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TWENTY YEARS OF VIRTUAL LIBRARY OF MATHEMATICAL FACULTY IN BELGRADE

Abstract. The aim of the article is to review work and history of Virtual library of Faculty of Mathematics in Belgrade since its foundation. Several interesting books, collections and documents deposited in the Library are presented, too. Some statistics related to the work of the Library is given.

Keywords. virtual library, electronic editions, history of science

1. Introduction

Virtual library (VB) of the Faculty of Mathematics of the University of Belgrade was founded twenty years ago. At this moment, about 5,000 units, books and digital versions of various printed documents, written by more than 4500 authors and coauthors, are deposited in the library. Since 2010, the library has had more than 300,000 visits and tens of thousands of downloads. This digital library contains relatively large and complete collection of retro-digitized books in mathematical sciences of Serbian authors, in particular written by the authors from the past. VB is open and accessible to the general audience. Even if the most documents in the library are in Serbian, about one half of the visits are coming from other countries and from all regions of the World. Our project for the library was at the beginning mathematically inclined, but since 2010 we started to include books from other areas of science and literature. However, the preference is still given to Serbian authors in mathematics and works related to South-East European (Balkan) area.

Today, the library has an important role in academic life not only at the Faculty of mathematics but also in the wider students and scientific community in Serbia. It is a good place where one can find reference works in mathematical sciences, in particular difficult to find books printed in Serbian and early works of Serbian mathematicians and scientists who were working in related areas such mechanics and astronomy. On this occasion, we present some historical and statistical data on the work of the Library, some of the most valuable collections, interesting books and other documents from the Library.

2. History

First idea for founding a digital library where works of Serbian mathematicians would be deposited appeared at the beginning of 2000, about at the same time when National Center for Digitization (NCD) was founded and its bulletin, the journal NCD Review (first issue was published in 2003). At the same time first conferences on digitization of scientific work and cultural heritage were organized (first held in the autumn of 2000). Some of these conferences were international, while the papers in NCD Review are published in English. Activities of the Library as well as reviews of most important digitized documents in possession of VB are published regularly in the journal. More

than fifty articles on this matter were published there, in 42 volumes of the journal published up to present.

First version of the Virtual library was finished in 2007. This project was headed by Žarko Mijajlović, metadata were provided by Mijajlović and Zoran Ognjanović, while the programming was done by Nada Đorđević and Tijana Zečević. The project is announced in [1], where also the aims and technical characteristics of the library are described. The library became operational in 2007 and contained then several hundreds of books. This version of the library is still operational, but it is replaced by new version three years later.

The second version of VB came in 2010 and is implemented in DSpace [3], repository software in public domain. DSpace is intended for servicing a specific need as a digital archives system, focused on the long-term storage, and for building open digital repositories. The project was headed by Ž. Mijajlović, while Dušan Vasiljević and Nikolina Vukša Popović did programming and adaptation of the software system required for the library. Zoran Ognjanović and Vojin Jovanović from the Mathematical Institute in Belgrade, and Nadežda Pejović and Tijana Zečević from the Faculty of mathematics collaborated on the project and contributed to developing the new version of VB. This version of VB with some minor and cosmetic changes and additions is still in use. Metadata, such as Dublin Core [4] and MARC [5], that describes the content, structure, and context of the digital resources in a digital library, are supported in DSpace and are completely followed throughout the development of VB. Hence, VB allows users to find, identify, and use the resources, as well as to manage and preserve them. This also provides the possibility of exchange the documents with other libraries and we did some with **Europeana** a web portal created by the European Union containing digitised cultural heritage collections of more than 3,000 institutions across Europe VB has also an important feature, namely, content of the library is visible on the WEB up to the words in documents and is open to internet browsers for search. Hence all documents and their contents and metadata appear in user browsing if appropriate query is posted. Further details related to the functions of VB can be found in [3].

The project of VB has been supported by the Faculty of Mathematics in Belgrade, and by Ministry of education science of the Republic of Serbia.

3. Statistics

At the time of writing this report, VB contains 4987 books and other documents, organized in 15 communities following types of documents, from mathematical sciences to the works in art and humanities and from regional divisions according to the origin of documents, including Croatia, Slovenia and Macedonia to the periodicals and rara books. Each community is divided into collections and sub-collections, reflecting contents of the documents. There are 4580 authors, covering the period from the early XVIII century to today. The number of visits of VB is 329 580, gradually increasing, reaching more than 200 per a day.

