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A NEW TYPE OF A NANO LUNAR ROVER STRUCTURE UTILIZING CARBON FIBER REINFORCED POLYMER

Abstract

The exploration of celestial bodies is currently constrained significantly by the elevated expenses associated with deploying rovers to space. Nano lunar rovers have emerged as a cost-effective and innovative approach, enabling more frequent and diverse missions. These compact rovers are designed to traverse the lunar surface, conducting detailed scientific research and experimentation with a minimal logistical footprint. This approach offers a promising solution to the financial and operational challenges of space exploration, democratizing access to lunar research. To further enhance the benefits and applications of nano lunar rovers, it is crucial to utilize advanced lightweight materials such as Carbon Fiber Reinforced Polymer (CFRP). Incorporating such materials increases the mass budget allocated to the payload and other subsystems, thereby optimizing their efficiency and potential for a wider range of scientific tasks and exploratory missions. This study proposes a novel nano lunar rover structure, underpinned by extensive finite element analyses, including quasi-static and modal evaluations, to verify the structure's adequacy. The results show that the proposed structure is lighter than commercially available rover structures and adequately equipped for the harsh lunar environment. This advancement paves the way for more sustainable and cost-effective lunar exploration, potentially revolutionizing our approach to studying and understanding the moon's surface.