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

Prof. Daqing Wang
Institute of Spacecraft System Engineering,China Academy of Space Technology (CAST), China
Prof. Wei Wang
CAST, China
Prof. pingyan Shi
China
Mr. Hui Wang
China

THE EFFICIENT MULTI-GNSS ACQUISITION METHOD ON HEO ORBIT

Abstract

GNSS (Global Navigation Satellite System) has been proved to be a practical and efficient system for various space applications in low Earth orbit (LEO) and medium Earth orbit (MEO), which could supply the space users with different styles of services, including location/velocity determination and time synchronization. However, in much broader high earth orbit and high elliptical orbit (HEO), the number of the space applications based on GNSS is sparse due to the very weak power of the received signal and the bad Geometric Dilution of Precision (GDOP). There are 2 ways to solve these problems, 1) use complex high sensitivity acquisition method; 2) have the ability to process multi-constellation signals (e.g., GPS, Galileo and Beidou). But this also implies several drawbacks, 1) complex algorithm means more FPGA resource; 2) multi-constellation processing ability also increases the resource burden. In this paper, the efficient multi-GNSS acquisition method is presented, which satisfies the requirements for extremely high sensitivity acquisition of multi-constellation with reasonable FPGA resource. Compared to a traditional architecture that integrates different acquisition methods together, this method designs universal VHDL part which is compatible with different signal styles, including GPS L1/L5, Galileo E1/E5 (a)/E5 (b) and Beidou B1I, and controls it by SOC part of FPGA. It will bring huge benefits to the receiver: 1) the universal VHDL part of multi-constellation means the resource arrangement is optimized; 2) the SOC part aided by other sub-systems can control the acquisition parameters, which means that it can adapt to different GNSS signal characteristics. The implementation on an Altera Stratix III FPGA shows that about 31.07% of the logic, 50% of the multipliers and 63.2% of the memory can be saved with the proposed method.