damaging delicate surfaces.

Planar, circular, and tubular configurations have been selected bearing in mind the potential application they might be used. In the case of tubular configuration both inside and outside of the tube is studied. Modeling and simulation were carried out using a Discrete Element Method (DEM) software. The results from the simulations are promising and prove the effectiveness of this method for dust transportation. On the experimental side, Simple tubular and planar shape will be constructed and then connected to AC power with different frequencies to optimize the device performance under room and cryogenic conditions.