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AUTONOMOUS ONE-WAY TIME TRANSFER ON THE LUNAR SOUTH POLE SURFACE USING HIGH SENSITIVE GNSS RECEIVER

Abstract

Since the renewed interest in Moon exploration by global space institutions in recent years, dependable access to moon has become a top space goal once again. The European Space Agency's (ESA) Moonlight initiative, which was created in support of NASA's Artemis program to return humans to the Moon, is one of the long-term existing projects that encourages many space companies to place a lunar constellation of telecommunications and navigation satellites. Providing a dedicated and dependable lunar telecommunications and navigation systems can minimize future mission design complexity, costs, and constraints, letting them to focus on their main tasks. The goal of this research is to provide preliminary evidence of autonomous time synchronization for a moon surface element. The simulation implements a one-way time transfer between the Global Navigation Satellite System (GNSS) and a Surface System equipped with a high sensitive receiver. On the one hand, the synchronization of a fixed-surface element is impacted by fewer problems than an orbiting system because:

- Possibility of having a more continuous and better visibility of the Earth GNSS Satellites.
- Possibility of having a more accurate knowledge of position and moon-referecing.

On the other hand, the ability to have a surface element synchronized with the Earth GNSS could provide significant benefits by acting as a form of "anchor" for more complicated systems (orbiting systems, etc). The analysis described in this paper is carried out using a MATLAB software environment and by utilizing the interaction with AGI STK.