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Mathematicians of Bohemia, Moravia and Silesia in XVII–XVIII centuries

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MATHEMATICIANS OF BOHEMIA, MORAVIA AND SILESIA IN XVII – XVIII CENTURIES

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1 Introduction

We are going to present here some information about mathematicians of Bohemia, Moravia and Silesia in XVII–XVIII centuries. However, we do not pretend completeness. Even more, this paper cannot be complete. For example, we must omit such eminent mathematician as Johann Kepler (1571–1630) His mathematical activity represented e. g. either by *Nova Stereometria Doliorum Viniarorum* (Lincii 1615) or by *Harmonices Mundi* (1619) could be an object of a separate paper. His connections with Bohemia and Silesia are wellknown.

The text presented here is a modified version of my lecture given during the conference *Historie Matematiky* XXI which was held at Jevíčko (24–28 August 2001).

2 Jesuit mathematicians of Bohemia, Moravia and Silesia

Information about them can be found in [15], [17], [18] and [39]. Moreover, the book [15] contains informations about Jesuit mathematicians from Prague's Clementinum until 1740. The information in [17], [18] and [39] are not always complete and correctly documented.

Professors of Jesuit academies in Brno, Prague, Olomouc and Wratislavia kept close contacts. Some of them lectured for a time at one of the above mentioned universities and then at the other university. It was motivated not only historically but also by decisions of superior authority in Societas Jesu.

Balthasar Conradus (1599–1660) [18], [39]

F. Pelzel [18] states that Conradus was born in Nysa. He attended gymnasium in Olomouc and then in Prague. He spoke perfectly Latin, Greek, German, Italian, Czech, French and Polish. He studied also in Wratislavia (according to Wydra [39]). He published three papers.

Theodorus Moretus (1602–1667) [18], [39]

Wydra [39] states that Moretus died in Wratislavia. He also cites his ten papers. Moretus lectured in Clementinum in the years 1634/35–1641/42 [15]. Later he was in Wratislavia, from the list of his publications in [39]. He published six papers in Wratislavia. I have found no Moretus paper in Wrocław University Library quoted in [18] and in [39]. His *Tractatus physico-mathematicus* (Wratislaviae 1665) is not cited in [17], [18], [39] but is available in this library.

Sigismundus Ferdinandus Hartmann (1632-1681)

Hartmann was connected with Bohemia and Silesia. Wydra states in [39]:

Bohemus e Societate Iesu; et Matheseos in Vniversitate Pragensi Professor, ab singularem Geometricarum veritatum notitiam, Bohemia Euclides dictus, anno 1668. Edidit: Catoptrica illustrata propositionibus Physico-Mathematicis, de speculorum essentia, et proprietatibus. Item de minimis & maximis speculis. Pragae 1668. Tertiam partis.

I have found two treatises of him in Wrocław University Library: *Universa Philosophia* (1667) and *Cometa Anni* 1680. However, the paper [8] drawn up by the Editors of Acta Eruditorum had appeared after Hartmann's death. It is worth to tell something about this paper. He proves directly, without assuming Pythagorean theorem, that the sum of areas of equilateral triangles built on orthogonal sides of right isosceles triangle is equal to the area of equilateral triangle built on its hypotenuse. In other words he shows how to duplicate equilateral triangle. Next he gives a rather complicated proof of Pythagorean theorem. It seems that the proof is not widely known (see fig. 1)

In triangulo rectangulo quocunque ABC***, quadratum hypothenusae*** $ABVT$***, aequale esse duobus quadratis*** $BCpP$***,*** $ACQq$ ***[. . .].***

