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CHRONICLE

Aleksei Alekseevich Dezin

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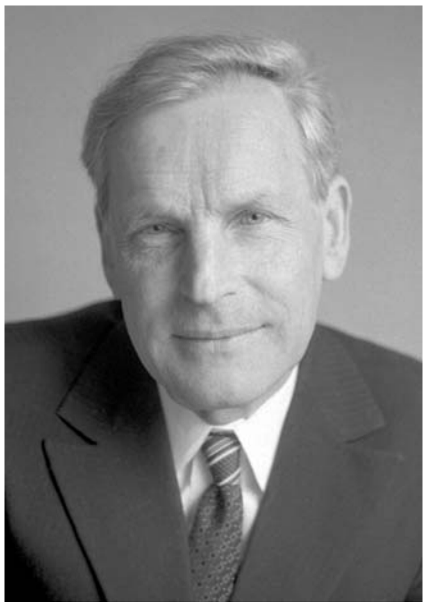

The famous mathematician Aleksei Alekseevich Dezin, a distinguished specialist in general theory of boundary value problems, differential operators, and functional analysis, a USSR State Prize winner, died on March 4, 2008.

A.A. Dezin was born in Moscow on April 23, 1923. His father, Aleksei Alekseevich Dezen, belonged to an ancient noble family of German origin; he graduated from Petrograd University and was a famous economist, one of the authors of the currency reform in the 1920s. Dezin's mother, Alisa Eduardovna, descended (in the female line) from the German noble family Osten-Sacken. Throughout his whole life, Aleksei Alekseevich Dezin kept sincere love and gratitude to his parents, whom he lost in early childhood. His father was arrested in 1936 and killed in 1937, and his mother was arrested in 1937 as a family member and condemned to 8 years of labor camps. The 14-years-old boy was sent to children's home and then arrested and condemned to 5 years in a labor colony. He served his sentence at a lumbering site in the Kolyma region, was released in December 1942, and was drafted in the early 1943. Until the end of the war, Dezin served in the army in the Far East region. During the war against Japan, he participated in the forced crossing of the Amur river near Blagoveshchensk and was awarded the medal "For Victory over Japan."

After the demobilization at the beginning of 1947, Dezin returned to Moscow, where he graduated from a secondary school with a silver medal and entered Moscow State University in 1948. He graduated from the Faculty of Mechanics and Mathematics of Moscow State University in 1953, was a postgraduate student there in 1953–56, and defended his PhD thesis "Boundary Value Problems for Symmetric Systems of Partial Differential Equations" (supervised by Academician S.L. Sobolev) in 1956.

In 1961, Aleksei Alekseevich Dezin defended his D.Sc. thesis "Invariant Differential Operators and Boundary Value Problems" (*Tr. Steklov. Mat. Inst.*, 1962, vol. 68). In 1956–91, he taught at Moscow Institute of Physics and Technology, first at the Department of Mathematics (1956–61) and then, as Professor of the Department of Computational Mathematics, at the Faculty of Aerodynamics (1962–91). In 1957, Dezin became a member of the Division of Mathematical Physics at the Steklov Mathematical Institute, where he worked for 50 years until the end of his life and was successively a junior researcher, a senior researcher, a leading researcher, and a councillor. Since the autumn of 1994, he was Professor of the Department of General Mathematics at the Faculty of Computational Mathematics and Cybernetics of Moscow State University. He has authored more than 80 scientific publications, including four monographs. For the monograph *"Obshchie voprosy teorii granichnykh zadach"* (General Topics of the Theory of Boundary Value Problems, Moscow: Nauka, 1980), he was awarded the State Prize in 1988. Seven of his students have become doctors of sciences.

The hardship in youth did not break Dezin's character. Even during his student years, he actively participated in research. In his diploma paper, he developed the technique of variable-radius averaging operators, which is, up to the present time, one of the most efficient approaches to the problem on the coincidence of weak and strong solutions of boundary value problems and also, for example, to problems concerning the continuation of functions.

In the cycle of papers written mainly before 1959, Dezin studied boundary value problems for symmetric first-order systems. He initiated the development of the method of energy inequalities for the analysis of the solvability of mixed problems in the hyperbolic case. Dezin (simultaneously with K. Friedrichs and R. Fillips) introduced a class of first-order systems that is quite interesting from the viewpoint of applications and was called the class of symmetric positive systems. He obtained new results on the classification of these systems and on the well-posed solvability of some distinguished natural classes of boundary value problems. In addition, at that time, Dezin indicated an existence condition for a solvable extension (a well-posed "boundary value problem") for first-order linear systems with constant coefficients. Simultaneously, he developed "functional methods" for some higher-order equations; in particular, he proved the existence and uniqueness of generalized solutions of mixed problems for the wave equation and for the heat equation.

