SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Space-Based Navigation Systems and Services (4)

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HIGH ACCURACY GNSS BASED NAVIGATION IN GEO

Abstract

Although significant improvements in efficiency and performance of communication satellites have been achieved in the past decades, it is expected that the demand for new platforms in Geostationary Orbit (GEO) and for the On-Orbit Servicing (OOS) on the existing ones will continue to rise. Indeed, the GEO orbit is used for many applications including direct broadcast as well as communications. At the same time, Global Navigation Satellites System (GNSS), originally designed for land, maritime and air –applications, has been successfully used as navigation system in Low Earth Orbit (LEO) and its further utilization for navigation of geosynchronous satellites becomes a viable alternative offering many advantages over present ground based methods. Following our previous studies of GNSS signal characteristics in Medium Earth Orbit (MEO), GEO and beyond, in this research we specifically investigate the processing of different GNSS signals, with the goal to determine the best navigation performance they can provide in a GEO mission. Firstly, a detailed selection among different GNSS signals and different combinations of them is discussed, taking into consideration the L1 and L5 frequency bands, and the GPS and Galileo constellations. Then, the implementation of an Orbital Filter is summarized, which adaptively fuses the GNSS observations with an accurate orbital forces model. Finally, simulation tests of the navigation performance achievable by processing the selected combination of GNSS signals are carried out. The results obtained show an achievable positioning accuracy of less than one meter. In addition, hardware-in-the-loop tests are presented using a COTS receiver connected to our GNSS Spirent simulator, in order to collect real-time hardware-in-the-loop observations and process them by the proposed navigation module.