SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Interactive Presentations (IP)

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PERFORMANCE AND PREDICTION OF COMBINED CLOCK ERROR MODEL FOR BEIDOU NEW GENERATION NAVIGATION SATELLITE

Abstract

The atomic clock is the core equipment of navigation satellite, and its performance and prediction accuracy directly determines the PNT accuracy. In this paper, the on-orbit performance and prediction accuracy of atomic clock on new generation navigation satellite are evaluated using bi-directional time synchronization data. Firstly, with the clock error data preprocessed by the combined MAD gross error detection, the evaluation method of satellite clock performance is studied. The frequency accuracy and frequency drift rate are established by the least square method and polynomial function method. The frequency stability of the satellite clock is obtained by the overlapping Hadamard variance. According to the practical time synchronization clock error data, the performance of Beidou new generation satellite clocks is evaluated and compared with regional satellites. The results indicating that clock performance of Beidou new generation satellites is better than regional satellites, and the clock performance of passive hydrogen is better than the new rubidium clock. Secondly, the weighted combined clock error prediction model is designed, which synthesize the polynomial model and the gray model by the classical weighted method. The simulation results show that the prediction accuracy of new generation satellite is improved about twice as high as that of regional satellites. The prediction accuracy is significantly correlated with the frequency accuracy and daily stability, and micro-correlated with the daily drift rate. The results can be incorporated into the satellite clock error prediction strategy, which provides a new possibility to improve the clock error prediction accuracy of Beidou navigation system. Moreover, the performance and prediction accuracy of the atomic clock is evaluated by the real measured data of the new generation satellites and the regional satellites. The results illustrate that the frequency accuracy, stability and prediction accuracy of the new generation satellites are improved compared with the regional ones. Finally, the influence on clock error measurement and prediction by ISL is evaluated. The results show that the clock error measurement of MEO satellites is improved, and simultaneously the accuracy is improved.