Исторические материалы

Historical materials

УДК 378.4:001.89

К 60-ЛЕТИЮ КАФЕДРЫ ВЫСШЕЙ МАТЕМАТИКИ И МАТЕМАТИЧЕСКОЙ ФИЗИКИ

Н. Г. АБРАШИНА-ЖАДАЕВА[1)]***, И. И. РУШНОВА***[1)]

[1)]*Белорусский государственный университет, пр. Независимости, 4, 220030, г. Минск, Беларусь*

Представлены ключевые достижения кафедры высшей математики и математической физики физического факультета БГУ за 60 лет ее существования. Приведены главные этапы развития кафедры – от создания в 1961 г. как общеобразовательной, обеспечивающей чтение лекционных курсов и проведение практических занятий по всем разделам высшей математики на физическом факультете и факультете радиофизики и компьютерных технологий до становления в качестве одной из ведущих кафедр физического факультета. Указаны приоритеты кафедры, которые в настоящее время во многом связаны с внедрением информационно-коммуникационных технологий в образовательный процесс и обновлением системы образования в соответствии с требованиями современного общества и научных достижений. Особое внимание уделяется поиску новых форм организации учебного процесса, подготовке современных методических комплексов и разработок, учебных пособий по изучаемым дисциплинам, контролю текущей успеваемости, проведению экзаменов и зачетов, стимулированию самостоятельной работы студентов.

Ключевые слова: кафедра высшей математики и математической физики; научно-исследовательская работа; учебно-методическая работа; информационно-коммуникационные технологии; организация учебного процесса.

Образец цитирования:
Абрашина-Жадаева НГ, Рушнова ИИ. К 60-летию кафедры высшей математики и математической физики. *Журнал Белорусского государственного университета. Физика.* 2021; 3:74–80.

For citation:
Abrashina-Zhadaeva NG, Rushnova II. The 60th anniversary of the department of higher mathematics and mathematical physics. *Journal of the Belarusian State University. Physics.* 2021; 3:74–80. Russian.

Авторы:
Наталья Григорьевна Абрашина-Жадаева – доктор физико-математических наук, доцент; профессор кафедры высшей математики и математической физики физического факультета.
Ирина Ивановна Рушнова – кандидат физико-математических наук; заведующий кафедрой высшей математики и математической физики физического факультета.

Authors:
Natalia G. Abrashina-Zhadaeva, doctor of science (physics and mathematics), docent; professor at the department of higher mathematics and mathematical physics, faculty of physics.
zhadaeva@bsu.by
https://orcid.org/0000-0001-8531-6490
Iryna I. Rushnova, PhD (physics and mathematics); head of the department of higher mathematics and mathematical physics, faculty of physics.
rushnova@bsu.by
https://orcid.org/0000-0002-1049-1953

THE 60th ANNIVERSARY OF THE DEPARTMENT OF HIGHER MATHEMATICS AND MATHEMATICAL PHYSICS

N. G. ABRASHINA-ZHADAEVA[a], *I. I. RUSHNOVA*[a]

[a]*Belarusian State University, 4 Niezaliežnasci Avenue, Minsk 220030, Belarus*
Corresponding author: I. I. Rushnova (rushnova@bsu.by)

The key achievements of the department of higher mathematics and mathematical physics of the physics faculty of the Belarusian State University during its 60 years of existence are presented. The milestones of the department's history are outlined – from its establishment in 1961 as a general education chair providing both lecture courses and practical classes in all branches of higher mathematics at the physics faculty and the radiophysics and computer technologies faculty to its further strengthening as one of the leading departments of the physics faculty. The department's present-day priorities, which are strongly related with the integration of information and communication technologies into the educational process and updating the educational system in accordance with both the requirements of modern society and scientific advances, have been indicated. Particular attention is paid to the searching for new forms of educational process organisation, developing new methodological supports and studying guides, textbooks for the studied subjects, monitoring of current progress, conducting exams and tests, stimulating students' self-study.

Keywords: department of higher mathematics and mathematical physics; research work; educational and methodical work; information and communication technologies; organisation of the educational process.

The university department of higher mathematics and mathematical physics (HM & MP) was founded in September 1961 as a general chair providing the high-level educational process in mathematics courses at the physics faculty.

