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A PROGRAMMED ELECTROMAGNET-SPRING BASED CUBESAT LAUNCH SYSTEM ON LUNAR SURFACE

Abstract

This paper demonstrates an ingenious idea for the design of an optimised launching system for facilitating exploration on locations with weak gravity and lack of atmosphere such as the moon. The idea presented is designed for CubeSat standards, not greater than 2U, with the moon as the primary subject and can be generalised to fit other standards such as TubeSat with slight modifications. The design employs an electromagnet-spring system with solenoids placed at both ends of a spring. The solenoids are magnetised to compress the spring system that when released will be capable of launching the low-weight spacecraft. The preferable spring material is austenitic Stainless steel A316 with justification for the first considerations, calculations, and conclusions. As the magnetic field can be varied by controlling the electromagnets' input current, the system is capable of launches to desired orbital heights. The mechanism of operation would first begin with the astronaut (user) setting a value for the vertical height they want to achieve with the CubeSat launcher. Once the initial height has been input, a simple program can compute the amount of energy that has to be stored in the compressed spring. Upon calculating this, the required magnetic field is developed by the launcher program within the electromagnet-spring system to achieve the force required for the CubeSat launch. The propulsion system of the spacecraft would take over after the launch to place itself in the designated orbit. The structure of the launch system is designed to operate at different angles to enhance better launching conditions. The idea is supported by theoretical calculations with verified simulation results. The paper describes and presents the overall design of the launcher along with material specifications, power supply requirements, the control program and the effective contact and release of the CubeSat from the launch system. The paper also addresses various technical challenges and possible approaches to tackle them such as the hysteresis loss of the solenoid core, magnetic susceptibility of the CubeSats and shock-related issues during launch. Furthermore, the details of the cost involved along with similar models of the magnet-spring system are discussed.