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Between Mathematics, Railways and Literature...

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ABSTRACT

In 2021, Russian University of Transport (previously known as MIIT, Moscow Institute of Transport Engineers) turns 125 years old. The Department of Higher Mathematics has existed since the inception of the university and has a rich history.

This significant date provides an opportunity to the authors to refer to some of the most important moments in the history of this Russian higher educational institution, as well as to recall the names of some scientists, mathematicians, university professors, whose activities undoubtedly influenced both the level of training of domestic railway engineers, and the high status of the educational institution itself.

It is also an opportunity to highlight the continuity of the values of mathematical knowledge for the past and future generations of students in transport and transportation fields.

Keywords: Russian University of Transport, history of transport, mathematics, transport, outstanding mathematicians, higher education, Boleslav Mlodzeevsky, Elena Wentzel, Anatoly Myshkis, Friedrich Karpelevich.

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INTRODUCTION

In 1895, an issue of opening an engineering educational institution in Moscow was raised during one of the meetings at the Ministry of Railways of Russia. At that moment, the country had the only higher school training highly qualified railway specialists. That was St. Petersburg Institute of the Corps of Railway Engineers that had existed since 1809. The need to open a new educational institution was dictated by the rapid growth of domestic industry at the end of 19th century, development of the network of railways and railway transport, and construction of large new railways.

The creation of Moscow Engineering School of the Ministry of Railways was initiated by Nikolai Pavlovich Petrov (1836–1920), who at that time held the post of Deputy Minister and supervised all educational institutions. He had engineering educational background, being graduate of both the Cadet corps and the Engineering Academy. It should be noted that N. P. Petrov took part in drafting the Regulations and Charter of the new educational institution, as well as in development of its study course and curriculum.

Imperial Moscow Engineering School (IMIU) was created following the model of Royal Indian Engineering College at Cooper's Hill in England, which trained under an accelerated program technicians for service in India. But already in 1907, the period of study at the IMIU was increased, the course of theoretical training of students was expanded, and by 1912, due to the staff of professors who worked within the walls of the School, the training programs were expanded to a level that corresponded to the educational standard of St. Petersburg Institute of the Corps of Railway Engineers. The latter, in turn, was modelled following the example of the famous French École Polytechnique and had the status of a military educational institution. And just like in the French École Polytechnique, mathematics was put at the top of disciplines learnt.

If assessed by their theoretical knowledge, railway track engineers were the most educated people in Russia, which testifies to the high requirements for theoretical knowledge and a good form of organisation of teaching.

In 1913, IMIU was transformed into Moscow Institute of Transport Engineers (MIIT).

We do not aim to remember all the educators who have worked in that transport higher education institution from its opening to the present time since this cannot be done within the framework of this article. Therefore, let us dwell on the activities of mathematics teachers, world-renowned scientists who at different times worked within the walls of the university.

Boleslav Kornelievich Mlodzeevsky (1858—1923).

BOLESLAV MLODZEEVSKY

We would like to start with reminiscences about Boleslav Kornelievich Mlodzeevsky, the first head of the Department of Mathematics at the IMIU.

B. K. Mlodzeevsky was born in Moscow on July 10 (June 28, old style), 1858, in the family of Korneliy Yakovlevich Mlodzeevsky (1818–1865), a professor of clinical pathology and therapy at Moscow University. After the death of their father, their mother Adelaida Vikentievna was greatly supported and assisted by her brother, a famous academician of painting, Kirill Vikentievich Lemokh, in raising children: seven-year-old Boleslav and five-year-old Vikentiy (who later became a famous physician).

Boleslav Mlodzeevsky graduated from Moscow University in 1883, and already in 1885, he became a privatdocent of the University.

In 1887, «Scientific Notes of Moscow University» published his first scientific research, his master's thesis «Investigations on the bending

of surfaces». This paper, besides deriving the general bending equation, a second-order equation which is linear with respect to the second derivatives of the sought function and their discriminant, presented the theory of differential invariants of quadratic forms. This theory was investigated in more detail and presented in the doctoral thesis «On the manifolds of many dimensions», published in «Scientific notes of Moscow University» in 1889.

