

工程热物理

采用共轭梯度法求解多变量稳态传热反问题

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摘要:

采用共轭梯度法研究了二维稳态传热系统边界温度分布和对流换热系数组合的多变量反问题, 并讨论了待反演参数的初始猜测值、温度测点数目及测量误差对反演结果的影响。其中, 测点处温度的计算值利用有限差分法求解导热正问题得到。数值仿真试验结果表明, 所提供的求解方法对于解决多变量混合型传热学反问题具有较高的精度和较好的抗不适定性, 适当减少温度测点数目以及当测量结果存在一定误差时, 也能够得到比较满意的反演结果。

关键词: 热传导反问题 共轭梯度法 边界温度 对流换热系数

Estimating Steady Multi-variables Inverse Heat Conduction Problem by Using Conjugate Gradient Method

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Abstract:

The multi-variables inverse problem for estimating boundary temperature distribution and the convective heat transfer coefficient of the two-dimensional steady heat conduction system was solved by using conjugate gradient method, and the effects of the initial guesses of inverse parameters, the number of measured points and the measured errors on the accuracy of inverse solutions were discussed. In the inverse process, the computed temperatures at measuring points were acquired by solving the direct heat conduction problem with the finite difference method. Numerical experiment results show that conjugate gradient method provided can solve such the multi-variables inverse heat conduction problem with high accuracy and better anti ill-posedness. When the number of temperature measured points is appropriately reduced and the measured temperatures contain some error in computational procedure, the satisfactory results can also be obtained with the method.

Keywords: inverse heat conduction problem conjugate gradient method boundary temperature convective heat transfer coefficient

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