IAF SPACE POWER SYMPOSIUM (C3)
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Author: Mr. JianWu Zhao
Institute of Telecommunication Satellite, China Academy of Space Technology (CAST), China, zhaojianwu030836@126.com

Mr. Feng Li
Institute of Telecommunication Satellite,China Academy of Space Technology, China, lifeng@cast.cn
Mr. Jie Xing
Institute of Telecommunication Satellite , China Academy of Space Technology, China, xingjie97@126.com
Mr. Jianwei Zhao
Shandong Aerospace Electro-technology Institute, China Academy of Space Technology, China, zhaojianwei@cast.cn
Mr. Fanglin Yang
Shanghai Aerospace Electronic Co., LTD, China, 35928997@qq.com
Mr. Shuo Jiang
Institute of Telecommunication Satellite , China Academy of Space Technology, China, jiangshuo@cast.cn
Mr. Ran Bi
Institute of Telecommunication Satellite , China Academy of Space Technology, China, biran0319@163.com
Mr. Ruolin Zhang
China Academy of Space Technology (CAST), China, zhangruolin@cast.cn
Mr. Yalin Li
Institute of Telecommunication Satellite , China Academy of Space Technology, China, liyalin@cast.cn
Mr. Lei Yun
Institute of Telecommunication Satellite , China Academy of Space Technology, China, yunlei@cast.cn

RESEARCH ON INTELLIGENT AUTONOMOUS MANAGEMENT ARCHITECTURE OF SPACECRAFT POWER SYSTEM

Abstract

In the future application scenario, the spacecraft needs higher power levels, system robustness and autonomous management operation of the power system, and requires the power system to realize the intelligent autonomous management of the power system according to the characteristics of the spacecraft mission and the load characteristics , to ensure the rational allocation of system energy. In this paper, a new spacecraft power system architecture is proposed according to the above requirements. The solar cell array, power control unit, battery, intelligent management unit, cable harness and other components in the system are intelligently and independently managed. Intelligent autonomous management system can achieve the collection of battery cell voltage, battery equalization, battery health status online assessment and life prediction; solar array output power prediction. The system can complete the dynamic balance control of the system according to the load requirements and the dynamic classification management of the load of the whole task stage. At the same time, the system can dynamically manage the charge and discharge of battery according to the energy supply of the spacecraft and ensure the reliable transmission and utilization of energy according to the life estimation of the cable harness and the location of the fault points. The above architecture realizes the intelligent autonomous management of the power system,

which can effectively improve the energy utilization ratio and greatly increase the robustness of the spacecraft power system. This paper firstly introduces the components and implementation of power system architecture, and then focuses on the design of the energy flow and the information flow of the system, and simulates and verifies the proposed intelligent autonomous management strategy of system. Finally, this paper forecasts the applicable scenarios and application modes of the above power system architecture, and discusses the follow-up research work.