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# 微小卫星低可观测外形飞行姿态规划

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# Flight Attitude Planning for Low Observable Micro-satellite Shields

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**摘要** 为提高在轨微小卫星的使用效能及生存能力,提出一种微小卫星低可观测外形飞行姿态规划算法。根据微小卫星雷达散射截面(RCS)、轨道及雷达威胁特性,建立了可进行长时间内最佳飞行姿态规划的数学模型,设计了低计算复杂度的链表式个体结构及进化规划策略,并实现了算法对高威胁区优化规划的能力。同时,算法低迭代步长下的快速收敛特性以及进化中规划精度及计算量可变的设计,也使其可灵活应用于不同的规划任务。仿真结果表明,算法可有效降低S波段及甚高频(VHF)波段雷达对微小卫星的威胁性,满足微小卫星低可观测外形飞行姿态规划的需求。

**关键词:** 姿态规划 微小卫星 低可观测性 进化策略 雷达散射截面 探测概率

**Abstract:** A flight attitude planning algorithm is developed for low observable micro-satellite shields to enhance the on-orbit satellite's survivability and operational effectiveness. According to the micro-satellite's radar cross section (RCS), its orbit and radar threat characteristics, a planning mathematical model is established to find the optimal flight attitude in a long planning period of time. A novel linked-list individual structure and an evolutionary planning strategy are defined to reduce the planning computational complexity, and a special planning method is designed to enhance the planning performance when the micro-satellite travels through a high threat zone. At the same time, the algorithm converges quickly with limited iterative steps, and the planning precision and computational load can be adaptively controlled during the planning. These features make the planning algorithm available for different applications. In the simulation, the algorithm reduces the micro-satellite's S-band and very high frequency (VHF)-band radar threat level obviously, and meets the needs of the low observable micro-satellite shield flight attitude planning.

**Keywords:** attitude planning micro-satellite low observability evolutionary strategy radar cross section (RCS) detection probability

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