Hartmann proves it as follows. We have

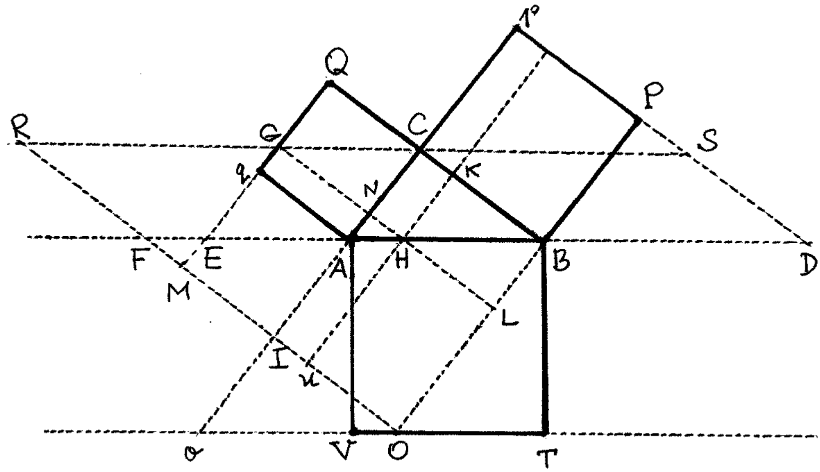

Fig. 1

$BCSD = BCpP$	(the same base BC and equal altitudes)
$ACGE = ACQq$	(the same base AC and equal altitudes)
$CGHB = CGEA$	(the same base CG and equal altitudes)

Thus: $HGSD = CGHB + BCSD = CGEA + BCPp = ACQq + BCPp$. On the other hand: $ABVT = ABOo = BOCI = BCFR = BCHG + GHFR = BCHG + BCDS = HGSD$, since $BD = FH$ and $PB = Hu$.

At the end of the paper he states without proof that:

IN OMNI PYRAMIDE RECTANGULA, TRIA QUADRATA LATERUM, ANGULOS RECTOS IN VERTICE COMPREHENDENTIUM, AEQVALIA SUNT QVADRATO DIAMETRI SHPAERAE CIRCUMSCRIPTAE.

It means that in every rectangular tetrahedron the sum of squares of edges forming right angles equals to the square of diameter of a sphere described on the tetrahedron. An immediate answer was given by Adam Kochański ([9], Propositio I, Theorema). He remarked that it is sufficient to build rectangular parallelepiped on the orthogonal edges of tetrahedron. Its diagonal is equal to the diameter of the sphere described on the tetrahedron, and the theorem follows immediately from Pythagorean theorem (see fig. 2).

We can read in [39]:

> ***Matthaevs COPPYLIVS (1642–1682)*** *e Societate Iesu Provintiae Bohemiae, in Caesareo Wratislaviensi Collegio Ordinarius & Publicus Mathematicum Professor. Edidit: Wratislaviae anno 1676. Archimedes Mechanicus, a nota paralogismi vindicatus.*

Coppylius took a doctor's degree in philosophy in Olomouc 1667. Sigismundus Hartmann was professor conferring his doctor's degree. His dissertation [4] contains fifty propositions on the following themes:
Theses Vniversa Philosophia: Ex Logica, I–VIII; Ex Physica, VIII–XXXII; Ex Elementis [Euclidis], XXXIII–XXXVI; Ex Animastica, XXXVII–XLV; Ex Methaphysica, XLVI–L. Coppylius promoted the mathematician Franciscus Ferdinandus Willrith *Ex Convnentu Wratislaviensis Societas JESU* [36] nine years later in Wratislavia. Mechanics was a subject of this dissertation. Three Coppylius books: citated *Archimedes Mechanicus*, and also *Universa Philosophia* (1667) and *Theses Mechanico-Sophicae* (1674) are available in Wrocław University Library.

Adamus Adamandus Kochański (1631–1700) ([24],[33],[35])

Kochański studied in Academia Vilnensi. He stayed for some time in Italy and next in Jesuit Collegia in Bochemia: at Prague (1670), Brno and Olomouc. Since he not feeling well there he asked his superior to go to Wratislavia. He spent there some years starting from 1677. He observed a comet and wrote some papers, published in *Acta Eruditorum* in Leipzig. Kochański is mentioned in almost all textbooks on the history of mathematics. His approximate rectification of a circle is simple and elegant. The construction (see [10]) is equivalent with approximation of π by $\sqrt{\frac{40}{3} - 2\sqrt{3}} = \frac{1}{3}\sqrt{6 \cdot \left(20 - 3\sqrt{3}\right)} = 3{,}141\,533\ldots$.
Kochański published ten papers in Acta Eruditorum. The most important Kochański papers are [9]-[14]. Then he was librarian of Polish king Jan III Sobieski. He corresponded with Hevelius and Leibniz. Kochański wrote papers dealing with astronomy, mechanics, geometry and number theory. Examples of magic squares (*Quadrata additionis* and *Quadrata subtractionis*) are presented in [13]. Quadrata additionis are standard (in our contemporary sense) magic squares, e. g.

