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E.YA.KHRUSLOV. ON THE OCCASION OF HIS 70TH BIRTHDAY

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On January 7, 2007 Evgueni Yakovlevich Khruslov, a prominent mathematician, Academician of the National Academy of Science of Ukraine, celebrated his 70th birthday.

Evgueni Khruslov was born in Kharkov, Ukraine. In 1954 he graduated from a high school at a city's suburb. When studying at the school, he preferred exact sciences, like physics and mathematics. However, at the time of graduation, he could not imagine mathematics to be his future professional occupation, and thus he chose a technical college, the Kharkov Polytechnic Institute, to continue the education.

After graduating from the Polytechnic Institute in 1959, he started to work as an electrical engineer at an automation research institute. At that time, Gleb Klyagin, a man of an extraordinary destiny, was working there. Before the World War II, Klyagin itself was very interested in mathematics, but as soon as the war began, he joined the regular army and after a while he was sent by plane to help guerrilla groups in Yugoslavia and Slovakia. After the war, Klyagin graduated from the Kharkov Polytechnic Institute and worked at that institute where Khruslov was directed. Being a man of observation, Klyagin could not miss mathematical abilities of a new employee. He saw that his colleagues continuously addressed Evgueni Khruslov with difficult mathematical problems. So, Klyagin decided to interfere in Khruslov's destiny and to tell about the young man to his old classmate, professor of mathematics Vladimir Marchenko. They agreed that Khruslov and Marchenko would speak, and then they would see. Thus Evgueni Khruslov met Vladimir Marchenko for the first time, and that meeting was the beginning of a long collaboration and friendship.

At that time, experts from the Kharkov Turbine Plant asked Marchenko to help in solving an applied problem concerning the determination of an optimal profile of turbine buckets. Taking into account the engineer specialization of Khruslov, Marchenko proposed to him to think about this problem. Notice that Khruslov did

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not know the variational calculus at that time; besides, standards methods did not work for that problem. Very surprisingly, Khruslov was able to give a comprehensive solution to the problem in just a week! This was the first mathematical work by Evgueni Khruslov, which unfortunately was not published.

Thus, Khruslov's faculty for mathematics became completely evident, and Marchenko proposed him to supervise his PhD studies at the Institute for Low Temperature Physics and Engineering (ILTPE), where Marchenko worked. This happened in 1962, and since that all scientific life of Evgueni Khruslov has been connected with this Institute.

But what about his mathematical education? Yet working at the automation institute, Khruslov entered the correspondence branch of the Faculty of Mathematics of the Kharkov State University. Following the PhD courses and selected mathematical courses at the University and working hard in the self-education, Khruslov quickly compensated for the deficiency in the formal mathematical education. Starting from his first days in the ILTPE, he actively participated in the scientific activities of the Department of the Mathematical Physics, and by the moment of termination of the PhD studies, he was a developed researcher.

In 1965 Evgueni Khruslov has defended his PhD thesis ("candidate of sciences") devoted to the Dirichlet boundary value problems in domains with fine-grained boundary for self-adjoint elliptic operators. For the Laplace operator, the potential theory was an appropriate analytical tool. With its help, it was proved that, as the boundary reduces to infinitely small particles, the solutions converge to a solution of the homogenized equation, in which the Laplace operator is replaced by the Schrödinger operator with a potential that is equal to the limiting density of the capacity of the fine-grained boundary. The Neumann boundary value problem appeared to be much difficult. Since the density of capacity is independent of the orientation of the boundary grains, and the solution to the Neumann problem depends significantly on the orientation, the potential theory turned out to be insufficient for the comprehensive study of the problem. Khruslov began to develop other approaches, first of all, variational methods. This allowed him to give a comprehensive solution to the Dirichlet problem for systems of elliptic equations of arbitrary order. He obtained homogenized equations for the main terms of asymptotics of solutions of these problems as the boundary reduces to infinitely small grains and gave the estimations for the convergence rate. Continuing these studies, in 1970 he extended his theory to the Neumann problem, where the main role is played by the notion of density of virtual masses: the Laplace operator is replaced by a general self-adjoint elliptic operator of the second order with variable coefficients at the derivatives, which are expressed in terms of the limiting densities of virtual masses.

The variational methods developed by Khruslov finally allowed him to construct generalized models of physical processes in micro-inhomogeneous media. For the first time he introduced the notions of strong connectivity and weakly connected domains, which played a central role in these models. Depending on the domain structure, boundary conditions on the complex boundary, and the oscillations of coefficients of the original equation, he constructed various non-standard models, particularly, multicomponent models and models with memory, which provide adequate descriptions, on a macroscopic level, for physical processes in media of complex structure.

