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Author: Ms. Xu Wang
CASIC, China, wangxu2012hit@gmail.com

Mr. Peng wang
China Aerospace Science and Industry Corporation, China, wp_fuyao@163.com
Prof.Dr. Yuguang Yang
China Aerospace Science & Industry Corporation (CASIC), China, yyg001@sina.com

A RESEARCH ON IMPROVED GROUND-BASED NAVIGATION SYSTEM

Abstract

In the last conference, we presented a ground-based navigation system composed of a few worldwide distributed navigation stations. Analysis shows that the system is able to provide real-time and high precision navigation services to multiple GEO satellites with positioning error less than 1516m. Based on the former analysis, further study is carried out and an improved navigation scheme is proposed. In the new scheme, a downlink is employed in the navigation system. By the cooperation of the uplink and the downlink, the system is capable of offering services of navigation, as well as transmission of high speed telecontrol and telemetry data, achieving the intergration of navigation, telecontrol and telemetry functions. The new scheme is of great importance for reducing payload weight and improving the satellite electro-magnetic environment (EME). Furthermore, with two-way ranging and velocity measurements, the actual distance and velocity can be obtained regardless of the clock error between satellites and ground stations, and thus improves the positioning dilution of precision (PDOP) factor, which increases the precision of the navigation solution. The paper focuses on the analysis of the improved ground-based navigation system scheme and the two-way measurement method. Results show that, in order to realize multi-target coverage and high antenna gain, multiple phased array antennas are required at the ground navigation stations. Also, via the 10W downlink from the onboard navigation receiver to the ground stations, a 1Mbps telemetry link is ensured, and the navigation accuracy is significantly increased with the positioning error reduced to less than 500m.