Solvability of linear boundary value problems for the stationary fractional advection dispersion equation

Nataliya Vasylyeva

Institute of Applied Mathematics and Mechanics of NASU

Fractional partial differential equations (FPDE) play a key role in the description of the so-called anomalous phenomena in nature and in the theory of complex systems. In particular, these equations provide a more faithful representation of the long-memory and nonlocal dependence of many anomalous processes. In the last two decades, FPDE have drawn an increasing attention in several research fields, including Mathematical Modeling, Electromagnetism, Polymer Science, Hydrology, Geophysics, Biophysics, Finance and Viscoelasticity.

For a fixed $\nu \in (1, 2)$, we analyze the stationary fractional advection dispersion equation for the unknown function $u = u(x, y) : \Omega\{(x, y) : x \geq 0, y \geq 0\} \to R^1$

$$\mathbf{D}_x^\nu u(x, y) + \mathbf{D}_y^\nu u(x, y) = f(x, y)$$

subject either to the Dirichlet boundary condition or to the Neumann boundary condition.

The symbols $\mathbf{D}_x^\nu$ and $\mathbf{D}_y^\nu$ denote the Caputo fractional derivatives of order ν with respect to space variables x and y correspondingly.

Under certain conditions on the given functions, we establish one-valued classical solvability of BVP in the fractional weighted Hölder spaces.