A. H. Turetsky

Doctor of science (physics and mathematics), professor A. H. Turetsky established and took over the leadership of the department (1961–1968). Among the first lecturers of the department of HM & MP were experienced employees of the mathematics faculty: professor A. V. Ivanov, associate professor N. I. Brish, associate professor I. A. Sokolov, associate professor M. S. Garashchuk, senior lecturer E. A. Murashko. Already in its early stages the department had developed certain traditions in the teaching of mathematics courses at the physics faculty. It was during these years that typical and working training programs were developed, programs were agreed with related disciplines and methodological support for the teaching process was elaborated.

Professor A. H. Turetsky was an exclusive organiser of educational, methodological and research work. His lectures on constructive function theory attracted a wide audience of mathematics students of various specialisations and were characterised by depth of content and accessibility of presentation. Scientific investigations supervised by the head of the department were related to the theory of approximation. A. H. Turetsky also chaired a scientific seminar, which attracted a great attention of employees and students of other universities and scientific institutions from the Minsk and became widely known including outside the BSSR. A. H. Turetsky was the founder of a scientific school, where under his supervision 7 PhD theses were successfully defended. His scientific heritage includes more than 60 scientific articles on the theory of interpolation, 2 monographs (1968, 1977) and textbooks [1; 2] approved by the Ministry of Higher Education of the BSSR, which even today are the source of new approximation problems for students and scientific followers.

Yu. S. Bogdanov

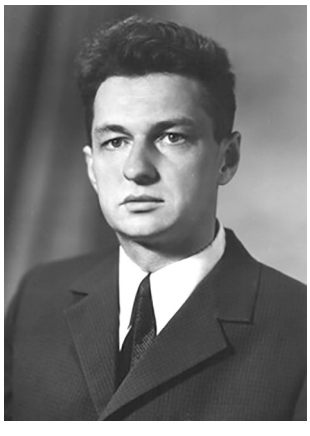
The department of HM & MP was chaired by professor Yu. S. Bogdanov (1968–1973). During this period the activities of the department staff were aimed at developing and improving the methods of teaching mathematics, as well as developing methodological supports for new training courses. Yu. S. Bogdanov has published a number of textbooks, 3 of which are addressed to students of physics specialties: «Lectures on mathematical analysis» (in two parts) [3; 4], «Lectures

A. S. Fedenko

on differential equations» [5]. Yu. S. Bogdanov made a great contribution to the establishment and development of the Belarusian school of differential equations, among his students there were more than 40 PhD, 5 of them became doctors of science. He obtained a great number of fundamental results in the modern asymptotic theory of differential equations and published over 100 scientific articles. In memory of the outstanding researcher-mathematician and lecturer the famous «Bogdanov readings» are traditionally held at the department of higher mathematics of the faculty of applied mathematics and informatics of the Belarusian State University.

Later the department was chaired by professor A. S. Fedenko (1973–1976). Scienific interests of A. S. Fedenko belong to the field of differential geometry, the theory of Lie groups, homogeneous and Riemannian spaces. A. S. Fedenko jointly with R. I. Tyshkevich published the textbook «Linear algebra and analytic geometry» in 1976 [6], besides he is the author of textbooks on algebra, topology, analytical and differential geometry [7; 8]. In books on modern differential geometry A. S. Fedenko's papers are characterised as fundamental. Eight PhD theses were defended under his supervision.

The department of HM & MP was headed by professor V. N. Rusak for the next 26 years (1976–2002). The head of the department continued the tradition of writing textbooks for mathematics courses. The textbook «Elements of linear algebra» [9] was published under the general editorship of associate professor R. F. Apatenok in 1977, the textbook «Collection of tasks in linear algebra» was published in 1980 [10]. The textbook «Collection of tasks in algebra and geometry» was published by the authors' team consisting of A. S. Fedenko, A. A. Burdun, E. A. Murashko in 1979 [7]. The monograph «Rational functions as an apparatus of approximation» was published by V. N. Rusak in 1979. The first and the second parts of the textbook «The course of higher mathematics» were published by V. N. Rusak, L. I. Shloma, V. K. Akhramenko, A. P. Krachkovsky in 1994 and 1997, respectively [11; 12]. The textbook «Mathematical physics» was published by V. N. Rusak in 1998 [13].



