

Interactive Presentations (IP)
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THE IMPROVED CCSDS PROXIMITY-1 METHOD OF MULTI ORBITER-ROVER
COMMUNICATION FOR MARS EXPLORATION

Abstract

Currently, there is an increasing interest for many countries to launch probes to MARS. Because of the really long distance between earth and MARS, the optimization of the mass and power consumption and the enhancement of reliability become extraordinary critical. In the meantime, with the increasing number of orbiters and rovers, which use CCSDS proximity-1 protocol to set up communication, the probable interference should also be taken into consideration. The common design of CCSDS proximity-1 protocol is based on a fixed pair of spacecraft that usually belongs to the same mission, which focuses on a given scenario exhaustively and fine-tune proximity-1 to operate under a fixed but optimized configuration. Besides, the common implementation of CCSDS proximity-1 protocol is based on FPGA and DSP because it is really complex. However, the drawbacks are obvious: 1) the interference from other orbiter/rover will decrease the efficiency of transmitting data; 2) the DSP is sensitive to SEE (single event effect), which will decrease the reliability of the system; 3) the power consumption of DSP is not small. In this paper, the improved CCSDS proximity-1 method of multi orbiter-rover communication is presented, which use special algorithm to avoid interference of hailing/working channel from other probes. Besides, only limited FPGA resource is used to implement proximity-1 protocol instead of FPGA and DSP, which is protected by TMR (triple modular redundancy) and timing scrub to decrease the SEE influence. By using the conception product which embeds 1 Xilinx Virtex4 chip, real test result shows that the presented method performs well in multi orbiter-rover situation and the needed FPGA resource are 10% slice, 6% DSP and 9% RAM.