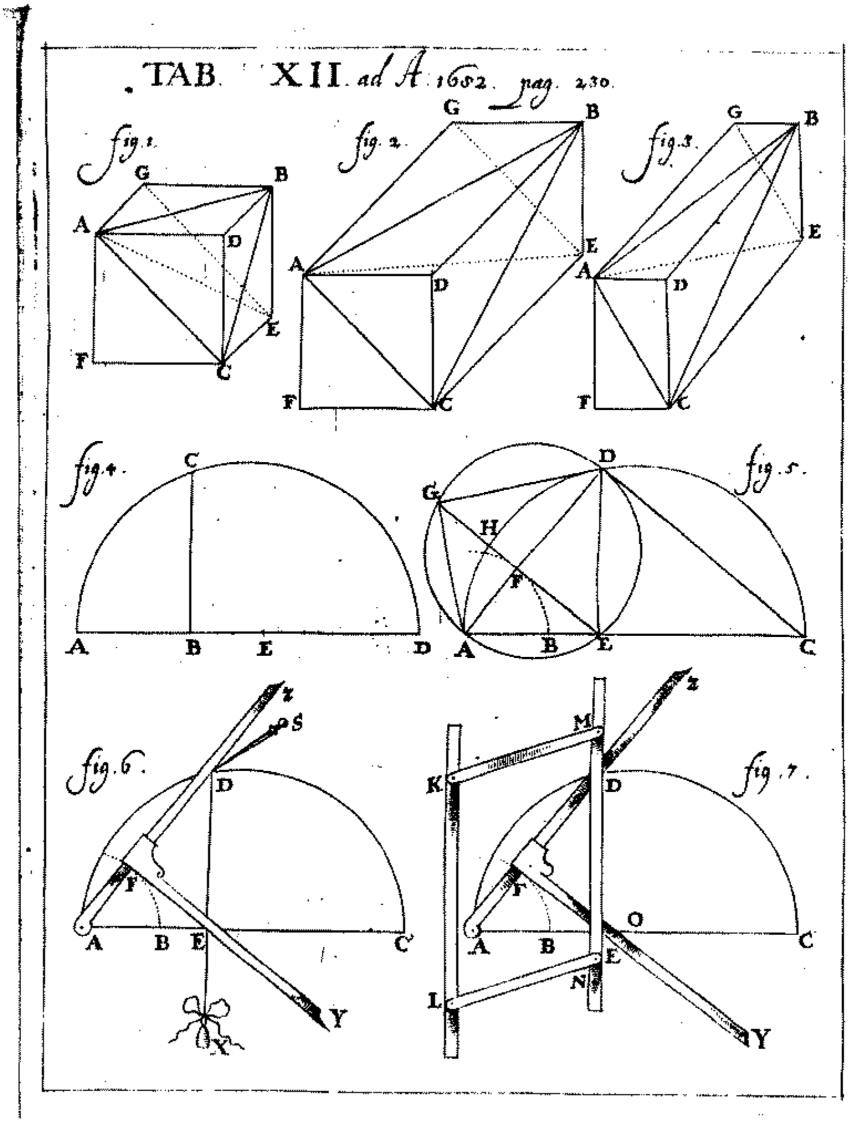

Fig. 2
A page from [9]

1	15	14	4		16	13	2	3
12	6	7	9		4	1	14	15
8	10	11	5		5	8	11	15
13	3	2	16		9	12	7	6

Quadrata subtractionis are much more interesting, e. g.

1	6	13	2		11	7	16	12
10	5	14	9		13	1	2	6
7	12	11	16		4	8	15	3
8	3	4	15		14	10	9	5

Kochański gives the following algorithm. Take for example the first square and arbitrary row, column or diagonal. Let 1, 6, 13, 2 be its first row. We must order the numbers: 1, 2, 6, 13, then add 1 and 6, 2 and 13. The difference of them, $15 - 7 = 8$, is constant for every row, column and diagonal. He gives four examples of 4×4 squares and also 5×5 squares of the first kind, and, moreover, the same number of such squares of the second kind. He defines also another kind of magic squares.

