

Історія

UDC 069.01:930.1(477-25)

DOI <https://doi.org/10.5281/zenodo.17781816>

**Origins of Information Technology and Computer Engineering
at Kharkiv Polytechnic Institute (1950s–1960s)**

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Accepted: 12.11.2025 | Published: 30.11.2025

Abstract. *The article examines the issues related to the reconstruction of industry after World War II. Addressing the challenges of improving the efficiency of the industrial complex in the context of post-war economic development necessitated solving a set of new engineering tasks. Their implementation was aimed at introducing automation tools into technological processes based on the use of computing technology. Representatives of higher technical education institutions made a significant contribution to the development of the theory and practice of information technologies, where scientific schools began to emerge in the early 1950s. The innovative research of Professor V. Vasyliiev, associated with the study of electronic models of complex dynamic systems, evolved into a powerful scientific school of mathematical modeling at the National Technical University “Kharkiv Polytechnic Institute” in subsequent years. The development of scientific research*

initiated by V. Vasyliiev led to the establishment of the specialized department “Mathematical and Computing Devices and Instruments” in 1961, which he headed for thirteen years. In 1959, the scientist initiated the creation and became the head of the basic laboratory of electronic modeling. In 1966, this laboratory was reorganized into an industry-specific research laboratory of electronic modeling under the Ministry of Electrical Engineering Industry of the USSR and the Ministry of Higher and Secondary Education of the Ukrainian SSR. V. Vasyliiev, as the head of the laboratory, was elected a member of the USSR National Committee on Analog Computing. The research topics covered the study of dynamic processes in complex systems of locomotive electrical equipment, carried out jointly with scientific institutions and enterprises. The significant role of V. Vasyliiev in the establishment of the Faculty of Automation and Instrument Engineering, where he became the first dean, and in the creation of the specialty “Mathematical and Computing Devices and Instruments” has been established. His individual talent, fluency in foreign languages, strong mathematical background, and broad erudition were applied in the development of curricula, material and technical resources, and educational literature. All these efforts ensured the formation of a system for training engineering and scientific personnel in the field of information technologies at Kharkiv Polytechnic Institute.

Keywords: *history of science and technology, information technologies, innovations, computing technology, scientific school, computer, production, industry, post-war reconstruction, Kharkiv Polytechnic Institute, Ukrainian SSR.*

**Витоки напрямку інформаційних технологій та комп'ютерної інженерії у
Харківському політехнічному інституті (1950-ті–1960-ті рр.)**

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***Анотація.** У статті досліджено питання відбудови промисловості після Другої світової війни. Вирішення проблем підвищення ефективності промислового комплексу в умовах післявоєнного економічного розвитку зумовила необхідність вирішення комплексу нових інженерних завдань. Їх реалізація була спрямована на впровадження засобів автоматизації у технологічні процеси, що ґрунтувалися на використанні обчислювальної техніки. Значний внесок у розвиток теорії і практики інформаційних технологій мали представники закладів вищої технічної освіти, де на початку 1950-х рр. почали формуватися наукові школи. Інноваційні пошуки професора В. Васильєва, пов'язані дослідженням електронних моделей складних динамічних систем сформувалися у потужну наукову школу математичного моделювання Національного технічного університету «Харківський політехнічний інститут» у подальші роки. Розвитком наукових досліджень, започаткованих В. Васильєвим, стало організація профільної кафедри «Математичні та лічильно-вирішальні прилади і пристрої» в 1961 р., яку він очолював тринадцять років. У 1959 р. науковець став ініціатором створення і керівником базової лабораторії електронного моделювання. З 1966 р. ця лабораторія була реорганізована у галузеву науково-дослідну лабораторію*

електронного моделювання Міністерства електротехнічної промисловості СРСР та Міністерства вищої та середньої освіти УРСР. Керівника лабораторії В. Васильєва обрано членом Національного комітету СРСР з аналогових обчислень. Тематика науково-дослідної роботи охоплювала питання дослідження динамічних процесів у складних системах електрообладнання тепловозів, що здійснювалися спільно з науковими установами та підприємствами. Встановлено значущу роль В. Васильєва у створенні факультету автоматики та приладобудування, першим декан якого він став та спеціальності математичні та лічильно-вирішальні прилади і пристрої. Його індивідуальна обдарованість, вільне володіння іноземними мовами, глибока математична підготовка, широка ерудиція були застосовані при створенні навчальних планів, матеріально-технічної бази, начальної-методичної літератури. Все це забезпечило формування системи підготовки інженерних та наукових кадрів в галузі інформаційних технологій Харківської політехніки.