V. N. Rusak

V. N. Rusak headed the Belarusian scientific school on approximation theory because he was an apprentice of A. H. Turetsky. Rational approximation and its applications became the main focus of scientific research at the department of HM & MP in the period of 1976–2002. The staff and graduates of the department defended 11 PhD theses. The doctoral thesis «Rational functions as an apparatus of approximation» was defended by V. N. Rusak at the Institute of Mathematics of the National Academy of Sciences of Ukraine in 1988. The doctoral thesis «Direct and inverse theorems of rational approximation» was defended by A. A. Pekarsky at Moscow State University in 1990. A great number of the results obtained by A. A. Pekarsky and V. N. Rusak, is included in the English language monographs: 1) «Rational approximation of real functions» by P. P. Petrushev, V. A. Popov (Cambridge, 1987) [14]; 2) «Constructive approximation» by G. G. Lorentz, M. V. Golitschek, Y. Makovoz (Berlin, 1996) [15]. For a long time associate professor M. A. Sheshko worked fruitfully at the department of HM & MP. He defended his doctoral thesis «Approximate solution of singular integral equations using residues» at the Computing Center of the Russian Academy of Sciences in 1992.

During his chairmanship V. N. Rusak has published over 180 scientific papers, prepared 9 PhD and 3 doctors of physical and mathematical sciences, founded a scientific school on rational approximation and its applications.

The period of leadership of the department of HM & MP by doctor of science (physics and mathematics) N. G. Abrashina-Zhadaeva (from 2002 to 2020) coincided with the beginning of a new stage in the evolution of the department. Firstly, the material and technical base of the department has been strengthened, secondly the number of employees has been increased and, accordingly, the research topics have been expanded significantly. N. G. Abrashina-Zhadaeva continued her scientific work on numerical methods of problems of mathematical physics as she was an apprentice of the school of academician A. A. Samarsky and professor V. N. Abrashin. Intensive research has been carried out on the theory of approximation by associate professor I. V. Rybachenko, associate professor N. K. Filipava; fractional partial differential equations by senior lecturer I. A. Timoshchenko; computational mathematics by associate professor A. A. Egorov; boundary value problems by associate professor V. V. Kashevsky, associate professor A. P. Shilin, senior lecturer T. A. Chekhmenok and others. Various applications of mathematical methods were studied by N. G. Abrashina-Zhadaeva, I. A. Timoshchenko, T. A. Chekhmenok, V. V. Kashevsky, A. P. Shilin. Scientific research in the field of numerical modelling of anomalous diffusion based on differential equations of fractional orders was carried out by N. G. Abrashina-Zhadaeva, N. S. Romanova, V. N. Rusak, I. A. Timoshchenko and others.

The staff of the department of HM & MP (2020):
T. A. Chekhmenok, L. G. Krylova, E. A. Tishchenkova, M. A. Gletsevich, I. V. Rybachenko,
N. I. Ilyinkova, D. N. Menyailova, O. A. Kononova, A. A. Egorov, N. G. Abrashina-Zhadaeva,
N. K. Filipava, I. A. Timoshchenko, L. L. Berezkina, V. I. Zelenkov, I. I. Rushnova, A. P. Shilin, A. G. Gutor

Scientific researches carried out at the department under the leadership of N. G. Abrashina-Zhadaeva were associated first of all with the solution of applied problems in various areas of the national economy. In particular, such topics as «Creation and applying of mathematical models of dynamic biosystems» (2011–2015), «Mathematical models in membrane systems and numerical methods for their study» (2016–2020) were carried out according to the state program of scientific research «Convergence». A. S. Lyalikov (2003), A. N. Kovalchuk (2004), I. V. Rybachenko (2005), M. A. Prokhorovich (2009) defended their PhD theses. N. G. Abrashina-Zhadaeva defended the doctoral thesis «Multicomponent vector splitting schemes in the methods of mathematical physics» at the Kazan Federal University in 2008.