Carolus Worel (1677–1744) (see [39]), e Societate Iesu, in Universitate Olomucensi Matheseos Professor, edidit Olomucii anno 1715 *Duplex manualis Mathematici vestigium*, continens varia ex Arithmetica, & Geographia ad usum quotidianum, & facilem documenta. *Tractatus Theologico-Canonico-moralis.* Pragae 1723.

He was professor of mathematics in Olomouc. Worel published short textbook [38] on elementary arithmetic (its format A6, 81 p.). He considers there arithmetic of natural and positive rational numbers as well as all standard algorithms such as *Regula Proportionum simplici directa et inversa* (*Regula de Tri directa and inversa*), *Regula Falsi*, algorithms for extracting square and cubic roots etc.

Similar elementary textbooks (e. g. [1]) were published by anonymous authors, probably Jesuits. It was often a rule in Societas Jesu to publish anonymous texts.

Josephus Stepling (1716–1778) was born in Regensburg, his father was Westfalian, his mother was Czech. He took the habit of Jesuits in 1733. Stepling studied philosophy in Olomouc and in Brno. He was professor of experimental physics for the first time in Prague. He participated in the reform of universities started in the year 1753 by Maria Theresia. Stepling corresponded with many famous scientists of his times, e. g. with Euler, de la Caille, Nollet, Hell and others. Pelzel [18] quotes fifteen Stepling's papers (for other references see [27]). The books [25] and [26] are specially noteworthy. The small book [25] (format A5, 30 cards, Caput I-VII) presents applications of calculus in calculating volumes and areas of bodies constructed from cones based on conic sections and their different intersections.

The book [26] presents on 196 pages a typical in XVIII century course of calculus. On the copy in Wrocław University Library we read: *Collegii Soc. Iesu Anno 1772. Vratislaviae.* Probably the book was used there at the university either by lecturers or by students. The fundamental notions are: infinitely small, infinitely large and differentials. Thus Stepling lectured calculus following Leibniz. In the text there are many formulae of the form $\left(a+\frac{1}{\infty}\right)^3 = a^3 + \frac{3a}{\infty}$. In the last chapter: *CAP. XV. De aequationibus differentialibus*, elementary information about differential equations can be found.

Mathematicians Societas Jesu from Vilnius had close relations with Prague's Clementinum (cf. [35]). In the half of the XVIII century, mathematically gifted young Jesuits were sent from Vilnius for two years study to Clementinum, to Stepling. Thoma Żebrowski (1714–1758) spent in Prague the years 1750–1752, cooperating with Stepling in mathematics and astronomy. Similarly, Casimirus Naruszewicz (1730–1803) visited Stepling in the years 1754–1756. Martinus Poczobut (1728–1810), called Odlanicki, was at the same time in Prague. He studied there mathematics and Greek with Stepling. Poczobut came back to Vilnius in the year 1756 due to the septennial war began this year.

Stephanus Schmidt (1720–1783) was professor of mathematics at Clementinum in the years 1755–1760. He lectured also in Olomouc and in Brno. The book [22] is the most important Schmidt's publication. It is a textbook for Prague students. This book is divided into chapters:

TABULA I. PRAECIPUAS LINEARUM RECTARUM, TRIANGULORUM ET PARALLELOGRAMMORUM AFFECTIONES COMPLECTENS.

TABULA II. PRIMARIAS CIRCULI ET POLYGONORUM PROPRIETATES COMPLECTENS.

TABULA III. DE RATIONE ET SIMILITUDINE FIGURARUM PLANARUM.

TABULA IV. DE STEREOMETRIA, SEU SCIENTIA SOLIDORUM.

TABULA V. DE TRIGONOMETRIA, SEU RESOLUTIONE TRIANGULORUM.

TABULA VI. DE GEOMETRIA CURVARUM CUM APPLICATIONE ALGEBRAE.

TABULA VII. DE PRAECIPUIS AD PRAXIM GEOMETRICAM SPECTANTIBUS.

TABULAE ARCHITECTURAE CIVILIS, ET MILITARIS IN VSUM AUDITORUM CONSCRIPTAE.

TABULA PRAELIMINARIS RECOLENDIS RUDIMENTIS MATHESEOS UNIVERSALIS POTISSIMUS SERVIENS.

