



Mihailo Petrović

ALAS

Life
Work
Times



Serbian Academy of Sciences and Arts







SERBIAN ACADEMY OF SCIENCES AND ARTS

MIHAILO PETROVIĆ ALAS: LIFE, WORK, TIMES
ON THE OCCASION OF THE 150th ANNIVERSARY OF HIS BIRTH

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Exclusive editions, such as this monograph, call for the engagement, enthusiasm and cooperation of a number of individuals and institutions. We would like to use this opportunity and extend our gratitude to everyone who has taken part or in any way contributed to, or supported the creation and publication of this monograph.

First of all, we would like to express our gratitude to the authors of papers for their effort taken to provide expert and high level insights into some main points of Mihailo Petrović Alas' life and work, at the same time preserving an important aspect of being easy to read and appealing to a broader readership. In addition, we would like to thank to Ms. Snežana Krstić-Bukarica and Ms. Nevena Đurđević from SASA Publishing Section for performing a thorough proofread of the papers, thus making the writing even more articulate.

The monograph features a number of photographs and the copies of documents that have been obtained owing to the kindness of the SASA Archive, SASA Library, SASA Mathematical Institute, Archive of Serbia, Mr. Viktor Lazić from the "Adligat" Society, Mr. Jovan Hans Ivanović and his "Mihailo Petrović Alas" Foundation, "Mihailo Petrović Alas" Primary School, "Svetozar Marković" University Library, Belgrade City Museum, Zavod za udžbenike (Institute for Textbook Publishing) in Belgrade, Virtual Library of Faculty of Mathematics in Belgrade and Digital Legacy of Mihailo Petrović Alas.

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Finally, we would like to express our gratitude to Mr. Mirko Milićević from the publishing house "Dosije Studio" for excellent prepress preparation of the monograph.

S. Pilipović, G. Milovanović, Ž. Mijajlović

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EDITOR'S FOREWORD

As soon as one first encounters the work of Mihailo Petrović, it becomes evident that he was a person that according to its numerous traits was a polymath. Above all, the academician Petrović was a gifted mathematician and a renowned professor at the University of Belgrade, but also a fisherman, writer, philosopher, musician, world traveler and a travel writer. He earned a degree in mathematics at the Belgrade Grand School and a licentiate degree in mathematics, physics and chemistry at the Sorbonne. At the age of 26, only a year after he had completed his studies, he defended his PhD degree in mathematics at the same university, as a student of the famous French mathematicians Henri Poincaré, Charles Hermite and Charles Émile Picard. In the same year (1894) he was elected to the position of professor at the Grand School to which he brought the spirit of the French mathematical school. It was at that point that his long and prolific journey through science began, whereas, owing to him, Belgrade achieved parity with other major European centers in mathematical sciences. He became an initiator and a leader of the Serbian mathematics and strongly contributed to the spirit of the modern European science in Serbia.

Petrović's expertise spanned several mathematical areas in which he achieved scientific results of world-class relevance: differential equations, numerical analysis, theory of functions of a complex variable and geometry of polynomials. He was also interested in natural sciences, chemistry, physics and biology, and he published scientific papers in these fields, too. In his scientific endeavor he managed to meet the most rigorous standards of the most developed European countries. In a brilliant rise, in a few years' time, up to the early 20th century, he wrote around thirty papers that he published in the leading European mathematical journals. It was due to this fact that he was elected a member of the Serbian Royal Academy as early as at the age of 30, and soon after he became a member of a number of foreign academies and prominent expert societies. He won the greatest respect of the global mathematical community: he was among few mathematicians (13) who delivered at least five plenary lectures or lectures as a visiting lecturer at the International Congress of Mathematicians (ICM). He delivered five such lectures (1908, 1912, 1924, 1928 and 1932). One such invitation has been considered by the mathematical community as an equivalent of an induction to a hall of fame. In addition, it has been considered that Petrović was a founder of new scientific disciplines, namely mathematical phenomenology and spectral theory. He invented several analogue computing machines, possessed technical patents and was the main cryptographer of the Serbian and Yugoslav Army.

