

38th STUDENT CONFERENCE (E2)  
Student Conference III (3)

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A HIGH PERFORMANCE FAULT-TOLERANT ON-BOARD COMPUTER SYSTEM FOR  
MICRO-SATELLITE**Abstract**

BUAA-Sat was a 30-kilogram student micro-satellite, which aimed at building up a low-cost and universal micro-satellite test platform. This paper presents a high reliable and low-cost on-board computer OBC system, which is based on maturely industrial technology. The independent function modules and standard data bus interface can easily meet different requirements of missions. Firstly, it introduces the OBC architecture and the hardware design. The OBC is consisted of three embedded modules. There are dual house-keeping function modules based on 32-bit RISC ARM9 processor, which can work on cold or hot redundant mode. The third module is a monitoring module, which is used to monitor the dual modules and emergency house-keeping management. Three modules can not only work independently, but also work united through CAN bus network, sharing data and uploading software in-orbit. Most of the logic and interface chips are substituted for FPGA devices, which saves much space and reduces power consumption. Secondly, the on-board software scheme of the OBC is given. The on-board software based on VxWorks is running in the ARM processor. The software was designed modularly. It has corresponding application tasks under the VxWorks real-time operating system. Thus, adding or deleting components and missions can be easily carried out by plugging or unplugging hardware and reconfiguring software parameters, which can meet requirements of "plug and play". Thirdly, fault-tolerant mechanism of the OBC is analyzed. The system fault-tolerant mechanism was based on fuzzy control method and expert database system. On-board computer accesses status parameters through sensors and evaluates the current status according to the fault-tolerant mechanism, and then it draws a conclusion to deal with the status. The on-board status database is updated, and algorithm parameters are adaptively adjusted. Lastly, a verification test scheme was given and the testing results show that the on-board computer system has high performance of automatic house-keeping management, fault-tolerant capability and portability enough to meet micro-satellite missions.