

On the methodology for constructing numerical algorithms for leaching of non-ferrous metals in a porous media

Michel Panfilov and Zharasbek Baishemirov

Keywords: Numerical methods, mathematical modeling, leaching, porous media.

Bright memory to my Supervisor, my “father” in science, the best friend - Michel Panfilov. . .

The idea of this research from a theoretical point of view, is determined by an attempt to lay the foundations of a new theory of filtration, taking into account the processes of chemical reactions characteristic of all porous media [1, 2]. In a realistic transport equation with a reaction in porous media, it is necessary to include terms reflecting the delay, in this case it should be either a differential equation with the delay argument or an integro-differential equation. It is also necessary to take into account the possibility of heterogeneous chemical reactions during the filtration of a multicomponent liquid, described by nonlinear relations, which leads to systems of nonlinear differential equations with delay. The specificity of differential equations with a retarded argument is that they extremely rarely have analytical solutions even in the one-dimensional case. Therefore, the main method of analyzing them and constructing solutions is numerical methods. These facts are not taken into account in any modern theory. Digital implementation of this theory, performed at the qualitative level of computational mathematics, is capable of solving important practical problems in the process of mining valuable and rare metals. The development of such a digital model can be used for research in various mining industries where in-situ leaching is used, for example, in the mining of uranium, copper, gold and other rare elements.

This research was funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP09261179).

Références

- [1] Panfilov M. Physico-chemical fluid dynamics in porous media. Applications in geosciences and petroleum engineering, Wiley VCH, 2019.
- [2] Panfilov M. Macroscale models of flow through highly heterogeneous porous media, Kluwer Academic Publishers, Dordrecht, 2000

Michel Panfilov
Institut Élie Cartan de Lorraine, UMR7502

Zharasbek Baishemirov
Abai Kazakh National Pedagogical University &
Institute of Information and Computational
Technologies CS MSHE RK
zbai.kz@gmail.com