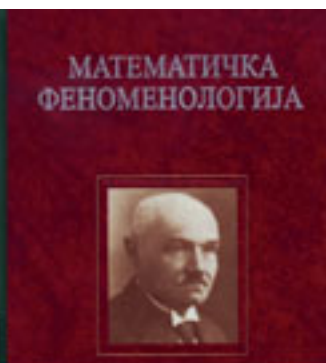
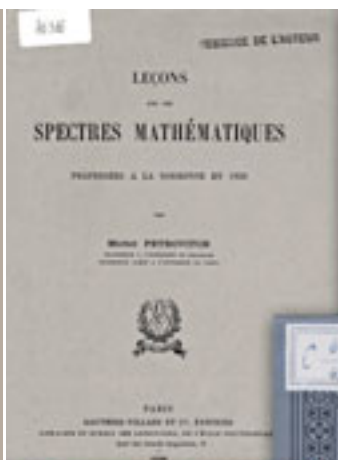
Up to the Second World War he was the mentor of all doctoral thesis in mathematics defended at the University of Belgrade. Aforementioned is related to one of professor Petrović's greatest and most important achievements – he was a founder of the Serbian mathematical school that has produced a great number of renowned and successful mathematicians not only in Serbia but also around the world.

In 2018, the Serbian Academy of Sciences and Arts and mathematicians in Serbia celebrate the 150th anniversary of the birth of Mihailo Petrović Alas. Throughout this year, the Academy has organized a large exhibition dedicated to Petrović, alongside a solemn gathering and a conference. This monograph commemorates this important jubilee of the Serbian mathematics. Given the fact that a lot of articles on Petrović have already been written, and that his collected works were published at the end of the last century, the editors and authors of the papers in this monograph were faced with a daunting task of finding some new details from professor Petrović's life and career. Even more so given that his body of work is immense, spanning different scientific areas and encompassing topics that at first glance one finds difficult to combine. As Dragan Trifunović, Petrović's biographer and a man who most thoroughly studied his life and work, noted on one occasion that almost an institute was necessary that would encompass professor's entire body of work. Therefore, we set a relatively modest goal to ourselves to shed light upon some main points of Petrović's life and work, times and circumstances he lived in, as well as to elaborate on the present developments in relation to the Serbian mathematical school, through a selection of papers. The authors of the papers steered clear of technical details and excessive use of mathematical language. Hence, the monograph is intended for a broader readership, in particular to those readers who are interested in the history of Serbian science and its evolvement at the turn of the 20th century, but also to those who want to gain a deeper insight into the life of a brilliant mathematician and a polymath, and, we can quite freely say, an unusual personality.

Ž. Mijajlović, S. Pilipović, G. Milovanović



MIHAILO PETROVIĆ ALAS:
LIFE AND WORK



MIHAILO PETROVIĆ:
SELECTED BIBLIOGRAPHY

APPENDICES TO BIBLIOGRAPHY AND SOURCES OF DATA

Prepared by Žarko MIJAJLOVIĆ and Stevan PILIPOVIĆ

Mihailo Petrović left behind more than three hundred science works in the field of mathematics and about one hundred works in other areas. He also published around twenty university textbooks and monographies. Petrović has very large opus in numerous fields, from mathematics and its applications to travelogue novels and fishing. He was publishing his works in the most famous world's magazines, books for the leading publishers, but also in domestic publications, and even in local magazines and newspapers. Some of his works were re-printed, while others were collected into thematic wholes and re-published that way. Manuscript *Stereometric inequalities* was printed in Collection of works of SAS XXXV only in 1953, ten years after Petrović's death. After the World War II, summarized compilations of Petrović's travelogues were published as separate editions and under different title. Regardless of editors' efforts in preparation of such editions, those books have to be credited to Mihailo Petrović. Having all this in mind, it is very complicated to gather the complete and accurate bibliography of Mihailo Petrović. Fortunately, this important and hard work was done very well and very thoroughly by Dragan Trifunović, definitely the best expert when it comes to professor Petrović's career. Trifunović's compilation of Petrović's bibliography can be found in several places, but the most complete version, together with numerous comments, registers, indices and other auxiliary texts is in the 15th book of Collected Works of Mihailo Petrović. In the same book there is a big list of sources and