When the Imperial Moscow Engineering School under the Ministry of Railways, opened in Moscow in 1896, Boleslav K. Mlodzeevsky gained the right to head the Department of Mathematics in it (it is worth noting that about 250 people applied for 50 teaching positions). Boleslav K. Mlodzevsky with his genuine enthusiasm actively engaged in the activity of the IMIU. He was fascinated by this work also because it was a completely new experience for him since, up to this point, Boleslav K. Mlodzeevsky had to train only future teachers of mathematics in gymnasiums and vocational schools (who at that time were trained at universities).

Boleslav K. Mlodzeevsky directly participated in developing first curricula in mathematics and first syllabi of mathematical courses used to train railway engineers.

Boleslav K. Mlodzeevsky worked at the IMIU until 1913. During these 17 years of work, the scientist managed to advance in his research, which was associated with the study of applied engineering problems, but also in theoretical issues. Naturally, much attention was paid to the geometrical disciplines. It should be noted that both future engineers and theoretical mathematicians studied according to the textbooks on analytical geometry written by Professor Mlodzeevsky.

B. K. Mlodzeevsky was fully endowed with such qualities as versatility of interests, breadth and depth of knowledge and elegance of presentation of scientific research. Thanks to that his name has forever entered the history of Russian science.

A new type of educational activity at that time was the conduct of special courses. It was Boleslav Mlodzeevsky who, in the 1900s, was the first to prepare and read a special «Course in the theory of functions of a real variable» and «Set theory». Later, these areas of mathematics became the leading ones in the world mathematical sciences. Professor Mlodzeevsky also organised a seminar on mathematics, which was attended not only by students, but also by academic faculty. Sessions of such seminars were a new form of organisation of study and independent

work of students. Later, this form of students' scientific work was also used at Moscow University, and over time it became widespread.

B. K. Mlodzeevsky's scientific interests are mainly related to differential geometry. More than half of 40 of his scientific works, which were published in various publications of that time, are related to geometry, in particular, to the study of surface bending.

Leaving Moscow University in 1913, as well the well-known events of 1914–1917 had a heavy impact on the mental and physical condition of Boleslav Kornelevich, and 1918–1919 were also complicated for him because of the illness of his wife.

The founder of the mathematical school of Moscow Institute of Transport Engineers, a talented scientist and professor deceased on January 18, 1923 at the age of 65. He was buried at the Novodevichy cemetery in Moscow. According to the decree of the government of the Russian Soviet Federative Socialist Republic, the grave of B. K. Mlodzeevsky was declares a monument of history and architecture.

Elena Sergeevna Wentzel (1907–2002).

ELENA WENTZEL

It is known from the history of domestic science and development of higher education that it was rather difficult for women in Russia throughout 19th and early 20th centuries to get a higher education, engage in teaching activities, and scientific research. Therefore, we would like to recall the woman mathematician Elena Sergeevna Wentzel, whose name is proudly inscribed in the history of our University.

Elena Sergeevna Wentzel[1] was born on March 21, 1907, in Reval (now Tallinn). Her father, Sergei Fedorovich Dolgintsev, was a mathematics teacher, and her mother Olga Dmitrievna worked as a teacher in an elementary school. In 1923, Elena Sergeevna entered the Physics and Mathematics Faculty of Petrograd University. At that time, the faculty staff comprised Grigory M. Fikhtengolts, Boris N. Delone[2], Nadezhda N. Gernet, Andrey M. Zhuravsky; and Ivan M. Vinogradov, future Academician, was her scientific advisor.

In 1929, she obtained a university degree in mathematics with the right to teach in secondary and higher schools and went to work at Ostekhbyuro, from where she soon moved to work at the Military Academy.

In 1935, Elena Wentzel moved with her husband (D. A. Wentzel, lecturer at the Artillery Academy, future leading specialist in the theory of artillery fire, the author of textbooks on ballistics) to Moscow. She continued professional activity at the Artillery Faculty of the Air Force Engineering Academy of the Red Army (AFEA; later the N. E. Zhukovsky Air Force Engineering Academy).

