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ADVANCED NAVIGATION AUGMENTATION SYSTEM BASED ON LEO COMMUNICATION CONSTELLATION

Abstract

The Global Navigation Satellite System (GNSS) is the most widely used positioning navigation and timing (PNT) system with more users than any other PNT system. Nevertheless, the currently used GNSS system can only provide basic navigation service, and cannot meet the requirements of intelligent transportation and smart city, which require precision navigation service with availability everywhere. Although the Space Based Augmentation System (SBAS) or the Ground Based Augmentation System (GBAS) can provide improvements on navigation precision and integrity, these systems still have several drawbacks. The SBAS consisting of geosynchronous satellites, which have high orbit height and low ground-receiving power, has inherent vulnerability such as weak signal strength, weak penetration and low robustness, and has a long convergence time for precision point positioning.While, the service area of GBAS is limited by the coverage area of the ground network. In this paper, a global navigation augmentation system based on LEO Hongyan communication constellation is proposed, which is constructed by China Aerospace and Technology Corporation (CASC). The LEO satellites can serve both as space-based monitoring stations and as navigation information broadcasting sources. When served as space-based monitoring stations, the LEO satellites can jointly determine the precise orbits and clock errors of GNSS satellites and LEO satellites with the data from the mounted high precision GNSS monitoring receiver and the ground based monitoring stations. When served as navigation information broadcasting sources, the Assistant GNSS (AGNSS) architecture is used to broadcast assistant navigation information, and the GNSS receiver can realize fast signal acquisition in the extremely complicate environment and achieve better anti-jamming capability for the navigation availability augmentation. For the navigation precision augmentation, besides the precise orbit, precise clock error, and integrity augmentation information, an additional navigation augmentation signal is broadcasted to realize global precise point positioning (GPPP) with sub-meter positioning precision level in dynamic mode and sub-decimeter precision level in static mode. The convergence time of precise point positioning is shorten from 30 minutes using a GNSS system alone to less than 5 minutes using a GNSS system together with the LEO global navigation augmentation system.