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Author: Mr. Jia Tian
China Academy of Space Technology (Xi'an), China, jia_epfl_tian@163.com

Prof. Wei Wang
CAST, China, wwei98@163.com
Prof. pingyan Shi
China, Shipingyan@gmail.com

THE HIGH PRECISE AND LOW TIME DELAY ACQUISITION METHOD OF GPS L1 SIGNAL FOR
HEO ORBIT

Abstract

Global positioning system (GPS) has been demonstrated to be a valid and efficient system for various space applications in low Earth orbit (LEO) and medium Earth orbit (MEO), such as for location determination and time synchronization. However, in highly elliptical and high Earth orbits (HEO), the number of existing space applications is much smaller because of the very weak power and the pretty high dynamic of the received signals. In such environment, the processing time of acquisition for each channel is more than 1 minute once a satellite is acquired, which means that the carrier frequency may change a lot and the initial code phase is modified with carrier Doppler shift, thus the PLL (phase lock loop) and FLL (frequency lock loop) are not able to track the current signal with the previous signal characteristic. 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 high precise and low time delay acquisition method of GPS L1 signal is presented, which could directly link the tracking part in high dynamic and sensitivity case without any assistance. In limited time, the initial frequency error is confined within 5 Hz and the ambiguity of the bit edge is solved, which means the newest and more precise signal characteristic parameters are sent to the tracking module. By using the GPS simulator\Spirent GSS8000 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.