contributions of other authors on Mihailo Petrović. This book, thanks to Institute for Text-book Publishing in Belgrade and engagement of academician Gradimir Milovanović, is publicly available via internet (see paragraph *electronic sources* in this appendix) in Digital legacy and Virtual library of Faculty of Mathematics in Belgrade. Let us also mention that almost entire Petrović's legacy is available there in digital form, as well as numerous authors' works on Petrović. The works which have been digitalized and uploaded into Virtual library or Petrović's digital legacy are marked in this bibliography with VB. Considering the easy availability of the material, before all of the mentioned Trifunović's compilation, we will mention here only excerpts from Petrović's bibliography and authors' contributions about him which are relatively new. Actually, the main goal of this selection is to point to versatility and broadness of Petrović's work. At the end, with the same goal, we are giving two interesting appendices on Petrović's membership in learned societies and his participation in work of various committees and boards.

Petrović published his scientific works and articles in 30 first-class foreign science magazines, and in the same number of domestic ones. The following list is brief excerption (according to Trifunović) from that list, together with number of published works in those magazines:

- *Глас Српске краљевске академије* (60),
- *Годишњак Српске академије наука и уметности* (20),
- *Rad Jugoslavenske akademije znanosti i umjetnosti* (12),
- *Bulletin de l'Académie royale de Serbie* (16),
- *Publications mathématiques de l'Université de Belgrade* (14),
- *Comptes rendus* (30),
- *Bulletin de la Société mathématique de France* (14),
- *Acta Mathematica* (1),
- *Mathematische Annalen* (3),
- *American Journal of Mathematics* (3),
- *L'Intermédiaire des mathématiciens* (9),
- *Věstník Král. české společnosti nauk* (6),
- *L'Enseignement mathématique* (8),
- *Rendiconti del Circolo Matematico di Palermo* (4),
- *Српски књижевни гласник* (13),
- *Гласник Југословенској професорској друштва* (6),
- *Тежак* (6),
- *Ловац* (6),
- *Полијика* (27).

