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Research Article

THE PROBLEM OF RESTORING THE RATE OF TEMPERATURE CHANGE ACCORDING TO INDIRECT OBSERVATIONS

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ABSTRACT

In this work the problem of temperature change in a given point of the surface solid State is considered. Applying the Dualism principle of the problem of managing and observation the question can bring to the problem of solution of extremal.

KEYWORDS

Revealing, heat, dualist, managing, observation, extremum, change, measurement.

INTRODUCTION

Consider heating an in nite plate of nite thickness S = 1, assuming that the initial temperature of the plate and the heating process are identical in thickness in all sections parallel to its side surface [1]. Then it is enough to analyze the process in some "rod"located in the plate. Let the temperature distribution over the thickness x(0 ≤ x ≤ 1) of the plate and over time t(0 ≤ t ≤ t̄) be described by a function T (x, t), de ned in the rectangle, where

$$\Pi = [0, 1]\, x\, [0, \bar{t}],\ \bar{t}>0$$

a xed number. The function T (x, t) is called the phase state of the heating process.

Inside the segment [0, 1] and at t̄>0 and during temperature distribution it obeys the heat equation:

$$\frac{\partial T(x,t)}{\partial t} = a\frac{\partial^2 T(x,t)}{\partial x^2} \qquad (1)$$

Here a is the temperature conductivity coe cient. At the ends of the rod, the following heat transfer conditions are accepted:

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$$\mu\frac{\partial T(x,t)}{\partial t}=\alpha\left[U(t)-T(1,t)\right];\ \frac{\partial T(0,t)}{\partial x}=0$$

Where μ- is the thermal conductivity coe cient, α- is the heat transfer coe cient between the heating medium, respectively, on one side =0 and the side surface of the plate on the other. The left end of the plate x= 0 is heat insulated. The temperature of the heating medium U (t) is called the control action or simply control. Let during the heating process it is possible to measure the temperature change at some points of the heated body. The task of determining the rate of change in temperature T (x̄, t) at the point X̄ ∈ [0, 1] over time at a given point of the rod from a known change in temperature at a point and the heat transfer law (1)-(2) is the subject of the identi cation (process) of heating, discussed below. Point xi ∈ [0, 1]Related Functionsyi (t)

(3)

$$y_i(t)=T(\bar{x}_i,t)+\xi(\zeta)$$

We call it the measured component of the heating process.

Task 1 From the functions yi(t), t ∈ [0, 1], constants a, α, μ and relations (1)-(3) determine

$$T'(\bar{\bar{x}},t)\ ,\ t\in[0,1],\ (\bar{\bar{E}}\neq\bar{E})$$

Let g (t) be some given function from (0, t̄)

Task 2.

For all the data of task 1, nd the value

Zg =

$$Z_g=\int_0^{\bar{t}} g(t)T'(\bar{\bar{x}},t)dt$$

It is clear that the solutions of Problem 2 for various functions g(t) = gi(t)i = 1, 2, ... making up the basis of space Z2(0, t̄) will allow us to nd the function from the projections Tj(x̄, t) (4) as an element Z2(0, t̄)..

Therefore, we will consider only Problem 2 below. For brevity, we consider below the observation of one the distribution of the sensor (i = 1) to the general case will be fundamentally understandable.

$$Z_g\int_0^{\bar{t}} g(t)T'(\bar{\bar{x}},t)dt=\int_0^{\bar{t}}\left[K(t)T(\bar{x},t)+\varphi(t)U(t)\right]dt$$

On the solutions of equation (1)(1), we consider the identity

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