A new course «Mathematical modelling of physical processes» was developed based on the results of the scientific researches «Investigation of rational approximations and their applications to the analysis of mathematical models» (2005–2010) and «Creation and applying of mathematical models of dynamic biosystems» (2010–2015). In these researches a generalised model of the electrodiffusion process was proposed based on the Nernst – Planck – Poisson equations and taking into account anomalous diffusion. A new numerical model was created based on the two-dimensional fractional Fokker – Planck equation.

The department maintained a high level of not only scientific, but also educational and methodological research during this period. The staff of the department was involved in the work on the topic «Development of methodological support in higher mathematics and its applications». A number of textbooks was published based on the great experience of teaching mathematics courses at the faculty of physics and the faculty of radiophysics and computer technologies and was focused on deepening theoretical knowledge and practical training of students [16–18]. The main aim of writing these textbooks was to make educational materials available to the students, in view of modern requirements and programs. Textbooks were written by all the staff of the department, headed by professor V. N. Rusak, professor N. G. Abrashina-Zhadaeva, associate professors L. L. Berezkina and A. P. Shilin. It should be noted that they were winners of the A. N. Sevchenko Award for the cycle of methodological works «Educational resources of the complex organisation of the educational process» in 2020.

Significant work has been done by the department of HM & MP to provide the library of the Belarusian State University with published textbooks. A large number of educational and methodological guides have been developed on the basis of the written textbooks, both in hard copy and digital form. They are available for students and convenient for the educational process. Educational resources have been created in digital form: digital educational and methodological supports in mathematical analysis and analytical geometry and linear algebra; a number of tests with the possibility of distance learning in analytical geometry and linear algebra;

an accompanying online resource for the course «Fundamentals vector and tensor analysis» (it was among the winners of the Belarusian State University educational online resources competition (I. A. Timoshchenko) in 2016); lectures using multimedia devices; digital laboratory practice on selected topics of mathematical analysis using the package «Wolfram Mathematica».

Textbooks on mathematical analysis, vector and tensor analysis, analytical geometry [19–21] were prepared and published with the participation of N. G. Abrashina-Zhadaeva and received universal recognition in the Republic of Belarus and abroad.

Moreover, the department of HM & MP was the initiator of the introduction of testing into the educational process to improve the students' self-study and the students' self-control. Associate professors of the department O. A. Chuprigin, N. I. Ilyinkova, O. A. Kononova made a great contribution to the work. O. A. Chuprigin prepared over 2500 questions on various topics in mathematical analysis and published textbook «Mathematical analysis. Theory in tests» [22].

The continuity of teaching school and higher mathematics was ensured by N. G. Abrashina-Zhadaeva jointly with the lecturers of the department L. L. Berezkina, N. S. Romanova, V. N. Rusak, I. A. Timoshchenko, N. K. Filipava. In particular, articles were prepared and published in the «Encyclopedia for schoolchildren and students», which is popular not only among the schoolchildren and students, but also among the lecturers.

Associate professor I. I. Rushnova is the head of the department of HM & MP since 2020. Her research interests focus on an important area in physics – the electro-optics effects in liquid crystals [23]. The extension of the research area has a positive impact on the involvement of students in the department's courseworks and theses. The main scientific directions of the department's work are related to the fundamental sections of computational mathematics, mathematical modelling and the theory of approximation by rational functions. Scientific topic «Analytical and numerical modelling of the properties of carbon's fractal systems» is being carried out according to the state program of scientific research «Convergence». Senior lecturer of the department A. N. Derevyago defended his PhD thesis «Semiclassical models of electrical conductivity, electroluminescence and spin-phonon magnetic resonance for heavily doped semiconductors» in 2021. Junior staff of the department, senior lecturers M. A. Gletsevich and L. G. Krylova has already been formalised their scientific researches in PhD theses and presented results at the seminars of the department.

The department of HM & MP continues to provide at a high level mathematical training of students studying in physical, radiophysical and computer-technical profiles. Postgraduate students N. S. Magon, D. N. Menyailova and M. A. Samarina were included to the staff of the department. They provide lectures and practical classes competently in all courses of higher mathematics. A worthy change is growing up. Moreover the lecturers of the department began to lecture in English in the following courses: «Mathematical modelling of physical processes» (V. I. Zelenkov), «Equations of mathematical physics» (A. N. Derevyago) for undergraduates from the Arab Emirates and the People's Republic of China. In addition, the department has already experience to work with foreign students, as the lecturers gave lectures on differential equations in Dalian Polytechnic University.

