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Author: Mr. zhang wei
China Academy of Space Technology (CAST), China, yuhang30@163.com

Ms. Ruilan Wu
Beihang University, China, alice-2003-sl@163.com
Mr. bo lee
Beihang University, China, liboy@sa.buaa.edu.cn
Mr. Jianbin Han
Beihang University, China, hangjianbin@yahoo.com.cn

SYSTEM DESIGN AND KEY TECHNOLOGIES OF BUAA STUDENT MICRO-SAT

Abstract

The missions of BUAA Student Micro-Sat (BUAA-Sat) include the coilable mast development, taking on-orbit photographs of the satellite, image compression, and communication technology. The modular no-cable multi-mission adaptive concept is adopted in the design of BUAA-Sat. Using commercial-off-the-shelf (COTS) components, BUAA-Sat is developed smaller, cheaper and more quickly. In particular space missions benefit quickly from the continuing development of emerging terrestrial COTS technologies. The modular design and plug and play (PnP) technique make satellites adaptable in multi-mission. No-cable design can greatly decrease the number of cable in the satellites, which can reduce the size and weight of satellite, and identify the fault location quickly. So it can be possible to design satellites quickly for different missions by using this design concept. Plate-rod structure integrated design is adopted in BUAA-sat. Body mounted solar array is used and the high integration of structure and thermal control is realized. All components are installed on the layer of the structure, and communicate with on-board computer (OBC) by CAN bus. It is convenient to increase or decrease payloads by change the number of layer without affecting the platform functions. The OBC subsystem is consisted of three embedded modules. Two of these are identical management modules based on 32-bit RISC ARM9 processor, which can provide cold or hot backup for each other and have the function of sharing data and injecting software on orbit. The third one is a monitoring module using an 8-bit processor, with the function of monitoring OBC and basic management. These modules can work independently or parallel. The software based on VxWorks operating system running in the ARM processor supports multi-task management and has high real-time performance. The coilable mast can be compact when in the rocket and deploy with 2-meter-long on orbit. It has the characteristic of small compact volume, high reliability and stiffness. It is used as a gravity gradient boom working together with a damper to make the satellite attitude stable. There are two cameras on each side of the boom which can provide on-orbit images of the BUAA-Sat and scientific experiments outside of the satellite. The BUAA-Sat prototype has a short design cycle and low cost. Ground tests have already verified the rationality of the system scheme and design. It will develop into a space verification platform.