Žarko Mijajlović
Faculty of Mathematics, Belgrade, Serbia
Nadežda Pejović
Faculty of Mathematics, Belgrade, Serbia

DIMITRIJE DANIĆ AND HIS WORKS IN VIRTUAL LIBRARY OF THE FACULTY OF MATHEMATICS

Abstract. In this paper we present digitized works of Dimitrije Danić (1862-1932), first Serbian doctor of science in the area of mathematics and a prominent professor of the Military Academy in Belgrade. Digital copies of his monographs and text-books are deposited in the Virtual Library of the faculty of Mathematics in Belgrade. These works were digitized in the frame of the long-lasting digitization project *Digitization of scientific and cultural heritage*, run by the Mathematical institute in Belgrade and the Faculty of Mathematics in Belgrade.
Keywords: Dimitrije Danić, digitized works, mathematics, XIX century.

Introduction

This paper belongs to the series of articles on digitized books, doctoral dissertations and other writings deposited in the Virtual Library of the Faculty of Mathematics in Belgrade, (http://elibrary.matf.bg.ac.rs). The library was founded almost 20 years ago, see [**2**], [**3**] and [**4**], and it is one of the largest Internet oriented database in Serbia of digitized books, master and doctoral dissertations and other written texts. It is open to the general public and it is freely accessible. At the time of writing this paper, it contains about 4500 digitized items and several important collections, including about 500 digital copies of PhD theses of Serbian mathematicians and digital copies of several very rare Serbian books, some of them dating the 18th century.

In building this online database we had in mind the preservation in digital form first of all works in mathematical sciences and related texts of Serbian scientists from the past. We consider it as an important part and an approach as well to the preservation of scientific and cultural heritage of the Serbian people. The other and equally important goal is to present these works to the general and scientific audience using the modern information technologies. This work is supported predominantly by the Faculty of Mathematics in Belgrade and projects - funds granted by the Serbian Ministry of Education, Science and Technological Development. It is recognized and supported in certain forms also by the other Serbian scientific and cultural institutions, in particular by the Mathematical Institute SASA (Serbian Academy of Sciences and Arts), SASA itself, University Library in Belgrade and the National Library. These institutions are also the main sources of the material: books, manuscripts and other writings that are digitized and placed in the Virtual Library. However, the most important part of this activity is the work of the participants of the Digitization projects of the Faculty of Mathematics. Without their enthusiasm this library would not exist.

In this occasion we shall present digitized works of Dimitrije Danić, an outstanding Serbian mathematician from the end of XIX century and the beginning of the XX century. At the turn of the 19th to the 20th century appeared in Serbia first mathematical

books that could be considered as the university text-books, see [5]. Let us mention *Algebarska Analiza* (Algebraic Analysis) written by Dimitrija Nešića and published in 1883, and *Analitična Geometrija tačke, prave, kruga i koničnih preseka* (Analytic geometry of point, line, circle and conics) written by Bogdan Gavrilović, published in 1896. Books written by Dimitrije Danić belong to this collection of early Serbian high level text-books in mathematics.

Short biography of Dimitrije Danić

Dimitrije Danić was born on January 21,1862. in Belgrade where he finished elementary education, too. The secondary school he attended in Zurich. After that he completed three semesters at the Polytechnical School at Berlin and seven semesters at the Department of Natural Science and Mathematics of Berlin University, majoring in mathematics. He wrote doctoral dissertation *Conformal Mapping of Elliptic Paraboloid on Plane* at. Jena University, and defended it in 1885. So he became the first Serbian doctor of mathematics. In the same year he applied for the post of a lecturer of lower mathematical analysis at the Belgrade Higher School [1] and in 1887, too, but he was not accepted as full time professor. It is interesting that his opponent for this position was Bogdan Gavrilović, the second Serbian doctor of mathematics and later the rector of the Belgrade University and the president of the Serbian Academy of Sciences. Danić was teaching at the Higher School for a very short time. However, the students boycotted his lectures for some reason. On this occasion, at the request of the Minister of Education, the Rector "sentenced students, thirty of them, to two days in prison". However, this judgment was never enforced. Disappointed, and after this and other controversies, Danić joined the Military Academy where he was elected full time professor of mathematics, very soon, already in December 1888. He lectured there all type of courses in mathematics as a reputable and distinguished professor. According to school curriculum these subjects were of the same quality and level as courses taught at the Belgrade Higher School and later on at the Belgrade University.

