SOLUTION OF THE DECONVOLUTION PROBLEM
IN THE GENERAL STATEMENT

V. V. Vasin, G. G. Skorik

The deconvolution problem, which arises in the description of well testing processes, is formulated in the form of a Volterra equation of the first kind with discontinuous input data (the kernel is the flow rate and the right-hand side is the pressure change) characterized by large measurement errors. In addition, the solution of this equation has multiscale behavior in its domain. In this situation, the traditional solution algorithms for Volterra equations, as a rule, do not provide satisfactory results. To solve the problem, we use the variational regularization methods and construct a function basis (a system of exponents), which allow us to take into account in the algorithms all a priori constraints known for the desired solution. As a result, we form a family of approximate solutions that satisfies the conditions of smoothness end exactness required for the interpretation of well tests. For the constructed regularizing algorithms, we formulate convergence theorems and describe the details of numerical implementation.

Keywords: deconvolution problem, well test, Tikhonov regularization, method of quasisolutions, system of exponents, a priori constraints.

V. V. Vasin, Dr. Phys.-Math. Sci., Prof., Krasovskii Institute of Mathematics and Mechanics, Ural Branch of the Russian Academy of Sciences, Yekaterinburg, 620990 Russia; Ural Federal University, Yekaterinburg, 620002 Russia, e-mail: vasin@imm.uran.ru .

G.G. Skorik, Cand. Sci. (Phys.-Math.), Krasovskii Institute of Mathematics and Mechanics, Ural Branch of the Russian Academy of Sciences, Yekaterinburg, 620990 Russia,
e-mail: skorik@imm.uran.ru .