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The International Conference CONTEMPORARY PROBLEMS OF FILTRATION THEORY dedicated to memory of Professor Pavel Fil'chakov

Proceedings of the International Conference Contemporary Problems of Filtration Theory is dedicated to memory of **Professor Pavel Fil'chakov**.

This Proceedings contain following papers: Kochina P. Ya., Golubeva O. V., Chern'ev A.P. Hmelynik M. I.: *Creation of P. F. Fil'chakov*; Fil'chakova V. P. : *Scientific Contribution of the Professor P. F. Fil'chakov to the development of Filtration theory*; Kochev K., Slaveykov Y.: *Investigation of pollutants transport by groundwater flow in river polders*; Kochina P. Ya., Kochina N.N., *On some results in Theory of filtration of Pavel Feodosievich Fil'chakov*; Olenik A. Ya., Kremez V. S., Dobronaravov A. A., *Mathematical modelling of Ecological Catastrophy*; Makarova N. V., Pol'akov V. P., Mitchenko T.E., *Mathematical modeling of filtration on filters*; Starkov, V. N., Pol'akov R. V., Tivonchuk V. I., *Method of the computer physicsca in the problems of filtration theory* and other.

We believe that such conferences will become traditional in the future.

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Pavel Fil'chakov was born on September 24 (11), 1916 in Petrograd (Leningrad, Sent-Petersburg) at the family of an engineer-designer. He attended the worker's High School in Kramatorsk (Donetsk Region) and then was graduated from the Kiev State University (1940). He did mathematics and mechanics at the Kiev University and proceeded to the Institute of Mathematics at Kiev for post-graduate course under Academician M. A. Lavrentyev. However, he didn't finish that course because of World War II.

In 1945, largely due to Lavrentyev efforts, Fil'chakov became to work at the Institute of Mathematics of the National Academy of Sciences of Ukraine. He was the head of the Department of Theory of Complex Variable since 1960, and the Department of Applied

Mathematics since 1963 up to 1978.

P.F. Filchakov defended his Ph.D. thesis in 1949, and the doctor thesis in 1952. He was elected a Corresponding Member of the National Academy of Sciences of Ukraine in 1964.

Professor Fil'chakov was a member of the professorial staff of the Ukrainian State Academy of Water Economy since 1956 to 1959, where he delivered his lecture on the High Mathematics.

Fil'chakov's great scientific achievements were recognized by the State Prize awarded to him in 1970 and the Honored Scientist of Ukraine in 1976.

P. F. Fil'chakov has published more than 160 papers and proceeding in leading mathematical, mechanical and technical journals. He is the author of many scientific monographs, directory books and manuals of mathematics.

The fields of research interests of Pavel Fil'chakov include filtration theory under hydro-technical structures, approximate methods of conformal mapping, exact and approximate methods

of solving boundary problems, numerical and graphical methods of applied mathematics, methods of electrical analogy and simulation of potential fields on resistance paper, design and construction of new models of devices of the EHDA-integrators, application of power series to integrating nonlinear differential equations for solving the very different engineering problems.

Recurrence relations to perform operations with power series (multiplication, division, raising to an arbitrary power and reversion of series with real and complex coefficients), numerical methods of conformal mapping given simply and multiply connected domains, such as *the method of trigonometrically interpolation and alternative method of conformal mapping of doubly connected domains*, to be realized with any preset degree of accuracy, *methods for determining the constants of the Christoffel-Schwarz integrals* by means of generalized power series and analytic continuation as well as methods to solving systems of algebraic and transcendental equations are advanced and developed by P. Fil'chakov.

The papers and monographs by P. Fil'chakov have contributed considerably to development of filtration theory and applied mathematics. He founded general **method of consecutive conformal mappings** (mappings **E**, **T** and **N**), which permits the effective mapping of an arbitrary simple connected domain on a semiplane. This method having been applied to the theory of groundwater flow a solution was obtained for the most general problem of uplift filtration (the two-dimensional case) in homogeneous and anisotropy (lamellar) soils, namely, the problem of filtration under a weir foundation of arbitrary line of impermeable soil. All the basic characteristics of the groundwater flow are determined: the uplift along the apron contour and at any given point of region of percolation, velocity of filtration and the discharge.

By means of *the graphic interpretation* of the method of consecutive conformal mapping it is possible to carry out a complete calculation of the percolation in a weir foundation on any practical profile, employing only a compass, ruler and nomographs (net nomograms, nomograms from doubled scales, nomograms from leveled points, nomograms with binary fields, compounds nomograms), if the soil under the foundation is homogeneous. *The graphical-analytical method* is elaborated for solving some problems of filtration under hydro-technical structures. It enables one to determine all necessary characteristics for any underground contour met with in practice. Such problems of filtration were decided by means this method: calculation deepened and non-deepened aprons with many lines of pilings, graphical solution for a single pile-line apron with $T = \infty$, calculation of aprons and a drained aprons of a practical profile with $T \leq \infty$, with a finite depth of water-permeable soil, in a double-layer medium.

In the case of a non-homogeneous soil the solution of similar problems may be accomplished with help of *the electric analogy method (EHDA)*. P. Fil'chakov was *the first* to use specially *impregnated (resistance) paper* as a conducting medium in the devices for simulation of potential fields. In collaboration with V. Panchischin 12 models of an EHDA integratur were designed and constructed by P. Fil'chakov at the Institute of Mathematics of the Ukrainian SSR Academy of Sciences for the purpose applying the electric analogy method for solving boundary problems.

The developed methods suggested by P. Fil'chakov permit the examination of certain questions concerning the rational subterranean contour of hydro-technical structures, for which there is no satisfactory solution as yet, in particular *the hydro-mechanical interpretation* has been given to such questions of extreme practical importance as the effectiveness of horizontal and vertical paths of filtration, *the hydrodynamic effect of pilings* and cavities at the contact of hydro-technical structures with the soil, rational disposition of pilings, the optimal distance between pilings etc.

P. Fil'chakov created a large scientific school of applied mathematics and filtration theory in USSR. There are 30 Candidates and Doctor of Sciences among his disciples (students), who work in different cities of Ukraine, Russia, Lietuva and Georgia. Pavel Fil'chakov actively cooperated with researchers of different countries of the world.