Nataliya V. Vasylyeva [1]

On a Moving Boundary Problem in the Case of Anomalous Diffusion

[1] *Institute of Applied Mathematics and Mechanics, Donetsk, Ukraine*
E-mail: vasylyeva@iamm.ac.donetsk.ua

Some problems in solid and fluid mechanics, heat conduction, molecular diffusion are typical moving boundary problems (free boundary problems). In a free boundary problem one or more of the domain boundaries is an unknown function of time.

One of an important application of the free boundary problem is to describe the diffusional release of a solute from a polymeric matrix in which the initial drug loading is greater then the solubility limit which is a problem of interest in controlled release drug delivery. Liu and Xu [2] were the first who introduced the time-fractional diffusion equation to the drug release process in the case of 1-dimensional space. As was shown [2], [3], the mathematical model of this process is the fractional Stefan problem (free boundary problem for subdiffusion equation). This problem was studied in [1], [3], [2] and some exact solutions were constructed.

In the case of slow diffusion, the fractional Stefan problem tends to the fractional Hele-Shaw problem (see [4]) which has been studied numerical by Voller [4] only in the one dimensional case.

We prove the classical solvability locally in time of the fractional Hele-Shaw problem for enough smooth initial data in the case of the 2-dimensional fluid domain.

[1] C. Atkinson, Moving boundary problems for time fractional and composition dependent diffusion, *Fractional Calculus and Applied Analysis* **15**, (2012), 207–221.

[2] J.Y. Liu, M.Y. Xu, An exact solution to the moving boundary problem with fractional anomalous diffusion in drug release devices, *Z. Angew. Math. Mech.* **84**, (2004), 22–28.

[3] X. Li, M. Xu and S. Wang, Analytical solutions to the moving boundary problems with space-time-fractional derivatives in drug release devices, *J. Phys. A: Mathematical and Theoretical* **40**, (2007), 12131–12141.

[4] V.R. Voller, An exact solution of a limit case Stefan problem governed by a fractional diffusion equation, *International Journal of Heat and Mass Transfer* **53**, (2010), 5622–5625.