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基于NSGA-II 的具有多目标子学科的协同优化方法

李海燕^a, 井元伟^b

东北大学a. 计算中心, b. 信息科学与工程学院, 沈阳110004.

Multi-objective collaborative optimization method based on NSGA-II for MDO problems with multi-objective subsystem

LI Hai-yan^a, JING Yuan-wei^b

a. Computing Center, b. College of Information Science and Engineering, Northeastern University, Shenyang 110004, China .

摘要

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摘要

针对子学科具有物理目标的多目标协同优化问题, 研究基于NSGA-II 的求解策略. 鉴于子学科个体满足约束可行性的进化过程与系统级分配期望值无关, 提出具有良好的可行性和多样性的初始种群生成方法, 以提高多目标子学科的计算效率和计算精度. 为了解决由一致性目标函数与物理目标函数的作用不同而造成的NSGA-II 非支配级排序困难, 提出将子学科一致性目标函数转化为子学科自身约束的策略. 最后, 利用工程算例对所提出方法的有效性进行了验证.

关键词 : 多学科设计优化, 多目标协同优化, 一致性目标函数转换, NSGA-II算法

Abstract :

The multi-objective collaborative optimization method based on NSGA-II is proposed for multi-objective multidisciplinary design optimization problems with multi-objective subsystems. The evolutionary process in which the individuals meet the feasibility is irrelevant to the target point allocated by the system level in multi-objective subsystem optimization. In view of this characteristic, a method for producing initial population with good feasibility and diversity is proposed to improve the calculation efficiency and accuracy of multi-objective subsystem optimization. In the process of NSGA-II non-dominated sorting, the effect of the interdisciplinary incompatibility function differs from the physical objectives, which increases the difficulty in sorting the individuals. To avoid this problem, a strategy of transforming the incompatibility function into a disciplinary constraint is presented in the multi-objective subsystem optimization. Finally, the engineering example shows the effectiveness of the proposed approaches.

Key words : multidisciplinary design optimization multi-objective collaborative optimization incompatibility function transformation NSGA-II algorithm

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通讯作者: 李海燕 E-mail: lihaiyan@ise.neu.edu.cn

作者简介: 李海燕(1979), 女, 副教授, 博士, 从事多学科协同优化、鲁棒优化方法的研究; 井元伟(1956), 男, 教授, 博士生导师, 从事复杂系统、远程通讯网络、通信控制等研究.

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