Since 1939 Elena S. Wentzel was an assistant lecturer, since 1940 a lecturer, since 1947 a senior lecturer at AFEA. In 1944 she defended her Ph.D. thesis, and ten years later her D.Sc. thesis. Since 1955, Elena Sergeevna was a professor at the Department of Aerial Shooting.

E. S. Wentzel's scientific interests were focused on the applied problems of the theory of probability, the use of probabilistic methods to improve the accuracy of aerial shooting and bombing, and to improve the methods of adjustment of air armaments. It should be noted that at this time formation and rapid development of mathematical disciplines, unified under the name of «Operations Research», took place in the Soviet Union and in the United States.

In 1961, E. S. Wentzel published the monograph «Foundations of the Theory of

[1] Also spelled sometimes as Ventsel or Ventzel. *Translator's note.*

[2] Also spelled in French and German as Delaunay. *Translator's note.*

Combat Effectiveness and Operations Research» written in collaboration with a number of other scientists.

In 1968, Elena Wentzel entered the position of professor at the Department of Applied Mathematics at MIIT [at the time its full name was Moscow Institute of Railway Engineers], where she worked until 1987.

E. S. Wentzel's works on operations research, linear optimisation, dynamic programming, game theory, queuing theory, and related issues found a great response in the engineering community.

In 1972, she published the book «Operations Research».

E. S. Wentzel is the author of several textbooks that are still popular and in demand not only in our country, but also abroad: «Probability Theory», «Introduction to Operations Research: Problems, Principles, Methodology», «Elements of Game Theory», «Elements of dynamic programming».

The textbook on probability theory was snapped up not only in scientific libraries, but also in ordinary ones. Anyone who wanted to win at Sportloto[3], calculate the likelihood of life on Mars, or meet their soulmate…

Until now, learning in such a discipline as the theory of probability at our University includes studying of the book «Theory of Probabilities. Problems and Exercises», written by E. S. Wentzel in collaboration with L. A. Ovcharov, as well as of «Probability theory and its engineering applications», and a number of other textbooks. E. S. Wentzel owns more than 130 scientific papers, the total volume of which is 3000 printer's sheets.

During the period when E. S. Wentzel worked at MIIT, the Department of Applied Mathematics has a unique scientific and pedagogical team, an informal centre for engineering mathematics education in the Soviet Union. E. S. Wentzel was the scientific leader of the Student Consulting Bureau (SCB). Students in mathematics acquired the most valuable skills in applied research, and engineers received real help in solving their problems. E. S. Wentzel devoted a lot of time and effort to individual work with students, believing that this type of activity is the basis of higher education. A number of students of E. S. Wentzel, graduates of MIIT, later became the authors of significant scientific works.

The biography of a scientist and lecturer, E. S. Wentzel, would be incomplete, if not to mention another side of her activities since at the beginning of the 1960s, journal publications, and then, in 1966, a collection of stories «Under the Lantern» were published signed I. Grekova (the pen name also involved mathematics: it is based on the name of the Greek letter «*igrek*» (Y)). In 1966 I. Grekova (E. S. Wentzel) was admitted to the Union of Writers of the USSR.

In her literary works, I. Grekova described the fate and characters of people working in the fields of science and technology, anxiety, sadness and joy of people of her generation, for which she was blamed by some part of the staff. An attempt to get rid of the disobedient professor made E. S. Wentzel in 1968 to write a letter of resignation from the AFEA.

While working at our University, Elena S. Wentzel wrote her most famous story «The Department[4]» (1978), which reflects, among other things, the problems of teaching mathematics. Unfortunately, these problems are of concern to our colleagues even now.

Many plays were written based on the stories by I. Grekova. Those plays were staged at Moscow Art Theater, Mossovet Theater, Vilnius Russian Drama Theater. We know and love the movie by Stanislav Govorukhin «Bless the Woman», the script of which was written based on the play by I. Grekova «The Hostess».

On April 15, 2002, E. S. Wentzel passed away, leaving a great scientific, pedagogical, and author's legacy.

