Josef Úlehla and His Calculus Textbook

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Abstract. Josef Úlehla (1852–1933) was a Czech teacher of primary and secondary schools. His subject was mainly mathematics and natural sciences, but he was interested in many other areas and wrote about them too. This text describes the biography of Josef Úlehla and analyses the context, historical background as well as reviews of his calculus textbook entitled *Počet infinitesimální* (*Infinitesimal Calculus*).[1]

Introduction

Josef Úlehla was an important Czech teacher of primary and secondary schools and one of the pioneers of education reforms. He was a contemporary of T. G. Masaryk (*1850, the first Czech president) or Alois Jirásek (*1851, a Czech writer, an author of historical novels). He worked in the second half of 19th century and early decades of 20th century.

Josef Úlehla was born in Podivín on the 16th March 1852. During the studies he passed several primary schools around his home, then he continued at the grammar school in Strážnice and Brno. In summer 1872 Josef Úlehla finished his studies as a graduate of Teacher College in Brno, where he gained the authorization for teaching at primary and secondary schools. In the same year he started his pedagogical career. He taught at many primary and secondary schools in Moravia. In 1897 he became the director of a secondary school in Klobouky, at the same position he worked in Jaroměřice nad Rokytnou (1905) and in Strážnice[2] (also in 1905) until his retirement. In addition, he performed as an inspector of Czech schools in Vienna (1912−1914) and after the First World War, in time of the First Czechoslovak Republic, helped to establish the new school in Lipov.

Josef Úlehla died on 22th December 1933.

Josef Úlehla never taught at the university in his whole life. This fact highlights his professional work. We know him as an author of many pedagogical articles, which were published in Czech pedagogical magazines *Komenský*, *Pedagogické rozhledy*, *Učitel*, *Věstník Ústředního spolku učitelských jednot na Moravě* etc., and he also wrote a lot of monographs. For example we can mention his book *Dějiny mathematiky*,[3] which deals with the development of mathematics.

A few articles have been about the life and work of Josef Úlehla written, but recent history of mathematics is missing the overall mapping and evaluation of his profession work. This article discusses Úlehla's calculus textbook entitled *Počet infinitesimální* and puts it into the broader historical context.

Počet infinitesimální

Josef Úlehla published his textbook *Počet infinitesimální* in 1906. In 1944 the book was published again. First we describe some other similar books which were edited in that time.

Other contemporary textbooks of calculus

Fixing the Czech language in Czech lands in the 19th century benefited from the "success" of the Czech National Revival and became an important prerequisite for the publication of mathematical textbooks in the Czech language.

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[1] Úlehla J.: *Počet infinitesimální*. Dědictví Komenského, Praha, I. ed., 1906, *Vyšší matematika bez učitele, počet infinitesimální*. Česká grafická unie, Praha, II. ed., 1906.

[2] Podivín, Strážnice, Klobouky, Jaroměřice nad Rokytnou are small towns in south Moravia, the area of Úlehla's life and work.