Google provides WEB analytics [6] that tracks and reports website traffic of an Internet site. Search Console provides data showing how often users saw or interacted with links to or content from the site, in particular in Google Search. It gives statistics on:

- **Clicks:** How often someone clicked a link from Google to the site.
- **Impressions:** How often someone saw a link to the site on Google.

- **Position:** A relative ranking of the position of the link on Google, where 1 is the top most position, 2 is the next position, and so on.
- **CTR (Click-through rate):** The ratio *clicks / impressions*.

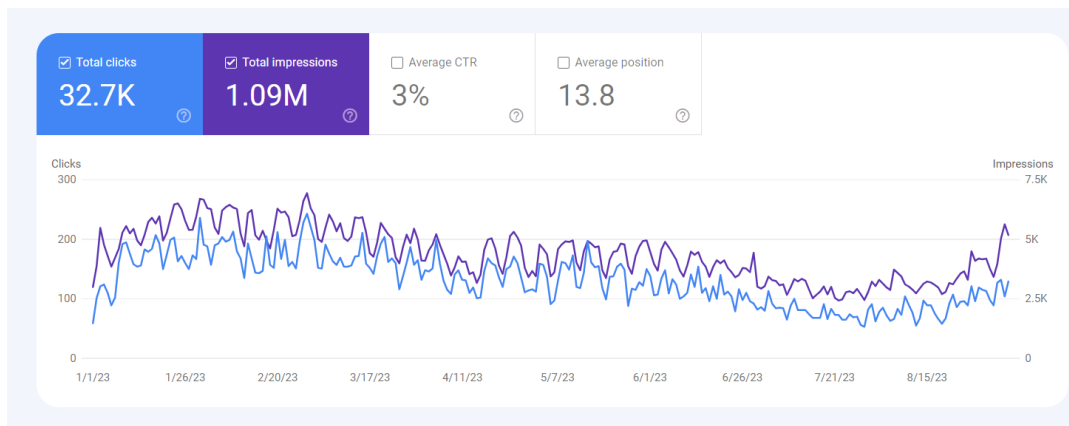


Figure 1. Google statistics of VB

Enclosed Google statistics shows data for VB for first eight months in 2023. We variations which corresponds to academic activities, the highest in winter time and the least during the summer with rising toward autumn. As there were about 33 000 clicks in the first eight months, the projection for the whole year would be 50 000 visits, or 150 visits per day.

Country	Clicks	Impressions	CTR	Position	Top queries	Clicks	Impressions	CTR	Position
Serbia	22756	579776	3.92%	10.64	sahovska otvaranja pdf	142	386	36.79%	1.75
Bosnia & Herzegovina	2721	54608	4.98%	12.24	logaritamske tablice pdf	124	468	26.50%	3.50
Montenegro	1833	54150	3.39%	10.75	polinomi srednja skola	75	660	11.36%	4.28
Croatia	631	17552	3.60%	14.33	etimološki rečnik srpskog jezika pdf	69	162	42.59%	1.59
Macedonia	506	14052	3.60%	12.10	elibrary	64	2257	2.84%	40.30
Germany	355	23180	1.53%	16.26	enciklopedija jugoslavije pdf	59	123	47.97%	1.29
United States	303	43506	0.70%	25.02	jovanka cubrilovic	57	595	9.58%	8.17
India	253	25512	0.99%	20.02	kroz vasionu i vekove pdf	53	683	7.76%	2.86
Kosovo	246	3972	6.19%	10.91	bulova algebra zadaci	49	197	24.87%	2.87
Unknown Region	235	5644	4.16%	12.15	šahovska otvaranja pdf	45	286	15.73%	5.30
Austria	162	7193	2.25%	13.35	jovanka čubrilović	42	280	15.00%	8.12
Slovenia	158	7185	2.20%	15.44	kockar dostojevski pdf	40	682	5.87%	7.65
Italy	128	8724	1.47%	13.84	polinomi zadaci srednja skola	40	560	7.14%	6.48
Turkey	115	7447	1.54%	18.69	trigonometrijske jednacine	39	1192	3.27%	8.16
Canada	110	6591	1.67%	17.98	matematika 1 pdf	36	233	15.45%	3.05
United Kingdom	105	11564	0.91%	17.23	etimologija srpskih reci	36	175	20.57%	6.02
France	103	9205	1.12%	16.64	kompletna knjiga o šahu pdf	33	469	7.04%	6.35
Russia	98	16788	0.58%	30.18	prirodni logaritam	31	1061	2.92%	6.87
Greece	85	3663	2.32%	13.47	katica hedrih	31	268	11.57%	10.85
Switzerland	83	5191	1.60%	14.66	dostojevski kockar pdf	30	518	5.79%	7.41
Netherlands	77	4646	1.66%	17.43	sajbija znacenje	30	382	7.85%	7.70
Bulgaria	67	5462	1.23%	13.68	takmicenje iz matematike za medicinske	30	116	25.86%	1.96
Poland	66	6183	1.07%	15.64	etimološki rečnik srpskog jezika	29	193	15.03%	4.15
Sweden	60	4068	1.47%	15.70	radioj kašanih	27	70	38.57%	4.36
Hungary	60	2227	2.69%	16.03	statika zadaci i resenja	26	334	7.78%	8.38
Brazil	53	11066	0.48%	26.09	e biblioteka	25	527	4.74%	9.86
Australia	53	4586	1.16%	17.94	genetski algoritam	25	269	9.29%	5.25
Japan	49	7817	0.63%	17.83	teorija skupova	25	247	10.12%	6.29