ANATOLY MYSHKIS

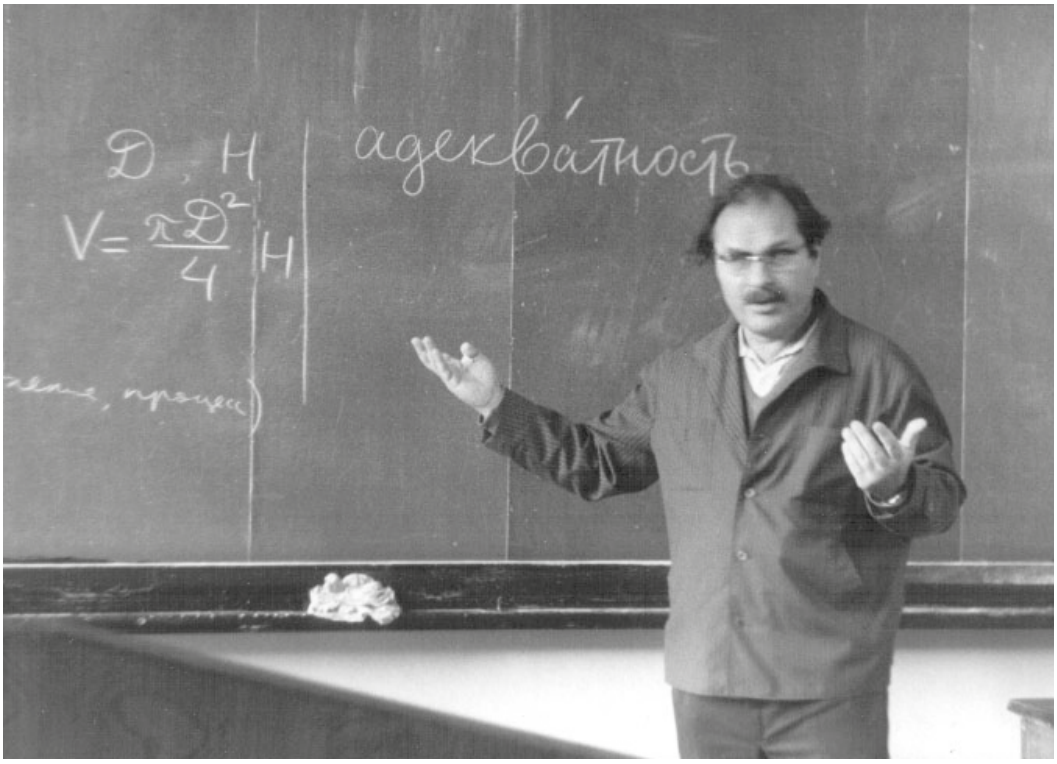
There was another mathematician among those attended at a time E. Wentzel's course, who should also be mentioned in this article. His name is Anatoly Dmitrievich Myshkis[5], professor at MIIT, internationally recognised scientist.

The authors of this article are especially pleased to remember Anatoly Dmitrievich, since for several years we have been lecturing side by

[3] Sportloto was then popular lottery where it was necessary to guess correctly a combination of numbers. *Translator's note.*

[4] Another name in English can be «The Chair». *Translator's note.*

[5] Myshkis Anatoly Dmitrievich. – Wikipeda (wikipedia.org). [Electronic resource]: https://ru.wikipedia.org/wiki/%D0%9C%D1%8B%D1%88%D0%BA%D0%B8%D1%81,_%D0%90%D0%BD%D0%B0%D1%82%D0%BE%D0%BB%D0%B8%D0%B9_%D0%94%D0%BC%D0%B8%D1%82%D1%80%D0%B8%D0%B5%D0%B2%D0%B8%D1%87. In Rus. Last accessed 25.06.2021.



Anatoly Dmitrievich Myshkis (1920–2009).

side at the Department of Higher Mathematics at MIIT.

Professor Myshkis's desk immediately caught the eye of a person entering the department office since there was always a mountain of correspondence stocked on it, received from diverse research communities, foreign colleagues, and students. We remember Anatoly Myshkis as a highly educated, intelligent, very benevolent person, a wise advisor and mentor.

Anatoly Dmitrievich Myshkis was born on April 13, 1920, in the city of Spassk, Ryazan region. From 1933 he lived in Moscow, where in 1937 he graduated from high school and without exams was enrolled in the Faculty of Mechanics and Mathematics of Moscow State University.

