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THE SUB-MILLIMETER-LEVEL RELATIVE NAVIGATION METHOD OF SATELLITE FORMATION BY USING DISTANCE MEASUREMENT OF FEMTOSECOND LASER COMB TO IMPROVE THE CDGPS

Abstract

Aiming at the problems of limited accuracy, low reliability and low continuity when using carrier phase differential GPS (CDGPS) for relative navigation of satellite formation, the relative navigation method of using high-precision distance measurement information of femtosecond laser comb to improve the accuracy of CDGPS is proposed in this paper. By using the Extended Kalman Filter (EKF) combined with the high-precision relative motion equation proposed in this paper as the state equation of the filter, the sub-millimeter-level relative navigation of satellite formation can be realized. At the same time, when observations cannot be obtained due to the lack of common-view GPS satellites and the implementation of maneuvering in formation missions, only relying on high-precision state equations for position calculation can also achieve high-precision relative navigation, which improves the accuracy and reliability of relative navigation. The simulation is carried out using GPS data generated by the simulator. The result shows that the 3D RMS of the relative navigation method proposed in this paper is 0.43363 mm. Compared with the relative navigation method of using CDGPS alone, the accuracy is improved by two orders of magnitude. At the same time, when measurement data cannot be obtained due to some special reasons, only relying on the state equation for position recursion can still achieve relative navigation with millimeter to centimeter accuracy over a long period of time.