Figure 2. Excerpt from Google search statistics

The first table gives the number of accesses from various countries; while the second one statistical data which titles from VB that were most popular. Statistics for VB until 2015 is published in [2].

4. Collections and books

Perhaps most valuable collection in VB is “Doctoral dissertations”. It consists of 585 titles and includes all dissertations defended at the Faculty of mathematics since 1912. There are also dissertations of all Serbian mathematicians who defended their theses before Second World War, including eight written in the XIX century in then leading European centers, see [6]. There is, for example, thesis *Ensembles ordonnées et ramifiées* (Université de Paris, Sorbonne, 1935), written by Đuro Kurepa which significantly influenced development of modern set theory. Some of these works are difficult to find in printed form. An anecdote witnesses this statement. Recently was held a conference in Serbian academy of science and arts (SASA) on the occasion of the hundredth anniversary of the birth of the prominent Serbian philosopher and academician Mihailo Marković (1923-2010). One of the participants presented his doctoral dissertation *The Concept of Logic* (University College London, 1956). Before he started his talk, he said “I barely found Marković’s thesis. Someone, I don’t know who, where and when, posted it on the Internet.” It appeared that its retro-digitized version is uploaded in VB and the presenter used just this electronic copy of the thesis. In metadata about this item one can find when and who did it. Several articles are written about this collection and most of them are published in NCD Review.

VB also contains electronic copies most of editions, monographs and non-periodicals of the Mathematical institute of SASA and the SASA Institute for the Serbian Language. There are also a collection of collected works of 15 prominent scientists who were working in mathematical sciences, including all works of Mihailo Petrović Alas, the founder of Serbian mathematical school. Particularly valuable is collection, about 200 of them, of books on astronomy, written in XIX and XX century by Serbian scientists. The merit for collecting and digitizing these books belongs to Nadežda Pejović, professor of the astronomical department of the Mathematical faculty. She also wrote many articles about these books and their authors see for example [5].

We cannot enter here into complete analysis of rare books and fine collections deposited in VB. However, good source on this matter, including historical circumstances and biographies of the authors, are articles published in NCD Review. We also recommend the interested reader to consult [7], where an extensive overview of VB is presented. In this occasion we shall present shortly three original documents from VB which exist in the printed form only in one copy, each. They are not mathematical in nature, but witness and illustrate some events from Serbian history and life of Serbian people.

The first document is a collection of letters from prison written by Veljko Čubrilović (1886 - 1915), a Bosnian Serb and teacher. Čubrilović was a member of “Mlada Bosna” (Young Bosnia) and participated in the organization of the Sarajevo assassination of Austrian Archduke Franz Ferdinand 15/28. June 1914. The District Court of the National Government in Sarajevo sentenced him to the death penalty by hanging as a member of for high treason. The death sentence was executed in Sarajevo on February 3. These letters were written shortly before his execution and are correspondence with his wife Jovanka and daughter Nada. We received the correspondence thanks to the courtesy of Vera Vujčić-Kovačević, Veljko’s granddaughter and professor of mathematics at the University of Belgrade.