These works put forward E.Ya.Khruslov as a leading expert in the homogenization theory for partial differential equations. He has developed a complete, in a certain sense, theory of homogenization of boundary value problems of mathematical physics, which is presented in the books by V.A.Marchenko and E.Ya.Khruslov "Homogenized Models of Micro-Inhomogeneous Media" (Kiev, Naukova Dumka, 2005, in Russian) and "Homogenization of Partial Differential Equations" (Birkhauser, 2006, in English).

A series of works of E.Ya.Khruslov is devoted to the study of the asymptotic behavior of solutions of boundary value problems on Riemann manifolds. Perhaps, the most interesting among them are works giving a homogenized description of harmonic fields, differential forms, and equations of diffusion on Riemann manifolds of complex microstructure. As a result of the studies of the asymptotic behavior of solutions of the homogeneous Maxwell equations on Riemann manifolds with infinitely growing topological genus, E.Ya.Khruslov has shown that upon the homogenization of such a system, the effective densities of the electric charge and current emerge.

Khruslov has been always interested in the applications of the obtained results to concrete problems. Particularly, he proposed a rigorous solution to the problem of the resonance passage of waves through a system of thin channels, which has found important applications in radiophysics.

Apart from the homogenization theory, the works by Khruslov concern other fields of mathematical physics. He obtained important results in the theory of completely integrable nonlinear evolution equations. Particularly, he proved a theorem on the decomposition of step-like initial data for the Korteweg–de Vriez equation into an infinite series of solitary waves — asymptotic solitons, and obtained, for the first time, the exact formula for the leading term of the long-time asymptotics, including the values of all constants involved. For a long time, mathematicians as well as physicists has been interested in this problem. The proposed method has been further generalized by E.Ya.Khruslov and his disciples to other nonlinear equations, including the two-dimensional (in the space variables) Kadomtsev–Petviashvili equation. These studies have allowed better understanding the role of the continuous spectrum in the generation of asymptotic solitons and curvilinear asymptotic solitons.

A number of works of E.Ya.Khruslov is devoted to the theory of inverse problems of electromagnetic sounding. He has constructed the transformation operators for Schrödinger-type operators with potentials linearly depending on the spectral parameter, which allowed him to solve several important problems of the reconstruction of electromagnetic parameters of a medium from the measurements of the field components on the medium surface. The developed methods have shown their efficiency when tested on data from real geophysical experiments.

Along with the prominent faculties of a researcher, Khruslov possesses remarkable administration abilities. Since 1986 he has served as head of the Department of Mathematical Modeling of Physical Processes of the ILTPE. Since 1996 he has been a vice-director of the ILTPE and a chief of its Mathematical Division. In 1993 he was elected as a Corresponding Member of the National Academy of Sciences of Ukraine. Since 2003 he has been a full Member (Academician) of the Academy.

Evgueni Khruslov has headed the Mathematical Division of the ILTPE at an uneasy time, when a number of talented researchers, at the peak of their power, left the country in the search of better conditions for their professional growth. At that time, many were very skeptical about the possibility of the development of the

fundamental science and particularly mathematics in the country. But Khruslov was always an optimist — not only by words but, first of all, by working hard on getting talented young people to the research work, the task that is really difficult nowadays. A distinctive feature of Khruslov is that he promotes disciples of his colleagues with the same energy and his own pupils.

In spite of his high ranks and positions, Evgueni Khruslov always was and continues to be maximally approachable for communication and discussions with colleagues and pupils. His democratic character in conjunction with adherence to principles when dealing with really important problems of science as well as of science administration is indeed his striking distinguishing feature.

For many years E.Ya.Khruslov has been giving lectures on various disciplines at the Kharkov National University and supervising PhD students. He is in earnest about all his duties and often prefers to do all by itself. He is always perfectly kind and frank with people, ready to provide help, and involuntarily inspires people with his optimism.

Khruslov's main hobby is sport. When being a student, he preferred wrestling. Further, he was spending his summer holidays in a small company of colleagues canoeing on small rivers in Ukraine and Russia. He was an excellent companion — robust, patient, and always in a cheerful mood. In winter, he switched to skiing — a passion preserved until now.

Prominent professional skills of Evgueni Khruslov, accompanied by high human faculties, have got to him the deserved respect and authority among colleagues, numerous disciples and wide scientific community. Evgueni Yakovlevich Khruslov met his 70 anniversary, being full of forces and creative plans. One can be absolutely sure that his plans will be put into effect.

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