Currently, the department of HM & MP provides excellent training for students of the faculty of physics and the faculty of radiophysics and computer technologies in 16 mathematical courses. The priority direction of modernisation of the methods of teaching higher mathematics is the introduction of new information technologies into professional activities. So educational portals *http://eduphys.bsu.by/* and *http://edurfe.bsu.by/* play an important role in the process of training young physicists and radiophysicists. They are developed on the basis of the Moodle platform. Training course is developed for each taught course on the educational portal and is structured as follows: lecture part, practical part and part for knowledge control, filled with various formats' tasks (test, essay, open type tasks) and difficulty levels. The use of visualisation of learning material on educational portals has a positive impact on the learning of the content being presented. The department is developing new standard programs and educational programs for four-year and five-year courses at the faculty of physics and the faculty of radiophysics and computer technologies.

The educational field is currently acquiring a distance learning format, so the department identifies the main aims of online learning: 1) to fill gaps in knowledge, abilities and skills in certain courses; 2) to develop basic courses of educational programs for students who are unable to attend full-time training sessions for various reasons; 3) additional hobby education; 4) in-depth study of previously completed courses (for postgraduate students).

To realise the possibility of obtaining a high-quality education, various textbooks, methodological supports and studying guides with detailed algorithms and methods for solving problems are of great help for students. The staff of the department prepared 3 electronic methodological supports in mathematical analysis for students of physical and radiophysical specialties [24; 25], a number of electronic studying guides only for 2020–2021. The textbook «Mathematical analysis. Examples and tasks» [26] will be published by A. A. Egorov, I. I. Rushnova, I. V. Rybachenko, A. P. Shilin in the third quarter of 2021. The staff of the department continues to publish textbooks in English [27].

For the first time, the department introduced open-type colloquia in the courses «Analytical geometry and linear algebra», «Mathematical analysis», «Fundamentals of vector and tensor analysis». They represent student's prepared responses to creative questions in the form of presentations or video.

The department has a permanent full-time physical and mathematical school «Kvant BSU» aimed at popularising mathematics and physics among schoolchildren and preparing pupils for olympiads and centralised testing. Young employees of the department are actively working in the physics and mathematics school headed by A. G. Gutor.

A total of 16 PhD theses and 7 doctoral theses have been defended by the staff and graduates of the department over the past 45 years. The tradition of preparing author's textbooks for courses in higher mathematics continues both in the typographic version and especially recently in the digital form. The staff of the department of HM & MP is ready to do everything to improve the level of mathematical training of students at the faculty of physics and the faculty of radiophysics and computer technologies, in order to provide our republic with qualified specialists for science-intensive and high-tech production.