In every chapter there are collected fundamental definitions and theorems. Necessary illustrations are given at the end of every part. TABULA I (100 passages) contains fundamental notions of planimetry. It can be related to the Book I of Euclid's *Elements*. TABULA II (80 passages) corresponds to the Book II, and TABULA III (79 passages) to the Book VI. TABULA IV (87 passages) contains elements of stereometry including Archimedes theorem about a cone and a cylinder inscribed in a sphere. TABULA V (51 passages) presents plane trigonometry and resolution of triangles, and TABULA VI (90 passages) is a standard course of analytical geometry, including description of conic sections and spirals. TABULA VII (66 passages) contains description of instruments used in cartography and geodesy. TABULAE ARCHITECTURAE present description of columns, different rafter framings, and fortifications. TABULA PRAELIMINARIS is an interleaf containing fundamantal notions of elementary algebra, e. g. binomial formulae, and methods of extracting roots and finding logarithms, but without numerical examples. It is noteworthy that the programe of lectures of mathematics *in Universitate Pragensi* from the year 1757 does not contain elements of the calculus. There are no proofs and reasonings.

Nepomucenus Polansky (1723–1776) take the Jesuit habit in the year 1738. He taught mathematics only for a year. He wrote a small textbook on elementary algebra [19] (A6, 42 cards). The author quotes there some fundamental identities, e. g. binomial formulae for two and three terms. Properties of the equalities are formulated as axioms. It was typical in the textobooks of algebra in the second half of the XVIII century. Polansky wrote also other papers including astronomy, e. g. *Dissertatio de Veneris Phasibus* (1761).

Stanislaus Wydra (1741–1804) had started his Jesuit career in the year 1757. He studied Latin. He was called to the professor position in Prague in the year 1773. He was not only eminent mathematician byt also historian of science. Wydra has written not only the book [39] but also *Leben Bohuslav Aloys Balbin der Gesellschaft Jesu* (1788). Balbins wrote papers from the history and Czech philology. Many other Wydra's papers are quoted in [18]. A textbook on calculus ([40], 88 pages, 97 passages) plays as essential role among his papers (cf. [32]). Although it is not essentially different from other similar textbooks (he applies Leibniz differentials), but very good applications of calculus to different examples make the book interesting, even now. Wydra's book is similar to the textbook [2] from Academia Wratislaviensis, but much more condensed. Wydra presents in [40] fundamentals of the calculus for students from Prague. We find there (loc. cit. p. 77-79) the following examples. VSVS CALCVLI INTEGRALIS IN CVBANDIS SOLIDIS (application of integral calculus to volumes of solids). Wydra shows how to calculate the volume of a rotation body (fig. 3).

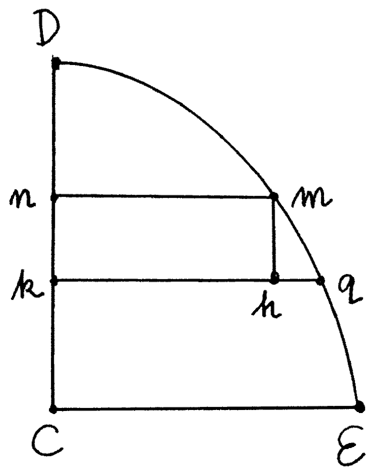

Fig. 3

Let a curve DE be rotated around axis DC. Let $DC = a$, $CE = r$, $Dn = x$, $mn = y$, $nk = dx$, p — the perimeter of the base circle formed by rotation CE. Wydra considers an *elementary cylinder* formed by rotation of *khmn* around DC. We have $r : p = y : \frac{py}{r}$. Thus area of the base of this cylinder is equal to

$$(mn \times \text{perimeter of the circle with radius } mn)/2 = \frac{1}{2} \cdot \left(y \cdot \frac{py}{r} \right) = \frac{py^2}{2r}.$$

He concludes that the volume of rotation body equals $\frac{1}{2r} \int py^2 \mathrm{d}x$. Note that in XVIII century the sign of integral was understood as definite integral. Following this ideas Wydra calculates volume of a cone, formed by rotation of the segment DE around DC (fig. 4).