Ключові слова: історія науки і техніки, інформаційні технології, інновації, обчислювальна техніка, наукова школа, комп'ютер, виробництво, промисловість, повоєнна відбудова, Харківський політехнічний інститут, УРСР.

Problem Statement. The reconstruction of industry after World War II required solving new engineering tasks aimed at introducing automation tools into technological processes based on the use of computing technology. The application of modeling made it possible to study objects through models that simulated real conditions. The implementation of new approaches in scientific research using computing technology contributed to the deepening of research, the development of innovative technologies, and the solution of complex engineering problems, enabling a thorough analysis of object characteristics and increasing production

efficiency. Representatives of higher technical education institutions made a significant contribution to the development of the theory and practice of information technologies. In the early 1950s, scientific schools began to form within institutes, and the results of research were implemented in industry. The development of the field of electrical apparatus engineering, initiated at Kharkiv Electrotechnical Institute by Professor B. Vashura, and advanced through the innovative activities of Professor V. Vasyliiev.

led to the creation of one of the first departments in Ukraine dedicated to mathematical computing and problem-solving devices (since 1969 – Department of Electronic Computing Machines, since 1992 – Department of Computing Technology and Programming, and since 2021 – Department of Computer Engineering and Programming). V. Vasyliiev's scientific pursuits, related to the study of electronic models of complex dynamic systems, evolved into a powerful scientific school of mathematical modeling at the National Technical University "Kharkiv Polytechnic Institute" (NTU "KhPI"). The study of the intellectual space of leading scientists, the reconstruction of historical processes through the prism of their lives and activities, and the objective assessment of their scientific contributions and impact on the development of specific fields of knowledge are important and relevant tasks of modern history of science and technology. At the same time, there is a noticeable lack of works that, based on the generalization of factual material, would highlight the role and place of Ukrainian scientists in the context of global scientific and technological progress, which emphasizes the relevance of the chosen topic.

Analysis of recent research and publications. The study of the development of information technology in Ukraine is represented by the works of the Ukrainian researcher B. Malinovskiy [1]. Based on a large number of archival documents, the scholar thoroughly examined the process of the formation of the computer industry in Ukraine. General trends in the development of informatics are considered in

works [2–3]. In the publication by researcher S. Zhabin, a periodization of informatics in Ukraine is proposed, which includes seven main stages of development [4]. The scientific contribution of Ukrainian researchers to the development of computing technology and its global context is outlined by A. Heza [5]. Biographical studies are important for understanding the development of information technology in Ukraine. Research into the intellectual biographies of prominent scientists, inventors, and science organizers against the backdrop of global informatics development contributes to the study of national scientific schools. The work of S. Rugalenko highlights the achievements of K. Yushchenko, the founder of theoretical programming in Ukraine [5]. The contributions of V. Glushkov's scientific school are presented in the study by O. Letychevskyi [6]. Issues related to the development of information technology in higher technical education institutions, including Kharkiv Polytechnic Institute (KhPI), are covered in the works of R. Ryzhnyak and N. Pasichnyk [8–9]. The contributions of scientists from Kharkiv Polytechnic Institute in the field of information technology are partially presented in the monograph by O. Tverytnykova [10]. Thus, despite the existing historiographical contributions on the formation of information technology in Ukraine, there is no separate study devoted to the origins of computer engineering at NTU “KhPI”.

The aim of the article to study focuses on the initial period of the formation of scientific research in the field of information technology at Kharkiv Polytechnic Institute and evaluates the contribution of Professor V. Vasyliiev to the development of mathematical modeling in Ukraine. **The research objectives** are to determine the role of scientists of Kharkiv Polytechnic, in particular V. Vasyliiev, in initiating scientific studies on the theory and practice of information technologies in Ukraine. The source base of the research consists of materials from the collections of the State Archive of Kharkiv Region, the archive of the National Technical University

“Kharkiv Polytechnic Institute,” and current documentation of the Department of Computer Engineering and Programming at NTU “KhPI.”

