Inverse Neumann problem for an equation of elliptic type

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Abstract: In this study, we consider inverse problem of finding a function u and an element p for an elliptic equation

$$\begin{cases} -u_{tt}(t) + Au(t) = f(t) + pt, 0 < t < T, \\ u_t(0) = \varphi,\ u_t(T) = \psi,\ u_t(\lambda) = \xi \end{cases} \quad (1)$$

in an arbitrary Hilbert space H with the self-adjoint positive definite operator A. Stability and coercive stability estimates for the solution of inverse problem (1) are obtained. The first and second orders of accuracy difference schemes are presented. Stability and coercive stability inequalities for these difference schemes are given. In application, inverse problem for the multidimensional elliptic equation is studied. The first and second orders of accuracy difference schemes for the multidimensional inverse problem with overdetermination are presented. Well-posedness of both difference problems are established. The results are supported by numerical example for the two-dimensional elliptic equation.

Keywords: difference scheme, overdetermination, well-posedness, stability, coercive stability.

References:

[1] A. Ashyralyev, P.E. Sobolevskii, New Difference Schemes for Partial Differential Equations, Operator Theory Advances and Applications, Birkhäuser Verlag, Basel, Boston, Berlin, 2004.

[2] D.G. Orlovskii, Inverse Dirichlet problem for an equation of elliptic type, Differential Equation, vol. 44, no1, pp. 124-134, 2008.

[3] C. Ashyralyyev, M. Dedeturk, A finite difference method for the inverse elliptic problem with the Dirichlet condition, Contemporary Analysis and Applied Mathematics, vol. 1, no. 2, pp. 132–155, 2013.

[4] C. Ashyralyyev, M. Dedeturk, Approximate Solution of Inverse Problem for Elliptic Equation with overdetermination, Abstract and Applied Analysis, volume 2013, Article ID 548017, 2013.

[5] C. Ashyralyyev, High order of accuracy difference schemes for the inverse elliptic problem with Dirichlet condition. Boundary Value Problems, 2014:5, 2014.