

利用代理模型的客机总体参数敏感性分析

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摘要 为了减少客机总体参数敏感性分析的计算量并实现分析结果的实时显示,研究一种客机总体综合分析模型的代理模型建模方法并用于快速敏感性分析。首先,明确设计变量和目标量并选取合适的多维设计空间,然后,用最优化拉丁超立方设计方法在该设计空间选取一定数量样本点,用客机总体综合分析模型对样本点分别计算分析,得到一系列关心的目标量;随后,用二阶多项式作为响应面构建近似模型;最后,基于该近似模型快速生成多种图形反映总体参数对目标量的影响趋势。以某型宽体客机总体参数敏感性分析算例表明,当样本点数目为设计参数的 15 倍左右时,代理模型的精度满足要求;通过趋势图、曲面图、Pareto 图可实时显示单、多参数对客机性能指标等目标量的影响关系。

关键词 客机;总体设计;敏感性分析;代理模型

DOI 10.3969/j.issn.1009-3516.2016.03.004

中图分类号 V221 **文献标志码** A **文章编号** 1009-3516(2016)03-00180-05

Analysis of Parameters Sensitivity for Airliner Conceptual Design Using Surrogate-Model

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Abstract: In order to reduce the computational burden of parameters sensitivity analysis in airliner conceptual design and realize the true-time indication of analysis results, a surrogate-model method for comprehensive analysis of airliner performance is investigated. Firstly, determine design variables and objective parameters as well as select suitable multi-dimensional design space. Secondly, the sample points in design space are selected with Opt LHD (Optimal Latin hypercube design) method, and are analyzed by an airliner conceptual multidisciplinary analysis code to obtain a series of required objective parameters. A second-order polynomial response surface is used to construct the surrogate-model to replace the multidisciplinary analysis code. Finally, various kinds of diagrams are generated using this surrogate-model to reflect influence of conceptual parameters toward objective parameters. An example of parameters sensitivity analysis

收稿日期:2015-09-18

基金项目:南京航空航天大学研究生创新基地(实验室)开放基金(kfjj20150108)

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引用格式:张陈力子,宋晓玉,祝雯生,等.利用代理模型的客机总体参数敏感性分析[J].空军工程大学学报:自然科学版,2016,17(3):18-22. ZHANG Chenlizi, SONG Xiaoyu, ZHU Wensheng, et al. Analysis of Parameters Sensitivity for Airliner Conceptual Design Using Surrogate-Model[J]. Journal of Air Force Engineering University: Natural Science Edition, 2016, 17(3): 18-22.