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AUTONOMOUS NAVIGATION SCHEME OF LEO CONSTELLATION BASED ON INTER-SATELLITE LINK AND MAGNETIC FIELD

Abstract

Compared to autonomous navigation of low earth orbit (LEO) constellation only based on inter-satellite link ,a method for autonomous navigation of LEO constellation combining inter-satellite link and geomagnetic measurement is proposed in this essay to solve the problem about overall rotation and drifting of LEO constellation. Magnetometer and observation camera are installed on the observation satellite.Spatial reference information is provided for LEO constellation by obtaining and analyzing the angular distance between the line-of-sight vector of target satellite in the same orbit of the LEO constellation and the direction of geomagnetic field. The module value of geomagnetic field is also used of measurement so that the absolute property of geomagnetic field is fully utilized. Meanwhile, inter-satellite distance is measured by inter-satellite link transponder subsystem. After non-rank deficient analysis, the state equation and measurement equation are established The optimal estimated about the whole state of LEO constellation can be conducted by using Extended Kalman Filtering (EKF).The results of simulation demonstrates that mean square error of autonomous navigation system of LEO constellation based on inter-satellite link and magnetic field is close to CRLB.The position error is less than 10m and velocity error is less than 0.01m/s. The autonomous navigation of LEO constellation can last 180 days, which meets application requirements.