Selected scientific works of Mhailo Petrović by 1900

1. О једној модификацији Грефеовој мейџода за решавање виших бројних једначина, first scientific paper, unpublished, 1886.
2. *Intégration graphique de certains types d'équations différentielles du premier ordre*, Bulletin de la Sci. Math. de France, 27, 200–2005, 1890.
3. *Sur les integrales uniformes des équations du premier ordre et du genre zéro*, Comptes rendus, Paris, t. CXVIII, 22, 1190–1193, 1894.
4. *Sur les zéros eū les infinis des intégrales des équations différentielles algébriques*, Thèses présentées à la Faculté des Sciences de Paris, N° 823, Gauthier-Villars, Paris, p. 109, 1894. (Doctoral thesis)
5. *Sommation des séries à l'aide des intégrales définies*, Compt. rendus, Paris, CXX, 15, 819–821, 1895.
6. *Sur l'équation différentielle binôme du premier ordre*, Compt. rendus, Paris, CXXI, 19, 632–635, 1895.
7. *Sur l'équation différentielle de Riccati et applications chimiques*. Vestnik kralovske, Sitzungsberichte der König – Böhmschen Gesellschaft der Wissenschaften, Praha, 39, 1–25, 1896.
8. *O diferencijalnim jednačinama prvog reda koje se mogu grafički integraliti pomoću g. Klerićevog šestara*, Glas LI, 18, 313–316, 1896.
9. *Sur les fonctions symetriques et periodiques des diverses determinations d'une fonction algebrique*, Bulletin des Sciences mathematiques, Paris, 2e serie, XX, 108–114, 1896.
10. *Remarques sur les équations de dynamique et sur le mouvement tautochrone*, American Journal of Mathematics, Baltimore, XVIII, 2, 135–144, 1896.
11. *Sur les résidus des fonctions définies par les équations différentielles*, Mathematische Annalen, Leipzig, t. 48, 75–80, 1896.
12. *Contribution a la theorie des solutions singulieres des équations différentielles du premier ordre*, Mathematische Annalen, Leipzig, 50, 1–3, 103–112, 1896.
13. *Sur un procede d'integration graphique des equations differentielles*, Comptes rendus, Paris, 1897, CXXIV, 20, 1081–1084, presented in French Academy of Sciences by professeur P. Appell, 17. 5. 1897, reprinted in *Journal de Physique*, Paris, 476–479, 1897.
14. *Sur l'équation différentielle lineare du second ordre*, Bulletin de la Societe mathematique de France, Paris, XXV, 8–9, 221–235, 1897.
15. *Quelques formules generales relatives au calcul des integrales definies*, Rendiconti del Circolo Matematico di Palermo, Palermo, XI, 6, 247–259, 1897.
16. *Хидраулична инџејрација*, Технички лист, Београд, 1898.
17. *Sur l'integration hydraulique des equation différentielle*, American Journal Math, Baltimore, 20, 4, 293–300, 1898.
18. *Sur une propriété des équations différentielles intégrables à l'aide des fonctions méromorphes doublement périodiques*, Acta mathematica, Stockholm, 1898, t. 22, pp. 379–386.

19. О електричним осцилацијама при исцртавању кондензатора, Глас СКА, LVI, 27–111, 1898.
20. Appareil à liquid pour l'intégration graphique de certains types d'équations différentielles, American Journal of Mathematics, Baltimore, Vol. XXII, No. 1, 1–12, 1899.
21. Прилози хемиској кинетици, Глас СКА, LVII, 207–277, 1899.

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1. О математичкој теорији активности узрока, (приступна академска беседа, саопштено 1. децембра 1899), СКА, Глас, књ. LIX, Први разред, књ. 22, Београд, 1900, стр. 183–247.
2. Jedno pitanje iz teorije funkcija sa dvjema nezavisno promjenljivim količinama, JAZU, Rad, knj. 143, Razred matematičko-prirodoslovni, knj. 29, Zagreb, 1900, str. 96–106.
3. Sur une classe d'équations différentielles du premier ordre, Vestnik Král, české společnosti náuk, Praha, 1901, Trida math. prirodovedecká, t. XXXI, pp. 1–20.
4. Remarque sur les zeros des series de Taylor, Bull. Soc. math de France, Paris, 1901, t. XXIX, pp. 303–312.
5. Generalisation de certaines formules de Stieltjes, Rendiconti Circ. Mat. Palermo, 1903, t. XVII, 327–334.
6. Sur une classe de séries entières, Comptes rendus, Paris, 1906, t. CXLIII, 4, pp. 208–210.
7. Jedna симетрична функција корена и њене особине, СКА, Глас, књ. LXXV, Први разред, књ. 30, Београд, 1908, стр. 75–100.
8. Procédé élémentaire d'application des intégrales définies réelles aux equations algébriques et transcendantes, Nouvelles annales des mathématiques, Paris, 1908, 4^e série, t. VIII, pp. 1–15.
9. Expressions diverses des fonctions associées, Bulletin de la Societe des Sciences de Bucarest-Roumanie, 1908, t. XVII, 1–2, pp. 11–19.
10. Télémètre à sextant, Brevet d'invention, Paris, 1910, Coll. XII (Instruments de précision, électricité), N° 413730 (avec M. Terzitch).
11. Allure d'une transcendente entière, Comptes rendus, Paris, 1912, t. CLIV, 8, pp. 499–501.
12. Principe de minimum dans les phénomènes électrodynamiques et électromagnétiques, Journal de Physique théorique et appliquée, Paris, 1912, 5e serie, t. II.
13. Une transcendente entière et son rôle d'élément de comparaison, Annales scientifiques de l'École normale supérieure, Paris, 1914, 3^e serie, vol. XXXI, octobre 1914, pp. 441–454.
14. Sur quelques fonctions des côtes et des angles d'un triangle, L'Enseignement mathématique, Geneve, 1916, t. XVIII, 3–4, pp. 153–163.
15. Remarques sur l'intégrales $\int uv dx$, L'Enseignement mathématique, Geneve, 1919, t. XX, 4, pp. 268–270.
16. Problèmes arithmétiques sur les équations différentielles, Bulletin Soc. mathématique de France, Paris, 1924, t. LII, pp. 514–519.
17. Correspondance entre la fonction et la fraction décimale, Proceedings of the V International Congress of Mathematicians, Toronto (Canada), 1924, pp. 449–455.

