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信息科学

卫星系统网络节点的智能化设计

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摘要： 为了提高卫星系统的控制精度，解决系统故障检测与故障处理问题，进行了卫星节点智能化设计。以嵌入式SOC处理器为基础，建立了智能化网络节点的体系结构，将其划分为自诊断及上位机辅助单元、智能电源管理单元、标准化接口单元和基本功能单元等4个部分。采用过采样技术和数据融合处理技术提高了自诊断及上位机辅助单元的数据采集精度，采用直接冗余检测和知识检测方法实现了数据纠错功能，采用自断电/加电技术实现了智能电源管理功能，基于标准无线接口设计实现了接口标准化功能。最后，在太阳矢量测量仪原理样机上对所设计的智能化网络节点进行了功能验证。结果表明：智能化太阳矢量测量仪测量精度可达 0.01° ，高于传统太阳敏感器的采集精度 0.1° ；实现了状态自检、测量数据校验及标准接口功能，提高了卫星系统的可靠性。设计的网络节点可进行自主故障检测及处理，具备自断电/加电功能，能够针对空间环境带来的翻转及锁定进行自主处理，支持单机设备的即插即用，可实现卫星系统的快速测试、快速集成和快速装配。

关键词： 智能设计 无线射频识别技术 网络节点 卫星系统 标准化

Intelligent Design of Satellite Network Nodes

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Abstract: The intelligent design of a satellite network node was implemented to improve the control accuracy of a satellite system and to solve the problems of fault detection and trouble processing. The system structure of the intelligent network node was established based on an embedded SOC processor. The node was divided into four parts: the diagnosis and On Board Computer(OBC) auxiliary unit, intelligent power management unit, standardization interface unit and the basic function unit. Then, oversampling technology and data fusion processing technology were used to improve the accuracy of the data collection in the diagnosis and OBC auxiliary unit, and the testing error correction method based on redundant detection or direct knowledge was used correct the data errors. In the intelligent power management unit, the self on/off circuit technology was implemented to improve the reliability. Moreover, the wireless standard interface design was adopted in the standardization interface unit. Finally, an experiment was performed on a principle prototype of the sun vector measuring instrument to validate the design of intelligent network node. The experimental results show that the accuracy of the sun vector measuring instrument has reached 0.01° , far higher than the traditional accuracy of 0.1° . It realizes the state self-inspection calibration, measurement data auto-calibration and the standard interface function and improves the reliability of the system. The network node can finish the fault detection and treatment by itself and can realize the self on/off circuit function. It deals with the space environment from the flip and locking autotonomously and allows the plug for the single equipment. Furthermore, the node supports quick test, rapid integration and rapid assembly of the satellite systems.

Keywords: Intelligent design Ratio Frequency Identification(RFID) network nodes satellite system standardization

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