[3] Úlehla J.: *Dějiny mathematiky*. Dědictví Komenského, Praha, part I, 1901 and part II, 1913. This book discusses the article Vízek L.: *Josef Úlehla (1852−1933) a jeho Dějiny mathematiky*. In J. Bečvář, M. Bečvářová (ed.): 32. mezinárodní konference Historie matematiky, Jevíčko, 26. 8. až 30. 8. 2011, Matfyzpress, Praha, 2011, str. 275−284.
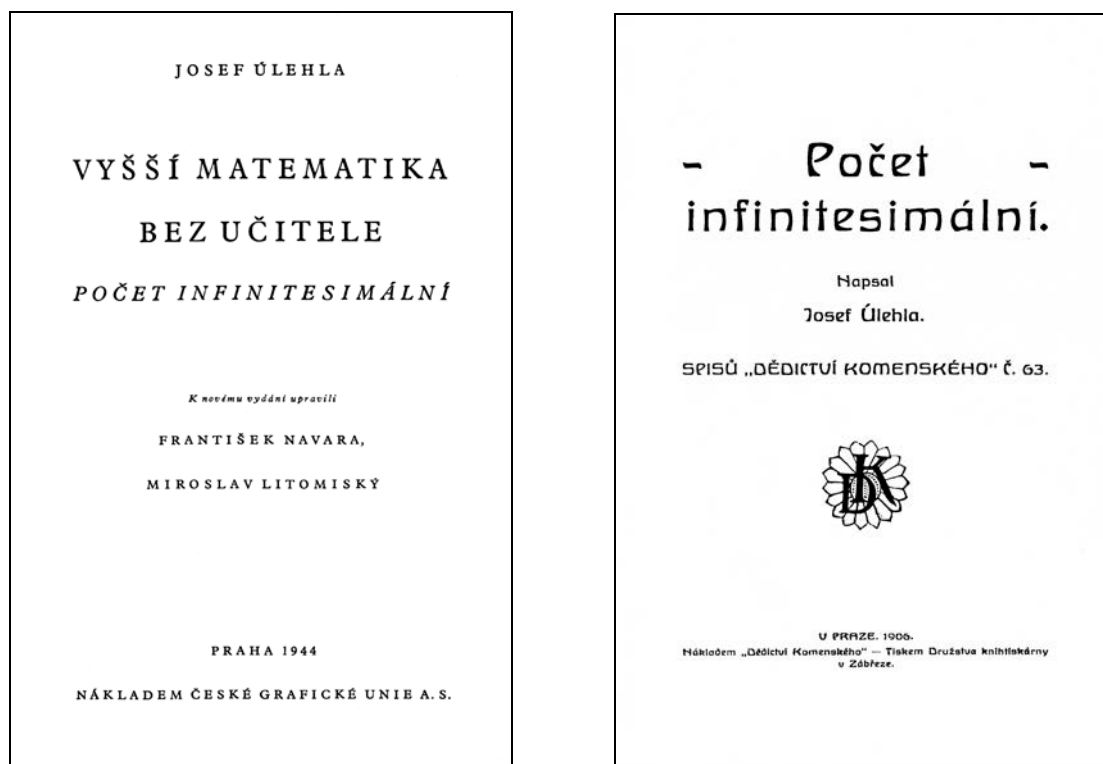
Figure 1. The main title of the first and second editions of the textbook.

The oldest comprehensive grammar school mathematics textbooks were published since 1860. The first and the only Czech study text of this kind on "higher mathematics," as the parts of mathematical analyse were called, is *Přídavek k algebře pro vyšší gymnázia*[4] (*The Addition to Algebra for Higher High Schools*) by Václav Šimerka (1819–1887). He published this thin book (only 56 pages) as an appendix to his grammar school textbook *Algebra čili počtářství obecné pro vyšší gymnasia*[5] (*The Algebra or else General Counting for Higher High Schools*). In the mentioned addition Václav Šimerka described the foundations of differential and integral calculus.

The first university study texts of mathematical analysis published František Josef Studnička (1836–1903) and Eduard Weyr (1852–1903). František Josef Studnička taught since 1864 at the Prague Polytechnic, there he published *Základové vyšší mathematiky*[6] (*The Basics of Higher Mathematics*), in which besides the basics of calculus wrote about differential equations and its applications in technical fields. Younger Eduard Weyr issued, for example, *Počet differenciálný*[7] (*Differential Calculus*), which used to be a substitution for the older textbooks by František Josef Studnička.

The analysis of *Počet infinitesimální* by Josef Úlehla

After textbooks, whose authors are mentioned above, Josef Úlehla published his own title. In the preface to this textbook he explained his motivation for writing:[8]

V literatuře naší není dosud elementární knihy, která by stručně učila základům počtu diferenciálního a integrálního. Šimerkův Přídavek k algebře jest příliš stručný, učebnice Studničkova a Weyrova jsou nesnadny pro začátečníky.

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[4] Šimerka V.: *Přídavek k algebře pro vyšší gymnázia*. Dr. E. Grégr, Praha, 1864.

[5] Šimerka V.: *Algebra čili počtářství obecné pro vyšší gymnasia*. Dr. E. Grégr, Praha, 1863.

[6] Studnička F. J.: *Základové vyšší mathematiky*. F. J. Studnička, Praha, part I, 1868, part II, 1871 and part III, 1867.

[7] Weyr Ed.: *Počet differenciálný*. Jednota čes. mathematiků, Praha, 1902.

[8] I. ed., preface, page I.

