THE SOLUTION OF THE INVERSE COEFFICIENT PROBLEM FOR THE SEARCH FOR THE HEAT CONDUCTIVITY TENSOR BY THE GRADIENT METHOD OF CONJUGATE DIRECTIONS

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When conducting a thermophysical experiment, it is often difficult to determine the various characteristics of the material at any point in space, it is necessary to install a huge number of thermocouples, to accurately know the error of the measured equipment, method, etc.

The aim of this paper is to create a stable algorithm for determining the thermal conductivity tensor in the region under consideration using the conjugate gradient method while minimizing the mean-square residual functional of the theoretical and experimental temperature differences taking into account the measurement error.

This method of the first order of accuracy makes it possible to determine the required parameters of the object with a minimum number of iterations with a high accuracy with minimal a priori initial information.

The first stage of the study is to determine the theoretical fields of the considered region, taking into account the anisotropy [1] by the finite element method, where the step in space is chosen in such a way that the experimental and theoretical values of the temperatures are in the same nodes.

The second stage is the compilation of the mean-square residual functional or mean-square error, which is minimized in accordance with the method, and also the choice of the form of the corresponding basis functions of the thermal conductivity coefficients, which depend on temperature.

The third step is the iterative search for the required constant characteristics, using the conjugate gradient method, previously selecting the descent step and calculating its direction [2]. Multiplying the constant values of the tensor by their corresponding basis functions, we obtain the desired values.

Thus, the dependences of the temperature nonstationary field of the parameters of the heat conductivity tensor for diffuse high-intensity radiant heating, the sensitivity coefficients on the characteristics of space, and also the dependence of the tensor parameters on the number of iterations are constructed.

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1. V. F. Formaliev. Heat transfer in anisotropic solids. M. Fizmatlit. 2015.

2. F.V. Vasiliev. Optimization methods. M. Fizmatlit. 2011.