Presentation of the main material. The development of the scientific school of information technology and computer engineering at NTU “KhPI” is linked to the evolution of electrical apparatus engineering in the early years following World War II. The Department of Electrical Apparatus was established in 1931, initiated by B. Vashura, a specialist in electrical apparatus engineering and a practicing engineer, who became its first head. His valuable practical experience gained at the Kharkiv Electromechanical Plant, profound knowledge of technological processes in the production of electrical apparatus, strong physical and mathematical background, and organizational skills were applied in designing curricula for future specialists in electrical apparatus engineering, developing the department’s material and technical base, creating educational literature, and training postgraduate students. In 1953, under B. Vashura’s supervision, a talented postgraduate student, V. Vasyliiev, defended his dissertation on “Relay Auto-Regulation of Electrical Machines” [10].

The further development of electrical apparatus engineering at KhPI is associated with the activities of Viktor Georgievich Vasyliiev. His scientific interests focused on developing the theory of nonlinear control systems. Since 1957, he served as acting head of the Department of Electrical Apparatus, where he initiated innovative research in electronic modeling and the design of computing devices [11, p. 2]. During sessions of the student scientific society, talented students V. Kalashnikov, I. Smilyanskyi, and A. Shpilberg implemented Vasyliiev’s idea of creating a device that became the foundation for the first analog computing machine (ACM) at KhPI. Based on an analysis of foreign scientific literature, Vasyliiev proposed using analog computing devices to study processes in nonlinear control systems. Under his guidance, student V. Kalashnikov developed an operational amplifier. Subsequently, a computing unit with eight operational amplifiers and a control system for operating modes was created, along with a precision power source

and an electronic indicator for slowly varying electrical signals. All these components formed the first analog computing machine at KhPI [12, p. 231].

The availability of a computing machine stimulated research activities at the Department of Electrical Apparatus. Studies were conducted on modeling dynamic objects and modernizing equipment, which enabled the initiation of a research topic focused on the stability of electric drives for heavy excavators. In 1957, under the leadership of V. Vasyliiev, the first research in the USSR on electromechanical systems of excavators using an analog computing machine (ACM) was launched. The optimization of the excavator control system for the Kharkiv Electromechanical Plant and the study of the dynamics of the drive mechanism of a rotary excavator for the Novokramatorsk Machine-Building Plant became the outcome of these experimental works. Thus, the department gradually developed theoretical research on nonlinear dynamic systems and applied studies aimed at the development and improvement of hardware and hardware-software tools for computing technology [13, p. 3].

In 1959, V. Vasyliiev initiated the establishment and became the head of the basic laboratory of electronic modeling, which included several research groups. The activities of the group focused on electronic modeling of control systems for complex dynamic objects and were aimed at developing methods of mathematical modeling for regulating energy systems. The first research topic of the laboratory concerned studies of locomotive control systems. The design and construction of locomotives were carried out by employees of the Kharkiv Electrovazhmash Plant, where the implementation and serial production of new products, including locomotive electrical equipment for TE-3, TE-10, and TE-15 locomotives, took place. The staff of the electronic modeling laboratory provided qualified scientific and technical assistance to the plant's design department. Using electronic models, parameters for protecting gas turbine locomotives from possible emergency modes

in electric transmission and the dynamics of gas turbine locomotives were studied [14, p. 5].

Between 1957 and 1961, under V. Vasyliiev's leadership, the laboratory conducted 14 research projects and obtained 3 authorship certificates. Collaboration continued with the Kharkiv Electromechanical Plant and Electrovazhmash, as well as with the Cheboksary Apparatus Plant. New partnerships were established with industrial enterprises such as Luhanskteplovovoz, Radiorele, Turboatom, and the Institute of Electrodynamics of the Academy of Sciences of the Ukrainian SSR. A number of significant research projects were carried out in the field of high-speed automatic circuit breakers and short-circuit devices in cooperation with the Electrovazhmash Research Institute laboratory. Due to the expansion of research topics, the director of Electrovazhmash provided technical assistance to expand and equip the electronic modeling laboratory [15, p. 109; 16, p. 11].

In 1966, the basic electronic modeling laboratory at KhPI was reorganized into an industry-specific research laboratory under the Ministry of Electrical Engineering Industry of the USSR and the Ministry of Higher and Secondary Education of the Ukrainian SSR. Vasyliiev, as head of the laboratory, was elected a member of the USSR National Committee on Analog Computing. Research continued in the field of electrical engineering, particularly in developing methodologies and studying complex electromechanical systems using mathematical modeling methods. The research topics included the study of dynamic processes in complex locomotive electrical systems, conducted jointly with the Institute of Electrodynamics of the Academy of Sciences of the Ukrainian SSR and Electrovazhmash. Issues such as the dynamics of AC-DC locomotive transmissions in traction mode and in electrodynamic braking mode were addressed. Joint studies were also conducted with the laboratory of electromechanical power sources for electroerosion processing methods, focusing on the influence of key parameters on

the commutation of DC machines (scientific supervisors V. Yakovenko and V. Tolkunov) [17, p. 22, 34–37].