The 1958–62 series of papers on invariant systems of first-order partial differential equations on manifolds became a brilliant stage in Dezin's activity. Trying to understand the structure of the Cauchy–Riemann equations on the plane and the well-known Moisil–Teodorescu system in three-dimensional space, Dezin generalized these elliptic systems to the case of an arbitrary n-dimensional smooth Riemannian manifold and found their complete expression via invariant differential operators. Such systems are really exact analogs of the Cauchy–Riemann system in numerous aspects, and now they are called so in the n-dimensional case. Cauchy–Riemann systems were investigated by Dezin not only on closed Riemannian manifolds. He also considered some boundary value problems for these systems on manifolds with boundary. Dezin proved the Fredholm property of these problems. He also showed that the index of these problems on a closed manifold as well as on a manifold with boundary can be expressed via the Euler characteristic of the manifold in a very simple way. Next, Dezin also showed how to perform a "correct" passage from the elliptic case to the hyperbolic and parabolic ones in the consideration of invariant systems. He found invariant notation for some linear systems used in mathematical physics. Dezin proved existence and uniqueness theorems for generalized solutions of the mixed Goursat problem for hyperbolic systems (in the multidimensional case), a mixed problem for parabolic systems, and some other problems.

For many years starting from 1962, on a special class of model operator equations, Dezin comprehensively studied a number of important issues in the general theory of boundary value problems for linear partial differential equations. He was interested in general theorems on the existence of solvable extensions as well as the realization of such extensions with the use of particular boundary conditions. In the case of model equations, he introduced the notion of a "proper" operator (close to the notion of a solvable extension) generated by a general differential operation with constant coefficients in a bounded domain of the Euclidean space and considered the problem of the description of proper operators via boundary conditions. Research carried out by Dezin is characterized by the analysis of essential relationships of the general description of well-posed boundary value problems with the spectral theory and by systematic use of nonlocal boundary conditions.

In the same framework, Dezin investigated some qualitative problems of the theory of partial differential equations degenerate on the boundary of the domain. For operator equations with discontinuous coefficients, he suggested a classification of various types of irregularities. In the investigation of boundary value problems for equations with a power-law degeneration, he obtained a detailed description of how the boundary conditions are satisfied on the degeneration line, including situations that have been less studied in earlier papers on degenerate elliptic equations.

Note also Dezin's work dealing with the analysis of changes in the point spectrum of some nonself-adjoint partial differential operators under small perturbations of the leading part and, in addition, with special nonlinear models containing nonlocal boundary conditions.

Dezin was always very interested in topical problems of fluid dynamics, which were often considered in his research. He found new invariant forms of the Euler equations and obtained a number of results on the problem of generation of circulatory zones in ideal fluid flows. Dezin suggested a method for the analysis of special properties of one-parameter flow families. He proved the regularity of the degeneration for the case of vanishing viscosity and for a linearized viscous incompressible flow model.

A large series of Dezin's papers deals with the modeling of objects of analysis and physics on discrete structures. The relationship, well known in topology, between the combinatorial and continuum definition of the cohomology ring has led Dezin to the idea of constructing intrinsically defined discrete models of invariant differential operators. He developed a method, which proved to be well suited to obtaining finite-difference analogs of various operators, including the operators of vector analysis. This approach is very interesting and is widely used in the theory of finite-difference approximations to equations of mathematical physics.

Dezin also studied such models for a special class of elliptic systems. He obtained discrete analogs of the Hodge and Kodaira orthogonal decomposition theorems. By using an analog of Spencer's construction, he analyzed the global solvability of systems of finite-difference equations and studied analogs of boundary value problems. In addition, the character of changes in the spectrum under a small variation of the domain was studied for some finite-difference operators in the simplest domains.

In this series, we also distinguish a group of Dezin's papers in which essential features of the passage from a classical description of an object to a quantum-mechanical one and from quantum mechanics to field theory were observed on the simplest finite structures.

This series of papers is close to another one, where Dezin considered the passage to a relativistic model and the passage from a local characteristic of the wave function (i.e., the Schrödinger equation) to the description of an evolution on a finite interval (i.e., the Feynman dynamics, or the Feynman integral) on the basis of definitions and original assumptions of the model of quantum mechanics in which the physical space is a real axis. It was shown that the first of these passages related to the use of the corresponding metric induces a two-dimensional Klein–Gordon equation replacing the Schrödinger equation as the time–energy duality and the energy–mass relationship appear. The relationship of three mathematical structures, probabilistic, functional-operator, and group-theoretic ones, whose interaction provides the formal scheme to be used, was comprehensively analyzed in the whole.

Dezin's scientific activity was primarily characterized by originality, diverse interests, deep understanding of the meaning of considered problems, clarification of fundamental relationships with other fields of mathematics, and permanent aspiration for new approaches and for posing new problems. This had considerable influence on the development of a number of divisions of the general theory of partial differential equations and related boundary value problems.

Aleksei Alekseevich Dezin was a distinguished mathematician and a brilliant lecturer and teacher. He belonged to hereditary Moscow intellectual elite, was broadly educated, and knew several foreign languages (in particular, he was fluent in English and read German, French, Italian, Church Slavonic, and Greek). He had a great literary talent, translated and wrote poetry, and authored the memoirs "Double Copybook," where he narrated about the tragic years of his youth. The home of Aleksei Alekseevich Dezin and his wife, Nataliya Borisovna, was a gathering place for a wide circle of their friends, including many distinguished mathematicians and humanitarians and Dezin's students, who were attracted by the intellectual atmosphere.

Being a broad-minded person of various interests and fine personal qualities, Dezin was an excellent model for young scientists. The blessed memory of Aleksei Alekseevich Dezin will remain in the hearts of his students, colleagues, and friends, for whom he has always been an exemplary person and scientist.

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