



## **PREFACE: PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS**

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This special issue on Partial Differential Equations and Applications is in memory of Professor Aizik Volpert.

Aizik Volpert was an outstanding Soviet and Israeli mathematician who has made fundamental contributions to partial differential equations, functions of bounded variation and chemical kinetics. He graduated from Lviv University in 1951, earning the candidate of science degree and the docent title in 1954 and 1956, respectively, from the same university. From 1951 on he worked at the Lviv Industrial Forestry Institute. Beginning from 1960, he worked at the Institute of Chemical Physics in Chernogolovka. In 1961 he became a senior research fellow and later the head of the laboratory. In 1962 he earned the "doktor nauk" degree from Moscow State University. In the 70s and 80s Aizik Volpert became one of the leaders of the Soviet chemical scientific community. In 1993 he moved to Israel and joined the Department of Mathematics at the Technion – Israel Institute of Technology. Professor Volpert developed an effective algorithm for calculating the index of an elliptic differential operator before the Atiyah-Singer index theorem appeared and was also the first to show that the index of a singular matrix operator can differ from zero. He was one of the leading contributors to the theory of BV-functions where he introduced the concept of functional superposition, which enabled him to construct a calculus for such functions and apply it in the theory of partial differential equations. His work on chemical kinetics and chemical engineering led him to define and study differential equations on graphs.

In this special issue, we present papers authored by a selected group of well-recognized experts in the area of partial differential equations and their applications. Most of the papers collected here have been contributed by friends and colleagues of Aizik Volpert, who have been influenced by his research. The special issue contains twelve papers contributed by researchers in partial differential equations from Canada, Finland, France, India, Israel, Portugal, Russia, Sweden and the United States.

These papers cover a wide spectrum of important problems and topics of current research interest in partial differential equations, including stochastic evolution equations on UMD-Banach spaces, the Nash inequality in general domains, perturbation theory of positive solutions of second-order linear elliptic equations, Liouville's systems corresponding to self-similar solutions of the Keller-Segel systems of several populations, sharp pointwise estimates for solutions of the modified Helmholtz equation, global solutions of the initial value problem for the focusing Davey-Stewartson II system, accretivity and form boundedness of second order differential operators, an extension of the Beale-Kato-Majda criterion for the 3D Navier-Stokes equation with hereditary viscosity, essential spectrum of periodic

medium with sparsely placed foreign inclusions, reduced equations for the hydroelastic waves in the cochlea, the theory and applications of reaction-diffusion waves, and the solvability of some systems of integro-differential equations with anomalous diffusion in two dimensions.

Therefore we feel that this special issue will be highly important for many mathematicians and applied scientists, who are interested in recent developments in partial differential equations, as well as in their numerous applications.

Matania Ben-Artzi, Simeon Reich and Alexander J. Zaslavski, Editors

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