

### ACADEMICIAN V. L. MAKAROV IS 75!



In 2016 the well-known Ukrainian scientist in the field of numerical mathematics, Academician of National Academy of Science of Ukraine (NASU), Doctor of Physical and Mathematical Sciences, Professor Volodymyr Leonidovych Makarov turned 75.

In 1963 V. L. Makarov graduated from the Faculty Mechanics and Mathematics of Kyiv State University. In 1967 he received a Ph. D. in Physics and Mathematics from the Kyiv State University. In 1974 he received a degree of a Doctor of Science in Physics, Mathematics and Computer Sciences and became a Professor of Applied and Computational Mathematics. In the period between 1981 and 1998 V. L. Makarov was the head of the Department of Numerical Methods of Mathematical Physics at the Kyiv National University of Ukraine. In October 1998 he became the head of Department of Numerical Mathematics at the Institute of Mathematics (NASU). During a long time V. L. Makarov was also the head of the Department of Applied Mathematics at the National Aviation University (Kyiv).

Numerous achievements of modern numerical mathematics are connected with the name of Professor V. L. Makarov. He developed many algorithms for solving different problems in mathematical physics; many other ones were developed and used for practical calculations under his supervision and with

his direct participation. V. L. Makarov has also carried out a wide range of theoretical investigations in numerical mathematics. His works span a vast majority of problems in mathematical modeling including numerical simulation. These works have opened new directions in the theory of difference schemes, in automatic design of complex radio engineering systems etc. Professor Makarov developed the base of common theory of polynomial interpolation of non-linear operators in abstract spaces and recently obtained new important results in constructive representation of the solution operators for differential equations with operator coefficients in Hilbert and Banach spaces. The latter ones allow the construction of efficient numerical algorithms without accuracy saturation or exponential convergent algorithms for solving partial differential equations, integral equations etc.

Professor Makarov published more than 370 papers, 13 monographs and 8 textbooks. Since 1963 until 1974 the main direction of V. L. Makarov's scientific activities was the theory of difference schemes. In this period, he was one of the first to introduce and study the new class of difference schemes – a so-called difference scheme with exact and explicit spectrum. Studying the mathematical apparatus of these schemes, special functions of discrete argument, V. L. Makarov achieved some important results in the theory of associated orthogonal polynomials. Difference schemes with exact spectrums are widely used in practice, especially when solving hyperbolic equations with non-smooth solutions.

V. L. Makarov made an important contribution to the theory of exact and truncated difference schemes, the base of which was established in 1959-1968 by academicians A. M. Tikhonov and O. A. Samarskiy. These scientists and their followers proved the existence and uniqueness theorems for exact difference scheme for vectorial systems of ordinary differential equations of the second order, of ordinary differential equations of the fourth order, differential equations with degeneration on the boundary and in unbounded domains. Sufficient conditions for conservatism of difference scheme for the equations of gasdynamics were pointed out.

In 1979-1980 in their common works, V. L. Makarov and academician O. A. Samarskiy suggested a new direction in numerical mathematics, namely difference schemes which rate of convergence is adjusted to the smoothness of the solution of the primary differential problem. These investigations were continued by V. L. Makarov and his followers. They derived and studied difference scheme with adjusted convergence rate for quasi-linear problems of mathematical physics in Sobolev spaces. Now these models are widely used in mechanics, elasticity theory, theory of operating systems with distributed parameters etc.

Since 1975 V. L. Makarov engaged in active research on the development of theoretical base for automatic projection of complicated radio engineering systems. This research, under his supervision and with his direct participation, created the mathematical concept of systems of embedded models, methods of verification of mathematical models, the statistical approach to the problem of verification. Important attention was paid to the algorithmic realization

of mathematical models, where the results by V. L. Makarov in the field of numerical methods were used.

During the last years V. L. Makarov laid the foundation of the general theory of the polynomial interpolation of the non-linear operators in abstract spaces. His work proves the necessary and sufficient existence and uniqueness conditions for polynomial interpolants in Hilbert and vector spaces and proposes procedures to construct these polynomials. Professor Makarov also obtained generalizations for the case of interpolation conditions containing Gato derivatives in all directions.

In the last decade V. L. Makarov have proposed and further develops a very efficient so called *FD*-method, which shows especially good results for eigenvalue problems.

In 1990 Prof. Makarov, while working in an international team at the University of Leipzig, began a new line of research. Together with I. P. Gavriluk he studied differential equations with operator coefficients as meta-models of partial differential equations, their solution operators and various operator equations in Hilbert and Banach spaces. A series of results of fundamental importance were obtained by Professor V. L. Makarov in this. These results were the base for the new efficient parallel approximations without accuracy saturation or with an exponential convergence rate to solutions of various partial differential equations. The exponentially convergent methods for various mathematical and applied problems remain to be the focus of Professor Makarovs research activities of the last decade since they are the basis for algorithms of optimal complexity. A part of results on this was published in the Birkhauser Series "Frontiers in Mathematics" (in co-authorship with I. Gavriluk and V. Vasylyk).

An important field of Professor Makarovs scientific activities is mathematical modeling of sloshing of fluids in moving containers with various marine applications. These phenomena are described by complex systems of nonlinear partial differential equations in domains with moving boundary. This investigations of Professor Makarov were supported by the German Research Council (DFG) and by the German Academic Council (DAAD). Professor V. L. Makarov has been teaching for 35 years in the Taras Shevchenko National University of Kyiv. He created a school of numerical mathematics which includes 48 candidates (PhD) and 15 doctors (DS) of physical-mathematical sciences that have prepared their theses under his supervision. Results published by V. L. Makarov are widely known in the scientific world and make an important contribution to mathematics. Long before the end of the Soviet Union V. L. Makarov has prepared the first teaching complex of books on numerical methods in Ukrainian (in co-authorship) including two theoretical parts, a practical part with algorithms and programs as well as two books with a collection of exercises. At that time such a complex was a novelty in teaching of numerical mathematics and not only in Ukraine. A creative and fruitful relationship connects V. L. Makarov with many other scientists including the famous mathematical schools of academicians A. M. Tikhonov, O. A. Samarskiy, and Kyiv and Leipzig schools of numerical and applied mathematics.

Under the guidance of Academician Makarov, a seminar on numerical mathematics takes place. V. L. Makarov is the editor of the following journals: "Differential equations", "Ukrainian Mathematical Journal", "Nonlinear Oscillations", CMAM, AMI, and a deputy editor-in-chief of the Journal of Numerical and Applied Mathematics. Besides, he repeatedly belonged to specialized boards of the doctoral and Ph.D. thesis defends. Academician Makarov was invited speaker at a number of international conferences and schools of applied mathematics. He is a member of the American Mathematical Society.

For the gained success in his work V. L. Makarov was awarded the order of the Labor Red Flag (1984), M. M. Krylov's Prize from NASU (2007), M. M. Bogolubov's Prize from NASU (2012) and State Prize of Ukraine in Science and Technology in 2012. In 2000 V. L. Makarov was elected as a Corresponding Member of the NASU and in 2009 as an Academician of the NASU.

Volodymyr Leonidovych Makarov is full of new scientific ideas and concepts. His active work promotes development of numerical mathematics in Ukraine and recognition of the achievements of Ukrainian mathematicians by the international scientific society.

We cordially congratulate the celebrator of a jubilee and wish Volodymyr Leonidovych creative successes and scientific longevity.

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