



航空学报 » 2014, Vol. 35 » Issue (1) :13-28 DOI: 10.7527/S1000-6893.2013.0335

综述

最新目录 | 下期目录 | 过刊浏览 | 高级检索

<< 前一页 | 后一页 >>

深空探测器自主技术发展现状与趋势

崔平远^{1,2}, 徐瑞^{1,2}, 朱圣英^{1,2}, 赵凡宇^{1,2}

1. 北京理工大学 宇航学院 深空探测技术研究所, 北京 100081;
2. 飞行器动力学与控制教育部重点实验室, 北京 100081

State of the Art and Development Trends of On-board Autonomy Technology for Deep Space Explorer

CUI Pingyuan^{1,2}, XU Rui^{1,2}, ZHU Shengying^{1,2}, ZHAO Fanyu^{1,2}

1. Institute of Deep Space Exploration, School of Aerospace Engineering, Beijing Institute of Technology, Beijing 100081, China;
2. Key Lab of Flight Vehicle Dynamics and Control of MOE, Beijing 100081, China

摘要

参考文献

相关文章

Download: PDF (3707KB) HTML 0KB Export: BibTeX or EndNote (RIS) Supporting Info

摘要

深空探测器距离地球远、所处环境复杂、苛刻,利用地面测控站进行深空探测器的遥测和遥控已经很难满足探测器控制的实时性和安全性要求。深空探测器自主技术即通过在探测器上构建一个智能自主管理软件系统,自主地进行工程任务与科学任务的规划调度、命令执行、星上状态的监测与故障时的系统重构,完成无人参与情况下的探测器长时间自主安全运行,自主技术已经逐渐成为深空探测领域未来发展的一项关键技术。本文首先分析了传统测控模式对深空探测的约束,回顾了深空探测器自主技术发展的现状,分析了实现深空探测器自主运行的关键技术,包括在轨自主管理系统设计技术、自主任务规划技术、自主导航与控制技术、自主故障处理技术和自主科学任务操作技术。然后结合深空探测工程实施和技术发展需求,提出未来深空探测器自主技术发展的趋势和重点。

关键词: 深空探测 自主管理 规划 自主导航 系统恢复

Abstract:

During the process of deep space exploration, the explorer is far away from the Earth while the environment around it is complex and harsh. Therefore it is difficult for ground stations with telecontrol and telemetry to satisfy the real-time and safety requirements of control systems for the deep space explorer. Autonomy technology then becomes a key to deep space exploration. An on-board autonomous management software system is used to enable the planning and scheduling of engineering and science tasks, execute commands, monitor states of the explorer and reconfigure the system when faults arise, all of which guarantees the autonomous and safe on-board operation without commands from the ground in the long cause of exploration. This paper first analyzed the limits of the traditional measuring and controlling mode for deep space exploration and reviewed the state of the art of autonomy technology. Then, it analyzed the key techniques of the autonomy of the explorer, which consisted of on-board autonomous management system designing, autonomous mission planning, autonomous navigation and control, autonomous fault processing and recovery, and autonomous operation of scientific mission. Finally, combined with the engineering implementation and technology requirements of deep space exploration, the paper envisaged the development trends and key points of autonomous technology of deep space explorers in future.

Keywords: deep space exploration autonomous management planning autonomous navigation system recovery

Received 2013-05-02; published 2013-07-19

Fund:

国家“973”计划(2012CB720000);国家自然科学基金(60803051, 60874094);高等学校博士学科点专项科研基金(20111101110001);北京理工大学科技创新团队资助项目

Service

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ Email Alert
- ▶ RSS

作者相关文章

- ▶ 崔平远
- ▶ 徐瑞
- ▶ 朱圣英
- ▶ 赵凡宇

Corresponding Authors: 徐瑞, Tel.: 010-68913550 E-mail: xurui@bit.edu.cn Email: xurui@bit.edu.cn

About author: 崔平远 男, 博士, 教授, 博士生导师。主要研究方向: 航天器自主导航与控制、智能控制、航天任务设计等。E-mail:

cuiipy@bit.edu.cn; 徐瑞 男, 博士, 副教授, 博士生导师。主要研究方向: 航天器自主控制、任务规划等。Tel: 010-68913550 E-mail:

xurui@bit.edu.cn; 朱圣英 男, 博士, 副教授。主要研究方向: 航天器自主导航与控制。Tel: 010-68918920 E-mail:

zhushy@bit.edu.cn

引用本文:

崔平远, 徐瑞, 朱圣英, 赵凡宇. 深空探测器自主技术发展现状与趋势[J]. 航空学报, 2014, 35(1): 13-28. DOI: 10.7527/S1000-6893.2013.0335

CUI Pingyuan, XU Rui, ZHU Shengying, ZHAO Fanyu. State of the Art and Development Trends of On-board Autonomy Technology for Deep Space Explorer [J]. Acta Aeronautica et Astronautica Sinica, 2014, 35(1): 13-28. DOI: 10.7527/S1000-6893.2013.0335

Copyright 2010 by 航空学报