NUMERICAL SOLUTION OF A TWO-DIMENTION DIRECT PROBLEM OF THE WAVE PROCESS

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Abstract: The problem of propagation of a potential along a nerve fiber, which is described by a telegraph equation of parabolic type, is considered.This problem is reduced to the inverse problem of the hyperbolic equation and the last problem is solved by a numerical finite-difference method, using methods:rectification of characteristics, isolation of features.A theorem on the convergence of an approximate solution to the exact solution of the inverse problem is proved.In connection with the equivalence of the problem, an approximate calculation of the membrane capacity of the problem is determined. Consider the following problem:

$$
\begin{gathered}
\frac{\partial^2 u(z,y,t)}{\partial t^2}+\frac{b_1(z,y)}{c_1(z,y)}\frac{\partial u(z,y,t)}{\partial t}=\frac{\sigma_1(z,y)}{c_1(z,y)}\triangle u(z,y,t)\\
+\frac{\sigma_{1z}(z,y)}{c_1(z,y)}\frac{\partial u(z,y,t)}{\partial z}+\frac{\sigma_{1y}(z,y)}{c_1(z,y)}\frac{\partial u(z,y,t)}{\partial y}+\frac{a_1(z,y)}{c_1(z,y)}u(z,y,t),\\
(z,t)\in R_+^2,\quad y\in R,
\end{gathered}
\tag{1}
$$

$$
u(z,y,t)|_{t<0}=0,\qquad \left.\frac{\partial u(z,y,t)}{\partial z}\right|_{z=0}=-\frac{1}{2}(r(y)\delta(t)+h(y)\theta(t))
\tag{2}
$$

Where a_1, b_1, c_1, σ_1 - coefficients of the equation, meaning some physical parameters of the environment, $u(z,y,t)$ - Environment pressure, $r(y), h(y)$ - functions of environment sources, $\delta(t), \theta(t)$ - Dirac delta function and theta function Heaviside, $R_+=\{x\in R : x\geq 0\}$. The direct problem is to determine the pressure of the medium $u(z,y,t)$ for known functions of the coefficients of the equation and the function of the sources. In this paper, all these tasks are grouped, systematized, summarized results, and numerical solutions of the problem.

Keywords: Two-dimensional, direct problem, wave processes, instantaneous source, cord, numerical solution

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