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LUNAR ARTIFICIAL SATELLITE CONSTELLATION: GEOMETRIC PROWESS OPTIMIZATION

Abstract

This article delves into the importance of finding the ideal configuration of lunar satellites and the crucial role that optimization processes and simulations play in the lunar groundbreaking space exploration initiative. The optimization process begins with a comprehensive analysis of the technical requirements for the lunar satellite constellation. This involves determining the number of satellites needed, their spatial distribution and the specific orbit elements they should have. Technical parameters, such as communication frequencies and data transfer rates, are also considered to ensure seamless integration with lunar missions. Simulations also play a pivotal role in testing the proposed satellite constellation under various realistic scenarios. This includes simulating communication delays, orbital adjustments, and emergency response procedures. Simulations aid in optimizing resource allocation for the satellite constellation. This involves assessing the efficiency of power distribution, fuel consumption, and data processing capabilities. By running simulations, researchers can fine-tune these parameters to ensure optimal resource utilization, prolonging the lifespan of the satellites and minimizing mission costs. Researchers can simulate potential malfunctions, collision scenarios, and communication breakdowns to devise contingency plans. This proactive approach ensures that the lunar satellite constellation is equipped to handle unexpected challenges, enhancing the overall mission success rate. In conclusion, the importance of finding an optimal satellite constellation for the Moon cannot be overstated. It is a critical component for the success of lunar exploration missions, enabling precise navigation, reliable communication, and effective resource exploration. The optimization process, coupled with simulations, ensures that the satellite constellation is not only technically and operationally sound but also aligned with the scientific goals of lunar exploration. Through rigorous testing of various scenarios, we have discerned intriguing insights into the nuanced behavior of geometric characteristics within the context of an optimal lunar artificial satellite constellation. Our efforts have unveiled not only promising leads on the desirable attributes these configurations should exhibit but also delineated the boundaries of what they should avoid. This empirical exploration has enabled us to delineate a discernible range within the parameters, shedding light on the intricate interplay of factors that define the geometric ideal for such satellite constellations. Within the confines of this article, we shall elucidate the primary steps undertaken during our investigative endeavors. Delving into the intricacies of our testing methodology, we aim to share the foundational insights gleaned from the examination of diverse scenarios.