Figure 1. Dimitrije Danić

---

[1] The Belgrade Higher School preceded the Belgrade University. This school was transformed to the university in 1905, when the King Petar I signed the decree of founding, *Act on Universities.* The *Higher School is also known as the Great School.* For details concerning the history of Belgrade University, see https://bg.ac.rs/en/university/history.php.

In teaching at the Military Academy, professor Danić was very strict professor and a person of high criterion but fair to his students. Besides his pedagogical work, he was also interested in the problems of military sciences. For example he was involved in problems of inner and outer ballistics of various arms and weapons. He was analyzing the results of combat marksmanship, fire dispersion and marking of the target. In his analysis he applied his knowledge on Jacob Bernoulli's independent experiments. For his distinguished achievements he was decorated with the Order of St.Sava of IV, III and II class.

Danić was teaching at Military Academy till his retirement. He died in Belgrade on March 23, 1932.
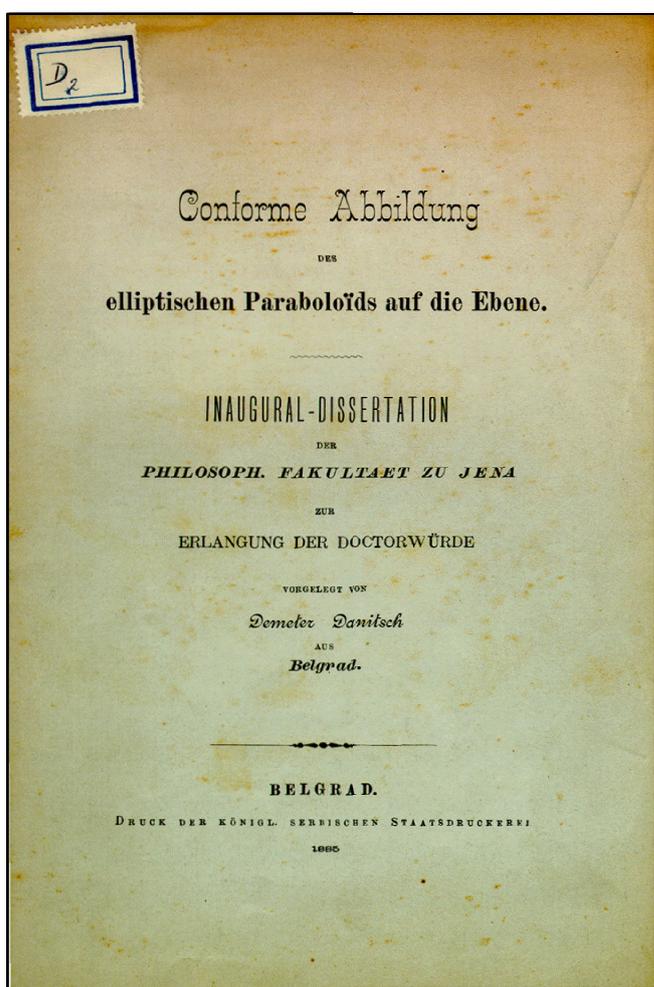
Doctoral dissertation

Figure 2. Cover page of Danić's dissertation

In his doctoral dissertation Dimitrije Danić considered conformal mapping of elliptic paraboloid to plane based on Gauss definition. In his work he used differential and integral calculus for solving obtained differential equations and along this work he had to solve complex elliptical integrals. His other contribution was introduction of elliptical transformations and use of elliptical functions in connection with elliptical integrals. From the modern point of view it could be said that he was working in the theory of complex functions of complex variables. Having in mind the time when this work was done and the level of development of mathematics in Belgrade, then the only center of higher education in Serbia, it could be concluded without any doubt, that his dissertation represented significant contribution to the development of mathematics in Serbia. On 17th March 1885 Danić passed examinations in mathematics, examined by Johannes Thomae, analytical mechanics and physics, examined by professor Sohnke. As a result he was awarded Ph. D. degree. The thesis later was published in Belgrade, but since it was written in German, Danić used a Germanized version of his name *Demeter Danitsch*, as can be seen on Figure 2. The scientific achievements in Danić's dissertation are explained in more details in [7]. Dušan Đurišić, professor of the Military

Academy, translated later, most probably in the second half of XX century, Danić's dissertation into Serbian. Digital copy of this hand-written translation is deposited in the Virtual library [8].

