SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Space Communications and Navigation Young Professionals Virtual Forum (8-YPVF.3)

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GPS C/A CODE CROSS CORRELATION MITIGATION TECHNIQUE FOR HEO ORBIT ACQUISITION

Abstract

As we all know that current GPS constellation has been proved to be a very efficient system for Low Earth Orbit (LEO) applications, such as location determination and time synchronization. However, for very High Earth Orbit (HEO) up to the moon altitude, the application based on GPS is still at research stage. There are many reasons which restrict the extension of space application, one of them is the bad cross correlation performance of C/A code. It will bring 2 consequences: 1) most of the side-lobe signals cannot be acquired because of the existence of much stronger main-lobe signals, which will decrease the number of satellites that could be used in space application; 2) the location error and geometry dilution of precision (GDOP) will increase due to the limited number of satellites available. To solve this problem, the normal method is to use L5 signals instead. But L5 signal is only transmitted in GPS Block IIF and Block III, which means there are only limited number of L5 signals available in the whole constellation. Therefore, in order to increase the robustness and reliability of the system, the receiver should have the capability to process L1 C/A signal. In this paper, the C/A code cross correlation mitigation technique is presented, which increases the cross correlation isolation from 21.1dB to at least 45dB, and that could satisfy the requirements for acquiring the side-lobe signals when the main-lobe signals exist. Besides that mitigation technique, a detection method is presented too, which can discover the acquisition error before transferring the results to tracking. By using the GPS simulator "Spirent GSS8000" which is very accurate for space simulation, real data is saved by the Fraunhofer front-end and processed by MATLAB software receiver. The simulation result shows that all the side-lobe signals can be acquired with the existence of the strong main-lobe signal.