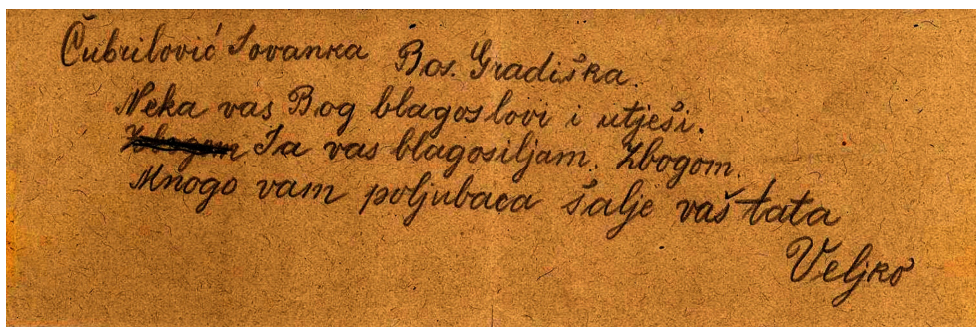


Figure 3. The telegram that Veljko sent to his wife and daughter before leaving for execution

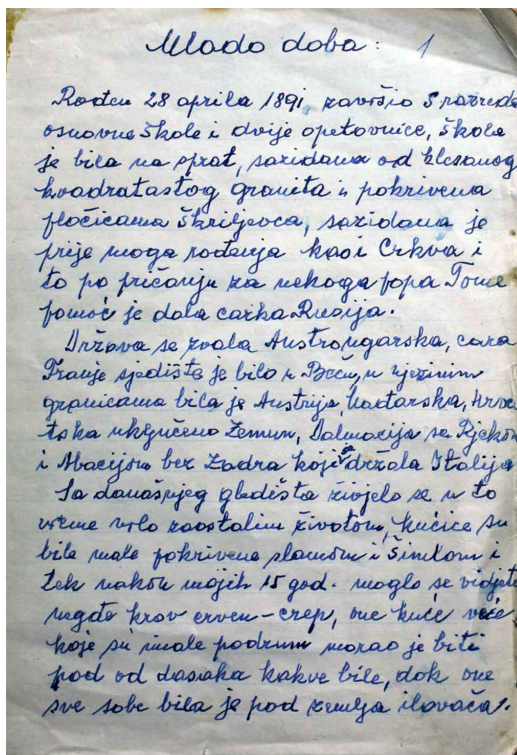


Figure 4. First page from Milan's diary

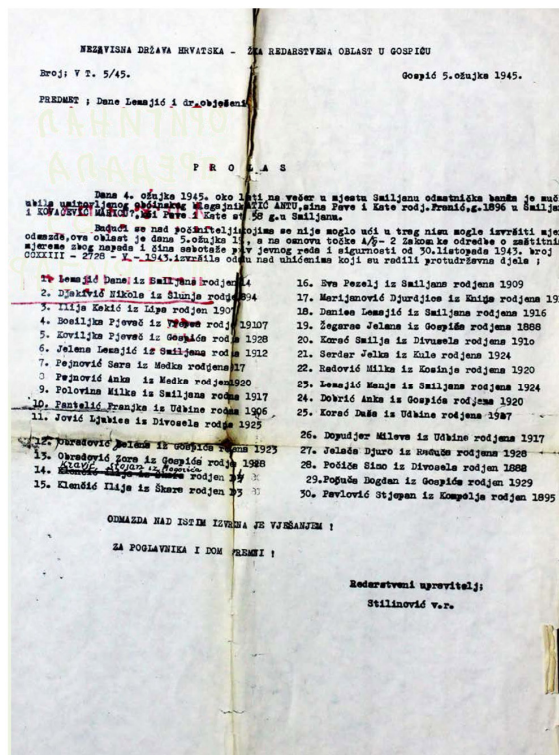


Figure 5. Report on execution by hanging of 22 women and 10 men on March 5, 1945. At number 10 is Franjka, Milan's wife