It seems that Danić did not have other scientific contributions or written papers. Ernest Stipanić, professor of Belgrade University and historian of mathematics wrote once [6] that Danić published some papers in Germaine journals, but for this we did not find some evidences.

Here is probably good place to comment in short the question who is the first Serbian doctor of mathematics. The natural candidate is Ruder Boskovic (1711–1787), the polyhistor and the greatest South Slav mathematician and astronomer. Nevertheless, under the circumstances that ruled Serbia until the first half of the nineteenth century, it is not so easy to answer this question. Serbs were conscious of their nationality as early as in the Middle Ages, which by European standards is considered to be very early. However, the spreading the Ottoman Empire and fall of the Serbian Empire stopped their natural development abruptly and any possibility of scientific or cultural development disappeared. By the early 19th century all Serbian countries remained enslaved, and the people were subjected to a persistent and systematic denationalization program. This program can be described "in the style of Aristotle's syllogisms" as follows:

1. The imposition of a foreign religion: Roman Catholic in countries under Austrian, Hungarian or Venetian rule, or Islam in countries under Ottoman's rule,
2. Equalizing the terms Serb and Orthodox.
3. Drawing the "logical conclusion" that people who are not Orthodox may not be Serbs at all.

Some sources as the Soviet dictionary, *Biografičeskij slovar dejatelej v oblasti matematiki*, Kiev, 1979, state that Bošković and even Marin Getaldić were Serbo-Croats. Jovan Dučić claims that the name Boško exists only within Serbs, which clearly indicates the origin of Ruđer Bošković, regardless of his religion [1]. Bošković used to say for himself that he is of Slavic origin. Bošković's father Nikola was an Ortodox Serb, but later he turned to Catholicism. Bošković's mother was of the Italian origin. Therefore we cannot talk with certainty about the nationality of Ruđer Bošković (1711–1787), a Jesuit nun and a Catholic scholar who most of his life spent in Italy and France. What we can say is that Bošković was one of the many of our talented people who had left their homes in search of knowledge, who lived and worked throughout Europe, where they have become immersed in other people's cultures.

Although some parts of Serbian country *de facto* gained independence much earlier, so it was until the Berlin Congress in 1878 when Serbia's independence was recognized *de jure*. Shortly afterwards the first Serb, Dimitrije Danić, became a doctor of mathematics.

Danić's Text-books

Dimitrije Danić wrote eight textbooks and manuals:

1. *Formulas and Theorems in Trigonometry* (1888);
2. *Analytical Geometry on Plane* (1893);
3. *Lectures on Trigonometry with Theory of Logarithm and Complex Numbers* (1889);

4. *Foundations of Infinitesimal Calculus — Differential Calculus* (1920);
5. *Foundations and Theory of Combination and Principles of Probability* (1921);
6. *Foundations of Infinitesimal Calculus and Integral Calculus* (1922);
7. *Analytical Geometry of Plane and Space* (1922);
8. *Formulas and Theorems of Mathematics* (1927).

All those works consist of over 2.000 textbook pages. Some of the textbooks were thematically pioneering works in Serbia, as for example Analytical Geometry of Plane and Analytical Geometry of Space, or Foundations of Theory of Combination and Principles of Probability.

At the end of World War I, Mihailo Petrović Alas, Bogdan Gavrilović and Milutin Milanković founded the Belgrade Mathematicians Club. Danić did not belong to that circle, nor did he attend Club meetings. The reason was probably the circumstances during his early attempts to get a professorship at the High School.

On the other hand, Danić wrote excellent textbooks for the Military Academy students that could be measured both in content and in a style with the best university textbooks. The books were characterized by high precision, completeness and beautiful graphic attachments. It seems that these textbooks were used by students from other faculties of the Belgrade Higher School, later University, too, especially technical ones. The reason was that there were no other textbooks, particularly at the end of the XIX and the beginning of the XX centuries.

