

## 相变传热问题的灵敏度分析与优化设计方法

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**摘要** 研究了相变传热问题的优化设计及其灵敏度分析方法. 在有限元-时间差分法和等效热容法求解相变温度场的基础上, 提出了相变温度场对设计变量一阶灵敏度的计算方法, 给出直接法和伴随法两种计算格式并分析了它们的特点, 建立了相变温度场优化的模型和算法, 在有限元分析与优化设计软件JIFEX中实现了该方法. 数值算例表明了灵敏度计算的精度和优化方法的有效性.

**关键词** [相变, 传热, 等效热容, 灵敏度, 优化设计](#)

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## Sensitivity Analysis and Design Optimization Methods for Problems of Heat Transfer with Phase Change

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### Abstract

The design optimization and sensitivity analysis methods for the problems of transient heat transfer with phase change have been researched in the paper. On the basis of phase-change temperature field solution with the finite element, time difference, and equivalent heat capacity methods, the numerical method to compute the first-order derivatives of temperature with respect to design variables is proposed. Two computational schemes of the direct method and the adjoint method have been given, and their characteristics have been discussed. The optimization model and algorithm are built for the transient temperature field with phase change. These methods have been implemented within the software JIFEX for finite element analysis and design optimization. The numerical results of example problems are given to illustrate the accuracy of sensitivity analysis and the effectiveness of design optimization.

**Key words** [phase change](#) [heat transfer](#) [equivalent heat capacity](#) [sensitivity](#) [design optimization](#)

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