18. *Problèmes d'intégration qualitative en astronomie*, Annuaire pour l'an 1930, Publications de l'Observatoire astronomique de l'Université de Belgrade, 1929, t. II, pp. 121–124.
19. *Une application de la résultante de deux fonctions*, *Mathematica*, Cluj, 1930, t. IV, p. 33–37.
20. *A propos d'une récente application de l'astronomie à la climatologie*, *Memoires*, Publications de l'Observatoire astronomique de l'Université de Belgrade, Belgrade, 1932, t. I, pp. 7–12.
21. *Theoreme sur les integrales curvilignes*, *Publications mathemat. de l'Univers. de Belgrade*, 1933, t. II, 45–59.

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1. *Елементи математичке феноменологије*, СКА, Београд, стр. 788, 1911. VB
2. *Méchanismes communs aux Phénomènes disparates*, Nouvelle Collection scientifique, Directeur Émile Borel, Librairie Félix Alcan, Paris, p. 279, 1921. VB
3. *Феноменолошко њресликавање*, СКА, Београд, стр. 33. 1933. VB
4. *Меџафоре и алеџорије*, СКЗ, 1967, стр. 196.

Appendices: a. complete bibliography of Mihailo Perović and works of other authors which were a reaction to Petrović's mathematical phenomenology; b. Mihailo Petrović (biography). Both appendices were put together by D. Trifunović. VB

Scientific monographies and university textbooks:

1. *Les spectres numeriques*, Gauthier-Villars, Paris, 98, 1919. VB
2. *Leçons sur les spectres matheatiques*, Paris 1928. VB
3. *Integrales premieres a restrictions*, Gauthier-Villars, Paris, 58, 1929. VB
4. *Крийџоџрафија*, Београд, 1928.
5. *Рачунање са бројним размацима*, предавања на Београдском универзитету, издање Задужбина Луке Ђеловића-Требињца, Београд, стр. 193, 1932. VB
6. *Елиџиџичке функције*, предавања на Београдском универзитету, издање Задужбина Луке Ђеловића-Требињца, Београд, стр. 236, 1937. VB
7. *Иниџеџраџија диференџијалних једначина џомођу редова*, Београд, 1938; друго издање Универзитет у Београду, стр. 196, 1969. VB
8. *Један диференџијални алеџориџам и њеџове џримене*, СКА, Београд 1936.

