The uniqueness of the solution of the two-dimensional direct problem of a wave process with an instantaneous source and a flat boundary

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Abstract: This article is devoted to the justification of the uniqueness of the solution of the problem. A two-dimensional direct generalized problem of hyperbolic type is reduced to a regular problem with data on characteristics and the uniqueness of the solution of this problem is shown.

We consider the following problem:

$$u''_{tt}(z,y,t)+\frac{b_1(z,y)}{c_1(z,y)}u'_t(z,y,t)=\frac{\sigma_1(z,y)}{c_1(z,y)}\Delta u(z,y,t)+\frac{\sigma'_{1z}(z,y)}{c_1(z,y)}u'_z(z,y,t)+$$

$$+\frac{\sigma'_{1y}(z,y)}{c_1(z,y)}u'_y(z,y,t)+\frac{a_1(z,y)}{c_1(z,y)}u(z,y,t),\quad (z,t)\in R^2_+,\quad y\in R, \tag{1}$$

$$u(z,y,t)|_{t<0}\equiv 0,\quad u'_z(z,y,t)|_{z=0}=-\frac{1}{2}(r(y)\delta(t)+h(y)\theta(t)), \tag{2}$$

where $a_1(z,y), b_1(z,y), c_1(z,y), \sigma_1(z,y)$ are the coefficients of the equation describing the physical parameters of the medium, $u(z,y,t)$ is the perturbation of the medium, $\Delta u(z,y,t)=u''_{zz}+u''_{yy}$ is the Laplace's operator, $r(y), h(y)$ are source functions, $\delta(t)$ is the Dirac's delta-function, $\theta(t)$ is the Heaviside's theta-function.

Keywords: two-dimensional, direct problem, wave processes, source, instantaneous, flat boundary, uniqueness of the solution

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References

[1] S.I. Kabanikhin, *Incorrect and inverse problems*, Novosibirsk, Siberian Scientific Publishing House, 2009.

[2] V.G. Romanov, *Stability of inverse problems*, Moscow, The scientific world, 2004.

[3] Yu.V. Anishenko, A.Dj. Satybaev, *The Uniqueness of the Solution of the Two-dimensional Direct Problem of Geoelectrics with Instantaneous and Corded Sources*, Science, New Technologies and Innovations 7 (2014) 25–29.

[4] A.Zh. Kokozova, *The Uniqueness of the Solution of the Two-dimensional Direct Problem of the Telegraph Equation with Instantaneous and Corded Sources*, News of Higher Educational Institutions of Kyrgyzstan 11 (2015) 19–23.

[5] A.Dj. Satybaev, A.A. Alimkanov, *The Uniqueness of the Solution of the Two-dimensional Direct Seismic Problem with Instantaneous and Corded Sources*, Bulletin of the Kyrgyz State University of Construction, Transport and Architecture 4(54) (2016) 56–62.

[6] A.Dj. Satybaev, G.A. Kaldybaeva, *The Uniqueness of the Solution of the Direct Problem of Thermoelasticity with a Flat Boundary*, The Problems of Automation and Control 1 (2011) 59–63.

[7] A.Dj. Satybaev, Zh.K. Matisakov, *The Uniqueness of the Solution of a Direct Problem of Acoustics with an Instantaneous Source and a Flat Boundary*, The Problems of Automation and Control (2010) 159–163.