After the Great Patriotic War began, students of the Faculty of Mechanics and Mathematics were called up to study at AFEA, which at that time was stationed in Sverdlovsk. There Anatoly Myshkis studied at the Faculty of Aviation Armament, where practical lessons on probability theory were taught by E. S. Wentzel (later they collaborated within the walls of MIIT).

In parallel with his studies at AFEA in 1942, Anatoly Myshkis studied at the Ph. D. school of Moscow State University (first in absentia, and later in person). In 1946, he defended his Ph.D. thesis. Since 1947, he taught in Riga at II Leningrad Red Banner Higher Aviation Engineering Military School and Latvian State University. Later, Anatoly Myshkis headed the departments at Belarusian State University, the Department of Applied Mathematics of Physics-Technical Institute of Low Temperatures of the Academy of Sciences of the Ukrainian Soviet Socialist Republic.

From 1974 until his death in 2009, Anatoly Dmitrievich Myshkis was a professor at MIIT.

The oldest lecturer at our university, Galina Fedorovna Kanaeva, who had worked for more than 50 years (from 1960 to 2013) at MIIT at various mathematical departments under the leadership of Yu. V. Rudnev, L. E. Sadovsky, F. I. Karpelevich, N. A. Pankin, R. I. Grigorchuk, V. B. Minasyan, O. A. Platonova as heads of mathematics departments, shared her memories of A. D. Myshkis and E. S. Wentzel.

Galina Fedorovna Kanaeva recalls:

«Anatoly D. Myshkis was so immersed in scientific activity and research work that at any moment he could be found reading either a book or a journal article. Even when rarely visiting the

MIIT (1960–1970).

dacha[6], which the university allocated for the professor's family, Anatoly D. Myshkis came there with a book. In the evening the book was read, and in the morning, he left for Moscow to sit at his desk.

The fact that Elena Wentzel and Anatoly Myshkis were outstanding scientists, recalls Galina F. Kanaeva, was immediately felt when communicating with these people as a young lecturer, as I was at that time. These were professors whose authority was indisputable for me». Galina Kanaeva also remembered that E. S. Wentzel conducted methodological seminars for mathematicians of MIIT, at which she shared her experience of lecturing. According to the recollections of Galina Kanaeva, who saved the notes with the instructions of Elena S. Wentzel, she recommended «not to deliver «dry» lecture, but to fill it with an emotional component. In order for the students not to have the opportunity to be distracted from the material presented by the lecturer, Elena Wentzel recommended even deliberately making mistakes when solving problems and making sure that students find these mistakes».

[6] Summer house. *Translator's note.*

*«*We were lucky*»*, concluded Galina Kanaeva, *«*after all, we worked with Scientists regarding whom this word should be written with a capital letter*»*.

Anatoly D. Myshkis is the author of more than 330 research articles, 70 methodological publications (many of which are co-authored with his colleagues), 14 articles in newspapers and magazines, 19 books published in 50 editions in 10 languages, two copyright certificates, he also translated and edited 16 books.

Anatoly D. Myshkis was the official advisor for thirty-six defended Ph.D. and seven D.Sc. theses.

The main area of A. D. Myshkis's research activity was the theory of functional differential equations, where he is the author of a number of fundamental results. Since 1950, when Anatoly D. Myshkis defended his D.Sc. thesis, his scientific activity was associated with topical issues and problems in the field of astronautics, transport, technology. In recent years, Anatoly Myshkis and his students were engaged in Zhukovsky's problem of starting a train. Researchers have received unexpected results that can be attributed not only to this problem. These results have

largely changed the classical understanding of the relationship between discrete and continuous models.

The contribution of A. D. Myshkis to mathematics and methods of teaching mathematics is invaluable. Many Soviet and Russian engineers studied according to his textbooks, and scientific works were translated into different languages and published in many countries.

He took an active part in the work of Moscow Mathematical Society, where he headed the section of engineering higher education institutions, in the work of the mathematical section of the Moscow House of Scientists.

