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论文

应用博奕理论的多目标分布式气动优化设计

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Distributed Optimization Using Virtual and Real Game Strategies for Aerodynamic Multi-objective Design

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摘要 应用博奕理论研究了最优气动外形优化设计方法。采用的基本的优化器为基于控制理论的约束优化设计方法,通过引入标量伴随变量来执行约束条件,进而将上面的方法和对策论结合起来处理多目标翼型优化设计问题,根据各种不同的气动标准(可以是互为冲突的)来优化翼型形状。在对称Nash策略中,每一个“player”都力图优化自己的目标,而Nash平衡则提供了多个目标之间的一种解。不同的翼型分裂和设计算例表明了本文虚拟和真实Nash竞争策略在多目标翼型优化设计中的能力。成功的设计结果表明了本文方法的有效性。

关键词： 博奕理论 多目标优化设计 分布式优化 最优控制理论 约束优化

Abstract： This paper approaches the question of multi-objective optimization for optimum shape design in aerodynamics via constrained control theory. The employed optimizer is based on control theory. A scalar adjoint variable to implement the constraints is introduced. Furthermore, the above method is combined with a formulation derived from game theory to treat multi-point airfoil optimization. Airfoil shapes are optimized according to various aerodynamics criteria (in conflict). In the symmetric Nash Game, each "player" is responsible for one criterion. Several kinds of equilibrium provide a solution to the multi-point optimization. Several kinds of airfoil splittings and design cases are shown for virtual and real game strategies in aerodynamic design,and successful design results confirm the validity and efficiency of the present design method.

Keywords： game theory multi-objective optimization distributed optimization optimum control theory constrained optimization

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