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SURFACE CLEANING BY TRAVELLING ELECTROSTATIC WAVES IN LUNAR EXPLORATION

Abstract

In recent years there is a growing international interest to go back to moon to use its resources or to establish a habitation zone. The engineers and designers must take into account the unique environment of the moon for the ongoing manned/unmanned missions. Lunar surface is covered by very fine and abrasive dust formed during millions years on meteorite bombardments. These particles are 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. They can adversely affect electronic devices and other mechanics during the mission either by adhering to them or by causing wear and abrasion. Since these particles are charged and have sharp edges, removing them from surfaces needs an effective and reliable method to detach them from the surface and transport them far enough to avoid them to redeposit again.

In this paper the possibility of using electrostatic and dielectrophoretic to remove dust particles from different surfaces has been studied. Planar, circular, and tubular electrode patterns have been chosen 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. They were covered with iron filing and then connected to a single phase AC voltage source. The effect of electrode gaping, activation frequency, voltage profile and amplitude were also investigated. Moreover, Discrete Element Method (DEM) is used to calibrate our models and thereafter the effect of having several layers of electrodes to manipulate and sort the particles as well as having the device connected to 3-phases or 6-phases voltage sources were examined. The results are promising and show the effectiveness and reliability of the device for surface cleaning and particle transportation during lunar surface explorations.