The second document is *Sećanje na minuli život* (A memory of past life), diary of Milan Pantelić, Serb from a village near the infamous place Jadovno, where many innocent victims were killed by Ustasha in 2WW on racial and religious grounds, mostly Serbs and Jews. Milan describes in his diary interesting and adventurous events during the First World War, first as an Austro-Hungarian, then Serbian and finally as a Russian soldier. His war journey lasted seven years and during that time he was in Serbia, Romania, Bulgaria and Russia, where he fought in Odessa, Kiev, Lugansk and Caucasus. Almost at the end of 2WW Ustasha killed by hanging his wife Franjku, even if she was of Croatian origin. Milan died in the middle of 1950-ies. This short diary contains also interesting ethnographic descriptions of country life in the late XIX century in Lika, now a part of Croatia. The diary is accompanied by original document, the order of NDH (The Independent State of Croatia, a 2WW-era puppet state of Nazi Germany and Fascist Italy) for execution by hanging 32 persons, mostly women, aging 15-60 years. We received this document thanks to the courtesy of Mrs. Mira, Milan's daughter, retired teacher.

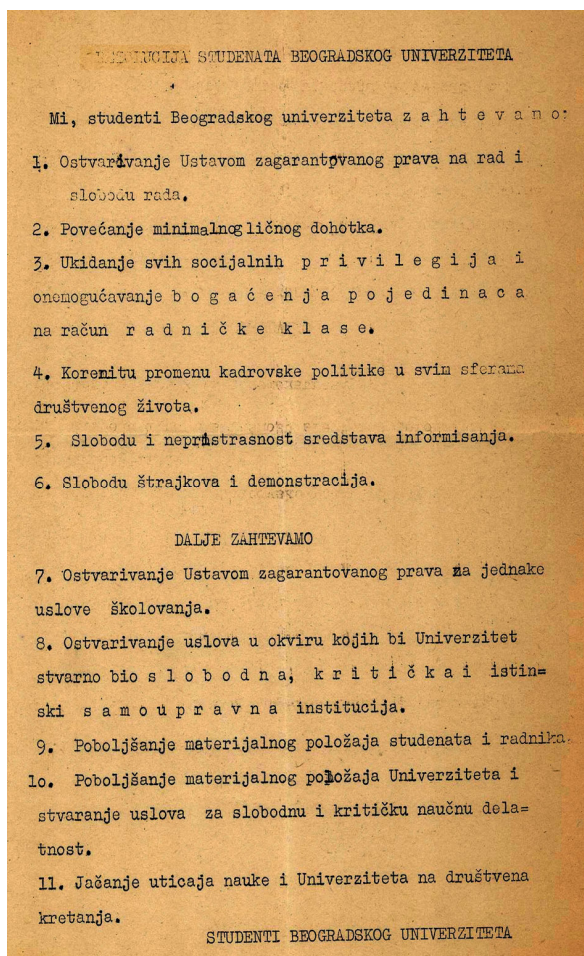


Figure 6. The first page from Student resolution

The last, only four page long document is *Resolution of students of the Belgrade University*, written during student protests emerged and ended abruptly after only seven days in June of 1968 at Belgrade University. This was in fact leftist movement leded by eight professors of the Faculty of Philosophy, the unorthodox Marxists of the Praxis school (Praksisovci). Josip Broz Tito gave for the right to students and so the protest ended. Interestingly, the leaders of the protest became later politically active and at times occupied the highest positions in Serbia – Dragoljub Mićunović as one of the founders of the modern Democratic Party and the Speaker of the Parliament, former Serbian President and Prime Minister Vojislav Koštunica and former Prime Minister late Zoran Đinđić. While some members became strong anti-nationalists and anti-war activists, other embraced Serbian nationalism, therefore leading the intellectual split of Praxis school into two schools. This document belongs to the author of this article.

5. Conclusion

Digitization of books and other documents aroused in print-only era is one of the most important goals that should be done as they provide invaluable historical records and are a part of the national heritage. VB is small project, it has deficiencies, but fulfils the main task, to preserve most valuable works in mathematical sciences written by early Serbian scientists and even some rare books and documents from other areas. Today, we have in VB such works as the first mathematical book written by Vasilije Damjanović in Serbian in 1767; probably the most important Serbian scientific work *Kanon der Erdbestrahlung*, published by Milutin Milanković in 1941, then the first translation of Bible into Serbian done by Atansije Stojković in 1830, first Serbian SF fiction *Jedna ugašena zvezda* written by Lazar Komarčić in 1902, just to mention few. We hope that VB will continue this somewhat silent but important mission.

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