The only professors at the Belgrade Higher School since 1896 to 1909 were Bogdan Gavrilović and Mihailo Petrović. In 1909 came Milutin Milanković for the professor of applied mathematics. Three of them were the only professor and lecturers of mathematics at Belgrade university until the appearance of Mladen Berić and Sima Marković, first mathematicians who earned their doctoral dissertations in Belgrade. The reason for the lack of the text-books is probably the fact that Petrović, a professor at the Faculty of Philosophy, mostly wrote monographs, and his students as a rule learned from his scripts. Gavrilović, who taught at technical colleges, wrote two excellent books, the first in the theory of determinants, the second one in the theory of second-order curves. Both books could be compared to the world's best works in the field. But these books were first of all and foremost monographs and rather difficult to access for the average student. The following somewhat anecdotal story witnesses this state at the University. The first author of this paper owns Gavrilović's book on the second – order curves which consists of two volumes, each having about 450 pages. Fore edges in the text block of about 40 leafs were blackish from the use dirt, while the rest of them in both volumes were quite white. It means that the former owner never opened most of the pages in the book.

Another feature of Danic's books is supplements from the natural sciences that relied on mathematics. These additions that usually came after the basic text were on mechanics, astronomy, geodesy and cartography. This fine feature was certainly of the great benefit to the general student of natural science, or of some technical faculty.

Contents of these books are extensively discussed and in details presented in [7].

Besides the doctoral dissertation, in the Virtual Library [8] there are digital copies of the Danić's books 3, 4, 8. Besides that there are digital copies of two hand written manuscripts:

1. *Теорија конформног снимања и њена примена у Картографији и Вишој Геодезији* (Theory of conformal mapping and its application to Cartography and Higher Geodesy), IV+147, Belgrade, end of XIX Century.
2. *Теорни основи Методе најмањих квадрата* (Foundation of the least square method), II+78, Belgrade, end of XIX Century

Page 50 from the script
Theory of conformal mapping and its application to Cartography and Geodesy

Page 22 from the script
Foundation of the least square method

Both scripts are certainly written before the Great War and are part of the famous collection of 24 manuscripts (see [5]) that belonged to Borivoj J. Pujić, a student of mathematics at that time. This unique collection of manuscripts owns the Mathematical Institute SASA. A reader of these scripts can see that the mathematical tools used in both of them are advanced, while the approach and the presented material is modern for that time.

Conclusion

Dimitrije Danić was the first Serbian doctor of mathematics and also an important and outstanding mathematician and the professor of mathematics at the Military Academy in Belgrade at the end of the XIX and the beginning of XX century. It is considered that he wrote several first-class manuals and text-book on mathematics used at the Academy. We also presented here for the first time scripts of his lectures that witnesses on the high level of his lectures.

Acknowledgment

References

1. J. Kečkić, *Serbian Doctors of Mathematics in the 19th Century,* Publ. Inst Math. 38(52), 1985, 3–6.
2. Mijajlović, Ž, Ognjanović, Z, Đorđević, N, Zečević, T. *Virtual Library -- data base of textual data*, NCD Review, 5 (2004), 42-48.
3. Mijajlović, Ž. 2009 *Application of information science in digitization of scientific and cultural heritage*, Proc. Conference: Mathematical and Information Technologies - MIT 2009, Kopaonik, Serbia, eds. J. I. Shokin et al., Publ: PMF Univ. Priština (Kos. Mitrovica), Inst. Comput. Technol., Siberian brunch RAN, Novosibirsk, Russia, August 5-8**,** 232–239**.** (CompSci, ISBN 978-86-7412-052-1, http://mit.rs/2009/zbornik.pdf), n2009.
4. Mijajlović, Ž, Ognjanović, Z., Pejović, A. *Digitization of mathematical editions in Serbia*, Mathematics in Computer Science, 3(2010), 251–263.
5. Mijajlović, N. Pejović, *Twenty four manuscripts in the Virtual Library of the Faculty of Mathematics in Belgrade*, NCD Review, 25(2014), 29–35.
6. E.Stipanić, *Putevima razvitka matematike*, 1988, Beograd
7. R. Vučićević, *Dimitrije Danić*, ed. *Život i delo srpskih naučnika*, knj. 2, SANU, 1997, 188–220.
8. *Virtual Library* of the Faculty of Mathematics in Belgrade, http://elibrary.matf.bg.ac.rs.

zarkom@matf.bg.ac.rs
nada@matf.bg.ac.rs