



航空学报 » 2013, Vol. 34 » Issue (3) :644-654 DOI: 10.7527/S1000-6893.2013.0102

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考虑输入饱和的两飞轮驱动航天器视线轴控制

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Line-of-sight Pointing Control of Spacecraft Actuated by Two Flywheels Considering Input Saturation

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摘要

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摘要

研究了非零初始整星角动量下两飞轮驱动航天器姿态机动控制问题,针对在两飞轮旋转轴平面外某一视线轴的指向控制,给出了目标姿态生成算法和一种抗输入饱和的视线轴指向滑模控制算法。首先,通过对两飞轮驱动航天器静止时的可行姿态进行分析,给出了视线轴指向目标方向的必要条件。然后,基于该条件得到了使视线轴与目标方向偏差最小的目标姿态。最后,对状态方程进行降维和线性化处理,设计了一种抗输入饱和的视线轴指向滑模控制算法。仿真结果展示了本文算法的可行性和有效性。

关键词: 航天器 欠驱动 视线轴 姿态控制 输入饱和

Abstract:

The attitude maneuver control of a spacecraft controlled by two flywheels with nonzero initial angular momentum is investigated in this paper. To deal with the pointing control of line-of-sight outside the plane of the two-flywheel-axis, a desired final attitude generation algorithm and an input anti-saturation sliding mode control algorithm are developed. First, the necessary conditions for actuating the line-of-sight toward a specified direction is obtained based on an analysis of the spacecraft's feasible attitude when its attitude remains motionless. Then, the desired attitude of the spacecraft with minimum pointing error between the line-of-sight and the specified direction is obtained under such conditions. Finally, an input anti-saturation sliding mode control algorithm is proposed after linearizing the dimension-reduced state equations. Simulation results and analysis illustrate the feasibility and effectiveness of the proposed algorithms.

Keywords: spacecraft underactuate line-of-sight attitude control input saturation

Received 2012-05-14;

Fund:

国家“973”计划(2012CB720000);国家自然科学基金(61174201)

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引用本文:

崔祜涛, 程小军. 考虑输入饱和的两飞轮驱动航天器视线轴控制[J]. 航空学报, 2013, 34(3): 644-654. DOI: 10.7527/S1000-6893.2013.0102

CUI Hutaο, CHENG Xiaojun. Line-of-sight Pointing Control of Spacecraft Actuated by Two Flywheels Considering Input Saturation[J]. Acta Aeronautica et

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