The development of scientific research initiated by V. Vasyliiev led to the establishment of the specialized department “Mathematical and Computing Devices and Instruments” in 1961. V. Vasyliiev served as the first head of the department from 1961 to 1962 and again from 1965 to 1974, while Professor V. Zverev headed it from 1962 to 1964. The department included the electronic modeling laboratory. In 1962, the department acquired a digital computing machine “MINSK-11.” By 1964, the first group of 24 engineers graduated. The total student body of the department in the 1964/1965 academic year was 407 students: 75 in the first year, 84 in the second, 54 in the third, 55 in the fourth, and 139 in the fifth. Organizing training for the new specialty faced challenges with industrial internships due to the lack of appropriate placements at enterprises, as large industrial plants in the city did not yet have electronic computing machines, which hindered the acquisition of practical skills [18, p. 2, 4–6, 7–11].

The strong scientific activity contributed to the training of research personnel. Under Vasyliiev’s supervision, the following candidates defended their dissertations: in 1967 – A. Tipikin (“Mathematical Modeling of Frequency Control Systems for Traction Asynchronous Motors”); in 1968 – V. Avgust (“Devices for Monitoring the Characteristics of Thin Magnetic Films During Deposition”), A. Shpilberg (“Automatic Regulators of Pseudorandom Processes”), V. Kalashnikov (“Study of a Tunnel-Diode Comparator for Analog-Digital Computing Systems”); in 1970 – S. Chervonnyi (“Indicator Devices for ECMs with Analog Operation Execution”); in 1975 – V. Kravets (“Research and Development of Digital Devices for Applied Spectral Analysis Based on Dyadic Methods”), Ye. Loboda (“Study of Functional Capabilities of Controlled Blocks of Nonlinear Functions”), S. Nedilko (“Research of Methods and Development of Technical Means for Implementing Statistical Modeling Algorithms in Automatic Control Systems”); in 1976 – B. Valikhmetov

(“Development and Study of Color Screen Consoles for Operational Technical Control Devices for ACS TP”), among others [19, Pp. 2, 4–6, 7–11].

It should be emphasized that between 1960 and 1962, V. Vasyliiev served as dean of the newly established Faculty of Automation and Instrument Engineering at KhPI. Thanks to his extensive experience and outstanding organizational skills, V. Vasyliiev made a significant contribution to shaping the faculty’s structure, developing new curricula, introducing industrial internships, and creating student scientific societies. The faculty was strengthened by the establishment of two new departments – Electrical Measurement Technology and Mathematical Computing Devices and Instruments. The faculty’s student body was substantial – 1,017 students, including 107 enrolled in the promising specialty “Mathematical Computing Devices and Instruments” [20].

Conclusion. Thus, Professor V. Vasyliiev was one of the founders of the field of information technology and computer engineering at NTU “KhPI.” A significant contribution to shaping his scientific worldview belongs to Professor B. Vashura, one of the pioneers of electrical apparatus engineering in Ukraine. The conducted research allows us to assert that V. Vasyliiev initiated innovative scientific studies based on the integration of analog computing devices and mathematical modeling methods. The creation of the first analog computing machine at KhPI facilitated the deepening of research topics, while the subsequent use of unique equipment enabled the expansion of experimental work, the establishment of productive collaborations with industrial enterprises and scientific institutions, and the organization of comprehensive research projects. On Vasyliiev’s initiative, a basic laboratory of electronic modeling was established, later reorganized into an industry-specific research laboratory. This contributed to the intensification of scientific activity and the implementation of numerous research projects on modeling the dynamics of complex industrial objects, as well as the formation of the scientific school of mathematical modeling at NTU “KhPI.”

The prospects for further research lie in the continued study of the activities of the mathematical modeling scientific school founded by Professor V. Vasyliiev, determining its place in the global scientific space, and examining the impact of the achievements of Kharkiv Polytechnic representatives on the development of modern areas of information technology.

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