Библиографические ссылки

1. Турецкий АХ. *Теория интерполирования в задачах. Часть 1.* Минск: Вышэйшая школа; 1968. 318 с.
2. Турецкий АХ. *Теория интерполирования в задачах. Часть 2.* Минск: Вышэйшая школа; 1977. 256 с.
3. Богданов ЮС. *Лекции по математическому анализу. Часть 1.* Минск: БГУ; 1974. 176 с.
4. Богданов ЮС. *Лекции по математическому анализу. Часть 2.* Минск: БГУ; 1978. 184 с.
5. Богданов ЮС. *Лекции по дифференциальным уравнениям.* Минск: Вышэйшая школа; 1977. 240 с.
6. Тышкевич РИ, Феденко АС. *Линейная алгебра и аналитическая геометрия.* 2-е издание. Минск: Вышэйшая школа; 1976. 544 с.
7. Бурдун АА, Мурашко ЕА, Феденко АС. *Сборник задач по алгебре и геометрии.* Минск: Издательство БГУ имени В. И. Ленина; 1979. 200 с.
8. Кононов СГ, Прасолов АВ, Тимохович ВЛ, Тралле АЕ, Феденко АС. *Топология.* Минск: Вышэйшая школа; 1990. 318 с.
9. Апатенок РФ, Маркина АМ, Попова НВ, Хейнман ВБ. *Элементы линейной алгебры.* Минск: Вышэйшая школа; 1977. 256 с.
10. Апатенок РФ, Маркина АМ, Попова НВ, Хейнман ВБ. *Сборник задач по линейной алгебре.* Минск: Вышэйшая школа; 1980. 192 с.
11. Русак ВМ, Шлома ЛІ, Ахраменка ВК, Крачкоўскі АП. *Курс вышэйшай матэматыкі.* Мінск: Вышэйшая школа; 1994. 431 с.
12. Русак ВМ, Шлома ЛІ, Ахраменка ВК, Крачкоўскі АП. *Курс вышэйшай матэматыкі.* Мінск: Вышэйшая школа; 1997. 505 с.
13. Русак ВН. *Математическая физика.* Минск: Дизайн ПРО; 1998. 208 с.
14. Petrushev PP, Popov VA. *Rational approximation of real functions*. Cambridge: Cambridge University Press; 1988. 371 p. (Encyclopedia of mathematics and its applications). DOI: 10.1017/CBO9781107340756.
15. Lorentz GG, Golitschek MV, Makovoz Y. *Constructive approximation.* Berlin: Springer-Verlag; 1996. 649 p. (Grundlehren der mathematischen Wissenschaften; volume 304).
16. Ахраменко ВК, Берёзкина ЛЛ, Ильинкова НИ, Кашевский ВВ, Крыленко НИ, Прохорович МА и др. *Высшая математика. Сборник задач. Часть 1. Аналитическая геометрия. Анализ функции одной переменной.* Абрашина-Жадаева НГ, Русак ВН, редакторы. Минск: БГУ; 2013. 359 с.
17. Ахраменко ВК, Берёзкина ЛЛ, Глецевич МА, Голубева ЕН, Егоров АА, Ильинкова НИ. Высшая математика. *Сборник задач. Часть 2. Линейная алгебра. Анализ функций многих переменных.* Абрашина-Жадаева НГ, Русак ВН, редакторы. Минск: БГУ; 2014. 384 с.
18. Глецевич МА, Голубева ЕН, Егоров АА, Зеленков ВИ, Ильинкова НИ, Кашевский ВВ и др. *Высшая математика. Сборник задач. Часть 3. Дифференциальные уравнения. Аналитические функции. Элементы функционального анализа.* Абрашина-Жадаева НГ, Русак ВН, редакторы. Минск: БГУ; 2015. 391 с.
19. Абрашина-Жадаева НГ, Тимощенко ИА. *Основы векторного и тензорного анализа. Теория. Задачи.* Минск: БГУ; 2011. 255 с.
20. Абрашина-Жадаева НГ, Берёзкина ЛЛ, Глецевич МА, Филиппова НК. *Аналитическая геометрия.* Минск: БГУ; 2018. 242 с.
21. Абрашина-Жадаева НГ, Тимощенко ИА. *Векторный и тензорный анализ в примерах и задачах.* Минск: БГУ; 2019. 250 с.
22. Чупригин ОА. *Математический анализ. Теория в тестах.* Минск: БГУ; 2019. 183 с.
23. Rushnova II, Kabanova OS, Melnikova EA, Tolstik AL. Integrated-optical nematic liquid crystal switches: designing and operation features. *Nonlinear Phenomena in Complex Systems*. 2018;21(3):206–219.
24. Ахраменко ВК, Ильинкова НИ, Рушнова ИИ, Чехменок ТА. Математический анализ. Дифференциальное и интегральное исчисление функций одной переменной [Интернет]. Минск: БГУ; 2020 [процитировано 20 июля 2021 г.]. 180 с. Доступно по: https://elib.bsu.by/handle/123456789/250914.
25. Егоров АА, Рушнова ИИ, Рыбаченко ИВ, Шилин АП. Математический анализ. Элементы дифференциальной геометрии. Теория поля. Теория функций комплексной переменной [Интернет]. Минск: БГУ; 2021 [процитировано 20 июля 2021 г.]. 175 с. URL: https://elib.bsu.by/handle/123456789/261138.
26. Егоров АА, Рушнова ИИ, Рыбаченко ИВ, Шилин АП. *Математический анализ. Примеры и задачи.* Минск: РИВШ; 2021. 157 с. (в печати).
27. Абрашина-Жадаева НГ, Ахраменко ВК, Березкина ЛЛ, Голубева ЕН, Кашевский ВВ, Чупригин ОА. *Математический анализ: теория, примеры и задачи.* Минск: БГУ; 2021 (в печати).