A. D. Myshkis received official titles of an honoured employee of higher education, an honorary member of the Presidium of Kharkov Mathematical Society, an honorary railway employee. The scientist's versatile activities have been recognised with several government awards.

The famous American mathematician Jack Kenneth Hale wrote that A. D. Myshkis introduced a general class of equations with a delayed [retarded] argument and laid the foundations for the theory of systems of such equations. Not every scientist, even a world-class scientist, can be said to be the founder of a fundamentally new direction in science.

Indeed, the most significant, but not the single one, achievement of Anatoly D. Myshkis is the development of the theory of the function of differential equations which was a new direction in the theory of differential equations.

FRIEDRICH KARPELEVICH

The authors of the article were lucky to work with another remarkable mathematician, Friedrich Izrailevich Karpelevich[7]. Friedrich Karpelevich was born in 1927. His youth fell on the war years. Childhood was difficult, at the age of 14, he came to the plant to work as a milling machine operator. Once his fingers got into the machine, and Friedrich Karpelevich lost part of the phalanges on several fingers. But, despite all the difficulties, in 1947 he entered the Faculty of Mechanics and Mathematics at Moscow State University. Already in his student years, he published papers on the problem of describing the set of all possible eigenvalues of stochastic

Friedrich Izrailevich Karpelevich (1927–2000).

matrices of order n, stated by Andrei Kolmogorov in 1938.

In his fourth year of study, he proved a theorem on the canonical embedding of a real semisimple Lie subalgebra, which is now referred to in textbooks.

This proof was included in F. I. Karpelevich's diploma work.

In 1956, Karpelevich was awarded the prize of Moscow Mathematical Society for a series of works on algebra.

In 1953, Professor Petr Konstantinovich Rashevsky invited the young scientist to his department of Higher Mathematics at MIIT.

Friedrich I. Karpelevich was a wonderful teacher. His lectures were distinguished by thoughtfulness and precision of formulation.

In 1962, together with S. G. Gindikin, he calculated the c-function as the product of B-functions, thus obtaining an expression for the density in the Plancherel formula (the Gindikin–Karpelevich formula). Another achievement in the theory of symmetric spaces was the «Karpelevich boundary» – the construction of the boundary of Riemannian symmetric spaces of non-positive curvature (1965).

Since the mid-1970s, F. I. Karpelevich began to actively study problems within the queueing theory. It is especially worth noting a cycle of works on multiphase queuing systems, carried out jointly with A. Ya. Kreinin, as well as a cycle of works on

[7] Fridrikh Karpelevich. Wikipedia (wikipedia.org). [Electronic resource]: https://en.wikipedia.org/wiki/Fridrikh_Karpelevich. Last accessed 25.06.2021.

the queuing theory, which was carried out jointly with M. Ya. Kelbert and Yu. M. Sukhov.

His research on the queuing theory is of great importance, both theoretical and practical, for the problems related to organisation of transportation and the economy of railway transport, and is widely known in our country and abroad.

For many years Karpelevich maintained scientific relations with St. John's College, University of Cambridge, England. He received invitations three times to conduct collaborative research at the College.

Until the end of his life (2000) Friedrich I. Karpelevich worked at our University.

In 1965, he organised and headed the Department of Applied Mathematics, from 1970 to 1988 he was the head of the Department of Higher Mathematics, and then for ten years headed the Department of Applied Mathematics-2.

He is the author of many textbooks on queuing theory, mathematical programming, and in many other areas of applied mathematics.

The list of his scientific publications includes 83 works. Many examples can be cited from within the most extensive list of his works and of the works about him [11; 12].

We would like to quote the words of Professor Semen Gindikin about Karpelevich: «The American Mathematical Society has published 2 volumes in which colleagues pay tribute to his memory. His results largely determined the current state of the areas in which he worked, and those results continue to live. Many in the world understand the depth of his achievements, but only those who happened to work with him know an equally important circumstance: how he organically combined amazing talent with amazing spiritual qualities».

In conclusion, we would like to note that thanks to the researchers, scientists, and faculty who worked within the walls of our University, during its 125-year existence, a whole cohort of scientists and railway engineers has been educated, and the railway transport of Russia has developed and continues to improve at the present time by their knowledge and forces.

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