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Hitchhiking to the Moon and Beyond (8)

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GNSS TO REACH THE MOON

Abstract

Reaching the Moon presents really strict requirements in terms of performance, flexibility and cost for all spacecraft subsystems. These requirements become more stringent if this mission is designed to be accomplished using a small satellite. Navigation subsystem is no doubt essential and nowadays, several systems offer different solutions to the navigation problem. Global Navigation Satellite Systems (GNSSs) such as GPS, GLONASS, or the future Galileo and BeiDou, introduce a relatively easier way to provide an autonomous on-board orbit determination system; they just require the realization and installation of an on-board GNSS receiver, with low cost, low power consumption and limited mass and volume. While GNSSs have been already exploited with success for Low Earth Orbit, their use for very High Earth Orbit (HEO) or Moon navigation is still at the research stage. In this context, the purpose of this research is to determine the potential achievable accuracy of a code-based GNSS solution, during the whole trajectory to reach the Moon. GPS, Galileo, and GPS-Galileo combined solutions are estimated, by considering constellations availability, pseudorange error factors and geometry factors. Unlike previous investigations, our study is making use of a very accurate multi-GNSS constellation simulator "Spirent GSS8000", which supports simultaneously the GPS and Galileo systems and the L1, L5, E1, E5 frequency bands. Integration of GPS-Galileo with other sensors and network assistance are also considered, in order to improve the navigation solution.