University lectures

In the library of Mathematical Institute of the SASA there are 14 scripts by Mihailo Petrović, all of them manuscripts. Notes from the lectures were written by student Borivoje J. Pujić, in the period from 1910–1914. Titles of the scripts: *Теорија алеџбарских једначина*, *Теорија извода са џрименама*, *Диференџијални рачун*, *Геомеџџријске џримене диференџијалноџ рачуна*, *Иниџеџрални рачун*, *Геомеџџријске џримене инџиџеџралноџ рачуна*, *Обичне диференџијалне*

једначине, Парцијалне диференцијалне једначине, Линеарне диференцијалне једначине, Геометријске примене диференцијалних једначина, Аналитичка геометрија у равни, Аналитичка геометрија у простору, Основи теорије детерминаната, Теорија функција. VB

Travelogues and novels

1. *Кроз јоларну област*, СКЗ, Београд, стр. 248, 1932. VB
2. *У царству јусара*, СКЗ, Београд, стр. 270, 1933. VB
3. *С океанским рибарима*, СКЗ, Београд, стр. 254, 1935. VB
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7. *Велико јуџовање*, избор из Петровићевих путописа и сећања, приредио Драган Трифуновић, стр. 165, „Вук Караџић“, Београд, 1982. VB

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1. *Да ли рибе спавају*, Ловац, Београд, 1897, т. II, 9, стр. 61.
2. *La pêche en Serbie*, Exposition Internationale de Turin, Београд, 13, 1911. VB
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5. *Бердајски риболови у прошлости и у садашњости*, СКА, Београд, стр. 132, 1941. VB

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Video recording *Mihailo Petrović Alas's Hydro Integrator* (7.21 min)

<http://alas.mi.sanu.ac.rs/video/hidrointegrator.mp4>

Video recording on Mihailo Petrović Alas's fishing activities (10.12 min)

<http://alas.mi.sanu.ac.rs/video/ribarstvo.mp4>

Appendices

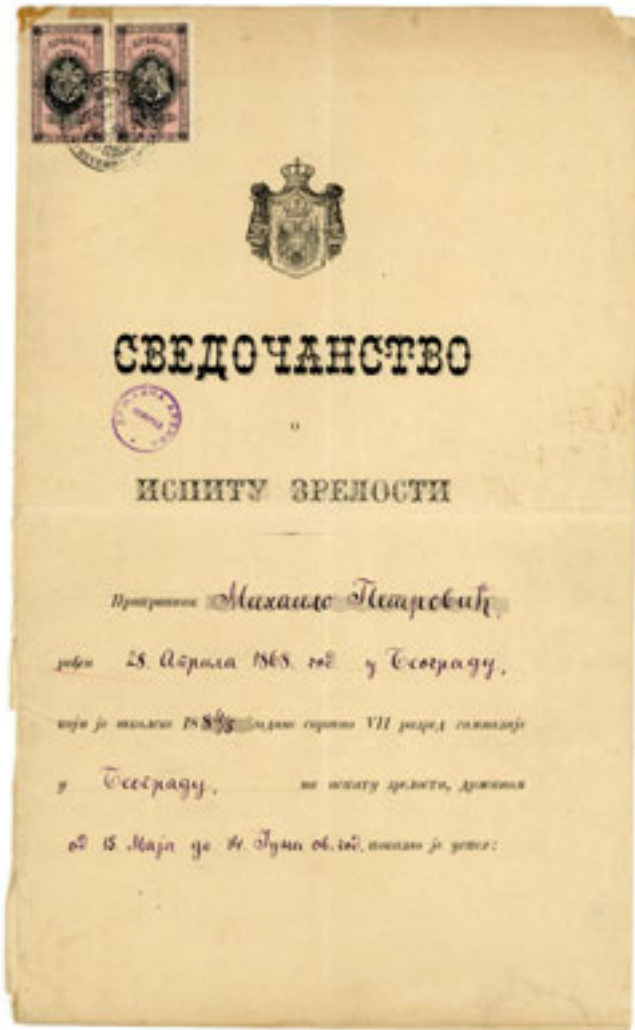
Member of academies, foreign and international societies: RSA (Royal Serbian Academy, corresponding member from 1897, full member from 1900), YASA (Yugoslav Academy of Sciences and Arts, corresponding member from 1897), member of Czech Academy of Sciences in Prague, Academy of Sciences in Warsaw from 1929, Academy of Sciences in Bucharest from 1929, corresponding member of Polish Academy of Sciences and Arts in Krakow from 1937, Société mathématique de France, Circolo matematico di Palermo, Société Française de Physique, Societatea de sciinte din Bucuresti, Deutsche Mathematiker – Vereinigung – Leipzig, Association

