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LUNAR NAVIGATION AND POSITIONING SYSTEM BASED ON CUBESAT CONSTELLATION

Abstract

In the scenario of Moon exploration, the introduction of a Lunar navigation system is an essential asset to support surface operations. A precise positioning real-time system on an astronomical body plays a key role in enhancing robotics and human activities, allowing to plan safer and more reliable missions. The system will provide accurate data on the location of vehicles and direct Line-of-Sight links to every region of interest on the Lunar surface, thus suppressing occultation times for Earth communications. Moreover, with the aim of building settlements on the Moon, the system will also provide the capability of coordinating technologically advanced machines operating autonomously to conduct research and gather scientific data. Furthermore, the navigation fleet will also co-operate with In-Situ-Resource-Utilization systems by mapping raw resources and providing end-to-end communications with different ISRU subsystems. In this paper, it is described the feasibility of such a system, focusing in particular on CubeSats which allow to minimize mission costs without incurring in a substantial degradation of the signal.

The Cubesats making up the navigation constellation will fly over non-circular orbits to ensure full coverage of the Lunar surface regions of interest, ensuring the capability of a continuous exchange of data with the Lunar Ground Segment. Finally, the comparatively short distance between Moon and Earth will facilitate the initial implementation of the concept in a Lunar orbit, paving the way for the employment of the same technology in future exploration missions on more distant celestial bodies, such as Mars.