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摄动椭圆参考轨道编队相对运动方程

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摘要 基于高斯摄动方程，推导了卫星在同时考虑J2和大气摄动情况下的轨道根数变化方程。然后，引入虚拟参考卫星的概念，通过将真实卫星在虚拟参考卫星附近作一阶展开的方式，分析真实卫星相对于虚拟参考卫星的运动情况，进而获得一种在同时考虑J2和大气摄动情况下的线性时变编队相对运动模型。最后，将数值仿真结果与STK高精度轨道预报模块作对比，结果表明:本文算法可较为准确地预测椭圆参考轨道编队（编队构形不大于10 km）的构形变化情况，从而验证了算法的有效性。

关键词 飞行器控制、导航技术 卫星编队 高斯摄动方程 J2摄动 大气摄动 相对运动

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Relative motion equation for perturbed ellipitical reference orbit formation

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Abstract The variation equation of the satellite orbit elements under both J2 and drag perturbations was derived based on the Gauss perturbation equation. Introducing the concept of virtual reference satellite, by expanding the real satellite dynamics to the first order around the virtual one, the relative motion of the real satellite with respect to the virtual one was analyzed to build a model for the linear time varying relative motion between formation satellites under both the J2 and drag perturbations. The comparison of the simulated results with the STK high precision orbit prediction module shows that for the elliptical reference orbit formation(its size no more than 10 km), the proposed algorithm can quite precisely predict the change of the formation, thus the effectiveness of the given algorithm was verified.

Key words control and navigation technology of aerocraft satellites formation Gauss perturbation equation J2 perturbation drag perturbation relative motion

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