There is not an elementary book in our literature, which would briefly taught the basics of differential and integral calculus. Šimerka's addition to algebra is too short, and Weyr's and Studnička's textbooks are difficult for beginners.

Josef Úlehla knew the textbooks published by his contemporaries and he shortly reviewed them. He wanted by his textbook to help the graduates of Teacher Colleges, where, according to his own experience, the study of mathematics was neglected. The book was designed for autodidacts. This primary affected its style, but it also helped to its re-edition in 1944, which is described below.

The textbook is divided into two parts, entitled *Diferenciální počet* and *Integrální počet* (*Differential Calculus* and *Integral Calculus*). The first part describes derivatives of functions of one variable, calculation rules for derivations, derivatives of basic functions and Maclaurin's, Newton's and Taylor's series. In other chapters the readers can learn about logarithms, trigonometric and hyperbolometric functions and their derivatives. Finaly Josef Úlehla detailed analysis of function, he wrote about searching the maximum, the minimum or asymptotes. Basically the author used the concept of Gottfried Leibnitz, who divided the length of the curve into small parts, differentials. By contrast, František Josef Studnička worked with the Newton's theory of flux.

At the beginning of the part *Počet integrální* (*Integral Calculus*) Josef Úlehla briefly notes, that the differentiation and the integration are the other operations and remarks:[9]

Není obecných pravidel pro integrování, jsou jen pravidla zvláštní, jednotlivá.

There are no general rules for integration, the rules are just special, individual.

The textbook continues with the list of integrals of elementary functions (without any proofs). It contains many specific examples of calculating the indefinite integrals, explanation of the substitution method and the integration by parts. The largest passage is about definite integral, where the author describes the calculation of the length of the curve, the area under the graph, the surface area and volume of the solid of revolution etc. The second part ends with short chapter dealing with differential equations and their applications in physic. This chapter was attached to the text by František Nachtikal (1874–1939). The last pages show the solution of algebraic equations of the three degree and bring the list of analytic expressions of some special curves.

The review of Úlehla's textbook

There were written three reviews on the first issue of *Počet infinitesimální*. The first of them was published in the magazine *Komenský*.[10] and it was unsigned. The other two can be found in *Škola měšťanská*[11] and *Pedagogické rozhledy*,[12] they are signed by initials K. B. According to the style of these texts we can presume, that they were written by the same author. All reviews are very positive. They mentioned Úlehla's affable style of explaining and described the contents of the textbook. Except some misprints, the reviews did not mention about any negatives.

The second issue of Úlehla's textbook

The book was very popular, because of its simple and affable style. Its popularity led to its second edition. During the German occupation of Czech lands in the Second World War, the Czech universities were closed. Therefore people became autodidacts, when they wanted to study something at the highest level of education. The war also complicated the publication of new textbooks. František Navara a Miroslav Litomiský prepared Úlehla's *Počet infinitesimální* for re-publishing in 1944. This time it was titled *Vyšší matematika bez učitele* (*Higher Mathematics without The Teacher*).

The text of the second edition is the same in its contents, but it is not only a reprint. The type was made new. The redactors corrected the mistakes in the text, replaced some expressions of the older terminology by new terms and added the list of contemporary literature, from which the readers could study.

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[9] I. ed., page 53.
[10] Komenský 35(1907), issue 8, March 14, 1907, p. 123–124.
[11] Škola měšťanská 9(1907), issue 7, April 4, 1907, annex, p. 21–22.
[12] Pedagogické rozhledy 20(1906–1907), issue 8, May, 1907, p. 614–616.

Conclusion

The positives of the Úlehla's calculus were specified in reviews. They declare that the Úlehla's concept of a simple book was successful. His textbook is like the "cookbook." One of the negatives could be that Josef Úlehla didn't work with the contemporary theory of mathematical analysis including the "ε and δ arithmetic." He wrote just the result without any proofs or exact definitions. Josef Úlehla also didn't add any list of literature. He didn't mention the books, from which he studied, or the books, which could be useful for the readers in their further studies.

Nowadays Josef Úlehla and his publications can inspire. The author's life shows us, how the teacher, who started at a small primary school can be active and what he can do not only for students, but also for his subject. Úlehla's work invites us to his world and can open the doors of the history of our "Queen of the Sciences."

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