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### 带子星航天器总体参数多学科设计优化

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### Multidisciplinary Design Optimization of Main Parameters of Spacecraft with Sub-vehicles

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摘要

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**摘要** 针对带子星航天器总体参数多学科设计优化(MDO)问题,进行系统任务分析和学科耦合关系分析。考虑有效载荷、轨道和结构等学科设计变量和约束条件,以航天器有效接近区和整星质量的综合指标为目标,建立MDO模型和相应分析模型。利用iSIGHT软件搭建求解平台,采用基于罚函数的协同优化(CO)算法对所建立的MDO模型进行仿真计算,并得到合理结果,验证了所建立的MDO模型的合理性和CO方法求解航天器MDO问题的有效性。对MDO问题的建模和求解过程为航天器MDO问题研究提供了一种典型示例,所建立的各学科分析模型可为同类问题提供参考。

**关键词:** 航天器 多学科设计优化 建模 分析 协同优化

**Abstract:** For the multidisciplinary design optimization (MDO) of spacecraft with sub-vehicles, system mission requirements and disciplinary coupling relations are analyzed. Taking account of the design variables and constraints in payload, orbit and structure disciplines, the MDO model and related analysis models are built, with the comprehensive index involving the effective proximity region and total mass as the objective. Using the iSIGHT software to construct the solving architecture, the MDO model and analysis models are simulated and calculated with the collaborative optimization (CO) method based on penalty function, and reasonable results are obtained finally. The results prove the rationality of the MDO model and the effectiveness of using CO method to solve spacecraft MDO. The research process provides a typical example for the research of the spacecraft MDO and the disciplinary analysis models can be a reference for problems of the same kind.

**Keywords:** spacecraft multidisciplinary design optimization model building analysis collaborative optimization

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