ANNIVERSARY OF THE SCIENTIST
ЮБИЛЕЙ УЧЕНОГО

In Commemoration of the Anniversary of Corresponding Member of the Russian Academy of Sciences, Doctor of Physical and Mathematical Sciences, Professor Alexander Ivanovich Sukhinov

Alexander Ivanovich Sukhinov is the head of the Department of Mathematics and Informatics at Don State Technical University, Director of the Research Institute of Mathematical Modeling and Forecasting of Complex Systems, Doctor of Physical and Mathematical Sciences, Professor, Corresponding Member of the Russian Academy of Sciences (RAS), and Honored Scientist of the Russian Federation.

A.I. Sukhinov has developed and studied scalable parallel methods for solving grid equations of diffusion-convection-reaction, including the minimal correction method and the adaptive alternating-triangular method for problems with a non-self-adjoint operator, which demonstrate the best convergence rate under constraints imposed by the grid Peclet number. He has also constructed and investigated efficient parallel algorithms for solving diffusion-convection-reaction and hydrophysics problems based on splitting schemes and scalable methods for grid equations, which take into account the architecture of advanced high-performance computing systems with massive parallelism.

A.I. Sukhinov created, studied, and implemented on distributed-memory supercomputers a complex of interconnected 3D precision models of hydrodynamics, heat, salt, suspension transport, and biogeochemical cycles for coastal systems. These models accurately reproduce vertical mass exchange and are stable for depth variations of up to 40–50 times. Based on these models, vortex structures were discovered in the Sea of Azov and the Mediterranean Sea, along with hypoxic zones and anaerobic contamination, as well as highly accurate predictions of extreme storm surges.

A.I. Sukhinov constructed a correct linearization of the initial-boundary problem for a quasilinear parabolic equation describing sediment transport in coastal systems and proved the convergence of the solutions of the linearized problems to the solution of the original nonlinear problem. He also studied the “closeness” of solutions to the initial-boundary problems for models of the dynamics of biogeochemical cycles, described by ten diffusion-convection equations with nonlinear and linearized source functions.

A.I. Sukhinov implemented a monotonic difference scheme approximating the initial-boundary problem for the biogeochemical cycle dynamics model, described by ten unsteady three-dimensional diffusion-convection equations with nonlinear source functions. The resulting discrete model of biogeochemical cycles was applied to a real coastal ecosystem — the Sea of Azov; simulation results using real data demonstrated the ability to make valid predictions of the geographic dynamics of phytoplankton population distribution under changing weather and climate conditions, such as increasing salinity and decreasing freshwater inflow.

For the parallel numerical solution of hydrophysics problems in marine and coastal systems, A.I. Sukhinov developed explicit parallel algorithms based on the introduction (following B.N. Chetverushkin’s regularization method) of second-order difference derivatives into discrete models with the correct determination of permissible regularization multiplier values, which allowed the reduction of the parallel solution time for hydrophysics problems by 50–70 times compared to other known discrete models, including for storm surge prediction and the consequences of natural and man-made disasters.

A.I. Sukhinov participated in 17 expeditions to the Sea of Azov, the Mediterranean Sea, and other locations. In 2001, he contributed to the discovery of a vast hydrogen sulfide contamination zone in the Sea of Azov. Based on the developed models, the mechanism of this catastrophe was explained, and the existence of large-scale closed circulations in the eastern part of the Sea of Azov was uncovered, acting as giant natural traps for pollutants and plankton populations — the so-called S-structures.

On the initiative of A.I. Sukhinov and under his leadership, major projects were carried out from 2015 to 2023 under the Federal Target Program “Research and Development in the Interests of Developing Russia’s Scientific and Technological Complex for 2014–2020”, the Russian Science Foundation, the Russian Foundation for Basic Research, and others, with a total budget exceeding 280 million rubles.

A.I. Sukhinov engages in significant scientific and organizational work. In 2019, he was elected a Corresponding Member of RAS in the Department of Mathematical Sciences. He is an expert for the Russian Foundation for Basic Research, the Russian Science Foundation, RAS, and the Directorate of Scientific and Technological Programs of the Ministry of Education and Science of Russia. He chairs the Dissertation Council 24.2.297.10 at Don State Technical University in the specialty "Mathematical Modeling, Numerical Methods, and Software Systems", and is also a member of the dissertation councils at Southern Federal University and North-Caucasian Federal University. He serves on the editorial boards of three peer-reviewed journals and one journal indexed in Scopus, and he is a member of the program committees of three prestigious international and national conferences.

The results of A.I. Sukhinov's scientific research and experimental development have been implemented in enterprises in Russia and the Rostov region (Donenergomash, Don Technologies, etc.). His work has been published in over 430 papers, including five monographs, 10 textbooks, and 14 patents and certificates of authorship. From 2019 to 2023, he published more than 100 scientific works, including over 60 indexed in the Scopus and Web of Science databases.

A.I. Sukhinov makes a significant contribution to the development and improvement of the educational process and the training of engineering and scientific-pedagogical personnel. The precision mathematical models and supercomputer software systems developed under his guidance have been implemented in the educational process. He has supervised the preparation of four Doctors of Science and 33 Candidates of Science. His students have won seven grants from the Russian Science Foundation and the Russian Foundation for Basic Research, as well as a Presidential Grant for Young Scientists from 2015 to 2022.

The editorial team of the journal Computational Mathematics and Information Technologies, along with Alexander Ivanovich's colleagues, congratulates the esteemed celebrant, wishing him good health, new scientific discoveries, and the joy of seeing the results of his work! May there be many more successful projects and grateful students ahead!