Inverse coefficient problems for one-dimensional heat transfer with a preservation of medium temperature condition

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Abstract: We examine mathematical model models describing the process of heat transfer in a homogeneous bar with a prescribed law of changes of the average temperature. So there is an inverse problem for the heat equation in which together with finding the solution of the equation it is required to find unknown coefficient depending only on the time variable.

In the domain $\Omega = \{(x,t) : 0 < x < 1, 0 < t < T\}$ consider a problem on finding unknown coefficient $p(t)$ of the heat equation

$$u_t = u_{xx}(x,t) - p(t)u(x,t) + f(x,t)$$

and its solution satisfying the initial condition

$$u(x,0) = \varphi(x),\ 0 \le x \le 1,$$

the nonlocal boundary condition

$$u_x(0,t) = u_x(1,t) - \alpha u(1,t),\ \ u(0,t) = 0,\ 0 \le t \le T,$$

and the overdetermination conditions

$$\int_0^1 u(x,t)dx = E(t),\ E(t) \neq 0, 0 \le t \le T,$$

where $E(t) \in W_2^1(0,T)$. Here the parameter α is any positive number, and $f(x), \varphi(x)$ and $E(t)$ are given functions.

In [1] (for $\alpha < 0$) some of these conditions were removed and it is shown that the inverse problem has the unique generalized solution. This work is a continuation of these studies. We consider the case $\alpha > 0$.

Keywords: heat transfer, law of changes of the average temperature, inverse problem, heat equation

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References

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