References

1. Turetskii AKh. *Teoriya interpolirovaniya v zadachakh. Chast' 1* [Interpolation theory in problems. Part 1]. Minsk: Vyshjejshaja shkola; 1968. 318 p. Russian.

2. Turetskii AKh. *Teoriya interpolirovaniya v zadachakh. Chast' 2* [Interpolation theory in problems. Part 2]. Minsk: Vyshjejshaja shkola; 1977. 256 p. Russian.

3. Bogdanov YuS. *Lektsii po matematicheskomu analizu. Chast' 1* [Lectures on mathematical analysis. Part 1]. Minsk: Belarusian State University; 1974. 176 p. Russian.

4. Bogdanov YuS. *Lektsii po matematicheskomu analizu. Chast' 2* [Lectures on mathematical analysis. Part 2]. Minsk: Belarusian State University; 1978. 184 p. Russian.

5. Bogdanov YuS. *Lektsii po differentsial'nym uravneniyam* [Lectures on differential equations]. Minsk: Vyshjejshaja shkola; 1977. 240 p. Russian.

6. Tyshkevich RI, Fedenko AS. *Lineinaya algebra i analiticheskaya geometriya* [Linear algebra and analytic geometry]. 2nd edition. Minsk: Vyshjejshaja shkola; 1976. 544 p. Russian.

7. Burdun AA, Murashko EA, Fedenko AS. *Sbornik zadach po algebre i geometrii* [Collection of tasks in algebra and geometry]. Minsk: Izdatel'stvo BGU imeni V. I. Lenina; 1979. 200 p. Russian.

8. Kononov SG, Prasolov AV, Timokhovich VL, Tralle AE, Fedenko AS. *Topologiya* [Topology]. Minsk: Vyshjejshaja shkola; 1990. 318 p. Russian.

9. Apatenok RF, Markina AM, Popova NV, Kheinman VB. *Elementy lineinoi algebry* [Elements of linear algebra]. Minsk: Vyshjejshaja shkola; 1977. 256 p. Russian.

10. Apatenok RF, Markina AM, Popova NV, Kheinman VB. *Sbornik zadach po lineinoi algebre* [Collection of tasks in linear algebra]. Minsk: Vyshjejshaja shkola; 1980. 192 p. Russian.

11. Rusak VN, Shloma LI, Akhramenko VK, Krachkovsky AP. *Kurs vyshjejshaj matjematyki* [The course of higher mathematics]. Minsk: Vyshjejshaja shkola; 1994. 431 p. Belarusian.

12. Rusak VN, Shloma LI, Akhramenko VK, Krachkovsky AP. *Kurs vyshjejshaj matjematyki* [The course of higher mathematics]. Minsk: Vyshjejshaja shkola; 1997. 505 p. Belarusian.

13. Rusak VN. *Matematicheskaya fizika* [Mathematical physics]. Minsk: PRO Design; 1998. 208 p. Russian.

14. Petrushev PP, Popov VA. *Rational approximation of real functions.* Cambridge: Cambridge University Press; 1988. 371 p. (Encyclopedia of mathematics and its applications). DOI: 10.1017/CBO9781107340756.

15. Lorentz GG, Golitschek MV, Makovoz Y. *Constructive approximation.* Berlin: Springer-Verlag; 1996. 649 p. (Grundlehren der mathematischen Wissenschaften; volume 304).

16. Akhramenko VK, Berezkina LL, Il'inkova NI, Kashevskii VV, Krylenko NI, Prokhorovich MA, et al. *Vysshaya matematika. Sbornik zadach. Chast' 1. Analiticheskaya geometriya. Analiz funktsii odnoi peremennoi* [Higher mathematics. Collection of tasks. Part 1. Analytic geometry. Analysis of the function of one variable]. Abrashina-Zhadaeva NG, Rusak VN, editors. Minsk: Belarusian State University; 2013. 359 p. Russian.

