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STUDY ON SATELLITE MOTION ERROR OF TWSTFT IN GROUND-BASED NAVIGATION SYSTEM

Abstract

To determine the satellites' orbit, dedicated TTC system is needed. These kind of TTC systems have its inherent disadvantages in robustness and coverage. "Reverse GPS" system based on ground-based navigation sources can solve the robustness and coverage problems to some extent. In the "reverse GPS" system, the station-to-station time synchronization error has decisive impact to the orbit determine error, and precise time transfer operation between navigation stations is necessary. Two-way satellite time and frequency transfer (TWSTFT) can achieve sub-nanosecond accuracy, and is the most accurate technology of major time transfer technologies. The error of TWSTFT comes from the propagation path asymmetry of two-way signals, and the motion of satellite may cause the asymmetry. This paper focused on the so called satellite motion error. First of all, we derived satellite motion error formula, and then calculated some GEO satellites motion from the two-line-element (TLE). Based on the satellite motion, we simulated the time transfer error of a group of ground stations. The simulation results show that, time transfer error caused by satellite motion could reach hundreds of nanoseconds. And because of the daily cycle feature of the GEO satellites' motion, the time transfer error is not a constant within a day. The conclusions of this paper are significant to revealing the characteristics of TWSTFT error and improving satellite time transfer accuracy of the "reverse GPS" system.