SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Architectures (4)

Author: Mr. Bowen Cheng
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, shanshui_66@163.com

Mr. Weiwei Liu
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, akinglw@163.com
Mr. Xiongwen He
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, hexw501@hotmail.com
Mrs. Minfang Yu
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, minfang_2001@163.com
Mr. Luyuan Wang
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, wang_luyuan@sina.com
Dr. Dong Yan
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, yandong200@163.com
Mr. Jianbing Zhu
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, xgdzjb@163.com
Dr. Ming Gu
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, gumingnr@163.com
Mr. Panpan Zhan
Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology(CAST), China, panpan3210@qq.com
Dr. YeChi Zhang
Harbin Institute of Technology, China, zhangyechi83@yahoo.com.cn

A DESIGN OF SPACECRAFT INTEGRATED AVIONICS

Abstract

With the development of electronic technology, highly integrated avionics system has become the trend of the next generation of satellite electronic system. Summarizing the requirements of future space missions, it is mainly reflected in such aspects: (1) Standardization, system hardware and software resources are designed based on open standards with high versatility; (2) Modularization, system's equipment can be assembled based on standard modules with high integration capabilities; (3) Reliability, system supports the module level of resource management and reconfiguration and improve the reliability of the whole satellite; (4) Expansibility, system becomes the basis of satellite computing platform and can expand computing resources according to the future intelligence and self-determination tasks demands.

In contrast, There are some problems still existed when the current satellite data management system (i.e. ODBH) compared to those features.On one hand, traditional product does not have modular features, typical phenomenon is that the backplane's standard chosen and functionalized are quite different, it makes difficult to form standard modular products; on the other hand, based on historical convention as well as customary, system hardware and software are highly coupling, the percent of software reused always stays in a low degree. In addition, the system design does not consider expanding computing capacity; it is difficult to meet future highly integrated mission requirements.

To solve above problems, this article proposes a design of integrated modular avionics, mainly completes the work in the following areas:

(1)From the standardization point of view, ARINC 659 Bus (i.e. SAFEBus), which has the highest rank of reliability, is chosen as system backplane bus based on common, efficiency, reasonable and high reliable design principles.

(2)Based on the concept of hardware modularity, eight replaceable modules are designed based on ARINC 659 Bus and can be easily assembled according to system requirement.

(3)Layered software architecture is designed and specific mission application can be constituted through this architecture, and most of software can be reused in different conditions.

(4)With the comparison of the existing system, the result shows that with standard ARINC 659 backplane and general module design, the system has greater advantages in fault tolerance, fault isolation and scalability. And standard modules and software architecture can promote the level of standardization of the system to meet the future requirements. The designed avionics provides a viable idea for the follow-up integrated electronic system research and development.