des docteurs des Sciences – Paris, Association française pour l'avancement des sciences (honorary president from 1928), international Committee for Unification of Terminology of Mathematical Physics – Berlin, ICMI (International Commission on Mathematical Instruction, since its founding in 1915), Shevchenko Scientific Society – Lviv, Rotary club, professeur agrégé at universities in Paris and Brussels.

Member of committees, boards, associations and societies: Committee for preparation of project of the laws of the Royal Serbian Academy, Committee for reviewing of the Academy's bills, representative of the Royal Serbian Academy in International Council of Scientific Unions; Association of university professors, Main Educational Council, Permanent Professorial Examining Committee, representative of Ministry of Education at maturity exams in gymnasiums in Belgrade, Kragujevac, Niš, Jagodina; part-time supervisor of secondary schools; Board for Literature in Nikola Čupić Foundation (elected to the vacant position upon death of writer Milan Rakić in 1938); Advisory Board of Ministry of People's Economy, Committee for passing of the first Law on freshwater fishing on lakes and rivers of Serbia in 1898, Committee for negotiations about signing Convention on fishing with Romania, as well as in negotiations about protection of fishing on Sava, Danube and Drina with Austria-Hungary; Board of Oceanographic Institute in Split, Committee for artificial fishponds of the Ministry of People's Economy, Belgrade Fishing Association (founder), Managing Board of the First Serbian Royal Preferential Shipping Company, Managing board of Association of Hunting Societies of Serbia; part-time inspector of Ministry of Agriculture and Waters.



Mihailo Petrović as a high school graduate of the First Belgrade Gymnasium, 1885 (SASA Archive, 14188/14)




Certificate of the maturity exam, 1885 (Archive of Serbia, MPS, F25, p207/894)



SASA Archive, 14197/II-22-3



SASA Archive, 14197/II-7


ПРЕДСЕДНИК
МИНИСТАРСКОГ САВЕТА

Београд 22-III 1909

Господине Професоре

Увек ми је навео на вас
за час Ј. Председник Министар.
Кои Ваван који је данас, 22.
Ово мес., касицу 4 и 5 час. са
може изложити још по нека и
на у овом сата, Београда улица 14.
Напомиње глумица, Ј. Професор,
Јурица који глуми са овоме

Милојковић



SASA Archive

An invitation to Mihailo Petrović to visit Stojan Novaković, the Prime Minister, 22 March 1909 ("Adligat" Society)



SASA Archive, 14188/27



Mihailo Petrović in the presidency of the First Congress of Mathematicians from Slavic Countries, Warsaw, 23–27 September 1929
(SASA Archive, 1419717)



ш.б.б.г. 2522

ЗАПИСНИК ДИПЛОМСКОГ ИСПИТА.

ГРУПА I Испитни предмети

А	Теориска Математика
Б	Ист. Математика
В	Фитика

КАНДИДАТ г.ца Зезаква Симић
 пријавио се да полаже Теориску Математику
 као први стручни предмет (раздео А).

Прегледав уписнице Испитни Одбор је ушардио да је
 кандидат испитно погодбе из члана 12. Уредбе Филозофског Факултета и да се
допусти приступити на испит.

10. Октобра 1928 год.
 у Београду.

ИСПИТНИ ОДБОР:

Чланови:

Председник,

Н. Симоновић
Млејковић

Мих. Петровић



Personal belongings of Mihailo Petrović in the hall of the elementary school in Belgrade that was named after him



Telemeter from 1910 –
Mihailo Petrović' patent which he constructed with general Milorad Terzić