SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Space Communications and Navigation Global Technical Session (8-GTS.3)

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THE GPS L1 ACQUISITION-TRACKING TRANSITION METHOD OF HIGH SENSITIVITY AND DYNAMIC FOR HEO ORBIT

Abstract

Although GPS was originally designed for providing position, velocity and timing (PVT) for terrestrial, maritime and air applications, the current application range goes far beyond the original expectation. In Low Earth Orbit (LEO), GPS provides real-time navigation, precise time synchronization, formation flying aiding and orbit determination for a lot of space users. However, for High Earth Orbit or Highly Elliptical Orbit (HEO) missions, the application based on GPS is still at research stage. There are many reasons which restrict the extension of space applications, one of them is the transition part between acquisition and tracking. In HEO case, the received signal power is very low and the dynamic is quite high, which means that the acquisition should take a lot of time to search for the correct code phase and Doppler. When the acquisition finally finds the correct results, the received signal characteristics basically have changed too much to be tracked by PLL and FLL. To solve this problem, the normal method is to use additional system (e.g. INS or orbit filter) to aid the GPS receiver, so the frequency search space, even the code phase search space can be reduced. But the drawbacks are obvious: 1) the additional system means more mass and power consumption required; 2) more money should be paid for the project. In this paper, the GPS L1 acquisition–tracking transition method of high sensitivity and dynamic is presented, which could solve the acquisition-tracking transition problem in high dynamic and sensitivity case without any assistance. Besides this technique, a bit synchronization method is presented too, which can find the correct bit edge within the acquisition process, further increasing the lock possibility of the tracking loop. By using the GPS simulatorGSS8000 which is very accurate for space simulation, real data is processed by Terasic DE3 platform. The simulation experiment result shows that the acquisition can be converted to tracking successfully on HEO orbit.