

基于非配置点部分误差控制联立方法的编队卫星队形重构

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Simultaneous approach with partial error control on non-collocation points based satellite formation reconfiguration

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摘要

针对编队卫星队形重构问题, 提出一种基于非配置点部分误差控制的联立方法. 首先采用基于Radau 配置点的拉格朗日插值多项式对微分代数方程组进行离散化处理; 然后引入非配置点, 要求避撞条件在非配置点处严格满足, 但不状态变量在非配置点处的误差估计进行控制, 从而降低离散化后得到的非线性规划命题的求解难度; 最后对3 颗编队卫星的队形重构问题进行测试和仿真并与相应文献中的结果进行了比较, 数值实验结果表明该方法具有更高的求解精度和求解效率.

关键词: 卫星编队飞行, 队形重构, 最优控制, 联立法, 非配置点

Abstract:

A simultaneous approach with partial error control on non-collocation points for formation reconfiguration of satellite formation flying is proposed. Firstly, Radau collocation points based Lagrange polynomials are utilized to discretize the group of differential algebraic equations. Non-collocation points are introduced. The collision avoidance conditions are required to be satisfied on the non-collocation points, while the error estimation of state variables are not. Then, solving difficulty of the nonlinear programming problem obtained by discretizing is reduced. Finally, the formation reconfiguration problem of three formation-flying satellites is demonstrated and simulated. The comparisons are made with the results in the related reference. The numerical results show that the proposed approach is more accurate and efficient.

Key words: satellite formation flying formation reconfiguration optimal control simultaneous approach noncollocation points

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