



航空学报 » 2013, Vol. 34 » Issue (8) :1934-1943 DOI: 10.7527/S1000-6893.2013.0174

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## 考虑避免碰撞的编队卫星自适应协同控制

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### Adaptive Coordination Control of Satellites Within Formation Considering Collision Avoidance

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摘要

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#### 摘要

基于势函数法研究具有模型不确定性的编队飞行卫星避免碰撞的自适应协同控制。势函数法的思想为设计碰撞区域势函数值较大,所设计的控制律使得系统势函数具有减小的趋势,从而实现避免碰撞的编队飞行任务。首先,在无外部参考轨迹的情况下,通过引入避免碰撞势函数,提出一种自适应协同控制器,编队卫星最终实现速度一致和避免碰撞。进一步,考虑已知外部参考轨迹的情形,基于新的势函数方法,设计新的自适应协同控制器,能够同时实现避免碰撞、速度一致、卫星跟踪参考轨迹的目的。对于所提出的两种控制方法,均通过合理地应用Lyapunov稳定性理论分析了闭环系统的稳定性。仿真结果表明了所设计控制方法的有效性。

关键词: 避免碰撞 速度一致 自适应协同控制 势函数 编队飞行

#### Abstract:

The adaptive coordination control based on potential function method associated with collision avoidance is investigated for formation flying satellites with model uncertainty. The idea of potential function method is designing the bigger value of potential function in the collision area. The potential function of the system declines with the designed control law, thus the mission of formation flying with collision avoidance can be satisfied. Firstly, an adaptive coordinated controller is proposed by introducing a collision avoidance potential function in the absence of external reference trajectories, so that formation flying satellites can achieve velocity consensus and collision avoidance eventually. Then, taking into consideration an external reference trajectory, a new adaptive coordinated controller is designed based on a new potential function, and the objective of collision avoidance, velocity consensus and satellites tracking the reference trajectory is realized simultaneously. For the two presented control approaches, the stability of the closed loop system is both analyzed by using Lyapunov stability theory. Simulation results demonstrate the effectiveness of the designed control methods.

Keywords: collision avoidance velocity consensus adaptive coordination control potential function formation flying

Received 2012-10-11; published 2013-03-22

Fund:

国家自然科学基金(61174037); 国家“973”计划 (2012CB821205); CAST创新基金(CAST20120602)

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引用本文:

郑重, 宋申民. 考虑避免碰撞的编队卫星自适应协同控制[J]. 航空学报, 2013, 34(8): 1934-1943. DOI: 10.7527/S1000-6893.2013.0174

ZHENG Zhong, SONG Shenmin. Adaptive Coordination Control of Satellites Within Formation Considering Collision Avoidance[J]. Acta Aeronautica et Astronautica Sinica, 2013, 34(8): 1934-1943. DOI: 10.7527/S1000-6893.2013.0174

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