17. Akhramenko VK, Berezkina LL, Gletsevich MA, Golubeva EN, Egorov AA, Il'inkova NI. *Vysshaya matematika. Sbornik zadach. Chast' 2. Lineinaya algebra. Analiz funktsii mnogikh peremennykh* [Higher mathematics. Collection of tasks. Part 2. Linear algebra. Analysis of functions of many variables]. Abrashina-Zhadaeva NG, Rusak VN, editors. Minsk: Belarusian State University; 2014. 384 p. Russian.

18. Gletsevich MA, Golubeva EN, Egorov AA, Zelenkov VI, Il'inkova NI, Kashevskii VV, et al. *Vysshaya matematika. Sbornik zadach. Chast' 3. Differentsial'nye uravneniya. Analiticheskie funktsii. Elementy funktsional'nogo analiza* [Higher mathematics. Collection of tasks. Part 3. Differential equations. Analytical functions. Elements of functional analysis]. Abrashina-Zhadaeva NG, Rusak VN, editors. Minsk: Belarusian State University; 2015. 391 p. Russian.

19. Abrashina-Zhadaeva NG, Timoshchenko IA. *Osnovy vektornogo i tenzornogo analiza. Teoriya. Zadachi* [Fundamentals of vector and tensor analysis. Theory. Tasks]. Minsk: Belarusian State University; 2011, 255 p.

20. Abrashina-Zhadaeva NG, Berezkina LL, Gletsevich MA, Filipava NK. *Analiticheskaya geometriya* [Analytical geometry]. Minsk: Belarusian State University; 2018. 242 p. Russian.

21. Abrashina-Zhadaeva NG, Timoshchenko IA. *Vektornyi i tenzornyi analiz v primerakh i zadachakh* [Vector and tensor analysis through examples and exercises]. Minsk: Belarusian State University; 2019. 250 p. Russian.

22. Chuprigin OA. *Matematicheskii analiz. Teoriya v testakh* [Mathematical analysis. Theory in tests]. Minsk: Belarusian State University; 2019. 183 p. Russian.

23. Rushnova II, Kabanova OS, Melnikova EA, Tolstik AL. Integrated-optical nematic liquid crystal switches: designing and operation features. *Nonlinear Phenomena in Complex Systems.* 2018;21(3):206–219.

24. Akhramenko VK, Ilyinkova NI, Rushnova II, Chekhmenok TA. *Matematicheskii analiz. Differentsial'noe i integral'noe ischislenie funktsii odnoi peremennoi* [Mathematical analysis. Differential and integral calculus of functions of one variable] [Internet]. Minsk: Belarusian State University; 2020 [cited 2021 July 20]. 180 p. Available from: https://elib.bsu.by/handle/123456789/250914. Russian.

25. Egorov AA, Rushnova II, Rybachenko IV, Shilin AP. *Matematicheskii analiz. Elementy differentsial'noi geometrii. Teoriya polya. Teoriya funktsii kompleksnoi peremennoi* [Mathematical analysis. Elements of differential geometry. Field theory. Theory of functions of a complex variable] [Internet]. Minsk: Belarusian State University; 2020 [cited 2021 July 20]. Available from: https://elib.bsu.by/handle/123456789/261138. Russian.

26. Egorov AA, Rushnova II, Rybachenko IV, Shilin AP. *Matematicheskii analiz. Primery i zadachi* [Mathematical analysis. Examples and tasks]. Minsk: National Institute for Higher Education; 2021. 157 p. (in press). Russian.

27. Abrashina-Zhadaeva NG, Akhramenko VK, Berezkina LL, Golubeva EN, Kashevsky VV, Chuprigin OA. *Matematicheskii analiz: teoriya, primery i zadachi* [Mathematical analysis: theory, examples and problems]. Minsk: Belarusian State University; 2021 (in press). Russian.

Received 06.08.2021 / revised 09.08.2021 / accepted 03.09.2021.