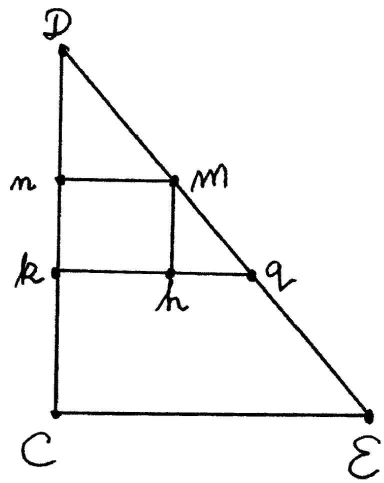

Fig. 4

Denote as previously $DC = a$, $CE = r$, $Dn = x$, $mn = y$, $nk = dx$, p — the perimeter of the base circle formed by rotation CE. Since the triangles CDE and nDm are similar, $a : r = x : y$. Consequently, $y = \frac{rx}{a}$ and $y^2 = \frac{r^2x^2}{a^2}$. Integrating we obtain $\int \frac{py^2\mathrm{d}x}{2r} = \int \frac{pr^2x^2\mathrm{d}x}{2a^2r} = \frac{prx^3}{6a^2}$. Puting $x = a$ we have the volume of the cone: $\frac{pra}{6} = \frac{pr}{2} \times \frac{a}{3}$, where $pr/2$ is area of its base, and a is the height of the cone. Not everything in Wydra's book is correctly proved. For example his arguments in calculating the volume of tetrahedron (loc. cit. p. 77–78) are invalid.

3 Mathematicians in Academia Wratislaviensis

Jesuits came to Wrocław for the first time in the year 1581. They tried to organize there collegium. However, having many difficulties there, they left the town in the year 1595. Jesuits appeared again in Wrocław in the middle of the XVII century. The emperor Leopold I delivered them the castle in Wrocław on 26th September 1659 for the future collegium. The castle was rebuilt in the XVI century by the prince Zygmunt, posterior Zygmunt Stary (Sigismund the Old), the king of Poland. Jesuits took the castle on 12th October 1659, and they decided to take 15th November 1659 as the date of founding the Collegium, in order to celebrate emperor's name. For the same reason Jesuit Collegium in Wrocław was often called *Leopoldina*. Existing historical documents show that the Cracow University and Prague University were opposed against founding university in Wrocław, based on Jesuits gymnasium existing there from the year 1659. Finally Jesuit Collegium in Wrocław became university (Jesuits Academy) in the year 1702. *Aurea Bulla Fundationis Universitatis Vratislaviensis* had been signed by the emperor Leopold I on 21st October 1702. From this time Leopoldina was the name of Academia Wratislaviensis Societas Jesu. We cannot tell too much about Leopoldina since its archive disappeared in the year 1831.

After the annulment of the Jesuits in the year 1773, Jesuit Academy was transformed into catholic university (still called *Leopoldina*). Ioannes Schmidel was professor in Jesuits Academy as well as Antonius Zeplichal, who came from Moravia. Silesia was a province of Prussia after the war between Prussia and Austria in 1740–42. Zeplichal had then the position of a director of the Prussian University in Wratislavia. He prepared *Schulgesetze fűr die Universität Breslau, und die Gymnasien des königlichen Schuleninstituts in Schlesien* (1777).

Teaching of mathematics at Jesuits Academy in Wratislavia in the second half of XVIII century was at a relatively good level (see [34]). Jesuits prepared at least six good textbooks from mathematics for their students (e. g. [2], [3], [6], [7], [20], [21]). The books are in general anonymus so we are unable to give names of their authors. Then, in XVIII century, astronomy, physics, geography, *architectura civilis et militaris, gnomonica etc.* were parts of mathematics.

Pelzel [18] states that

Anton(ius) Zeplichal *wurde zu Trebitz in Mähren im J. 1737 am 13. May gebohren. Er studirte die Humaniora zu Iglau, und trat, in* *den Orden 1753 den 27. October. Er gieng nach Schlesien, wie die Absonderung von Böhmen geschab. Ist Doctor der Philosophie, königlicher Preussischer Director Vniversitöt zu Bresslau, und der gesammten Katholischen Gymnasien im Herzogthum Schlesien und in der Grafschaft Glaz, wie auch Priester des Königl. Schuleninstituts in Schlesien. [...]*

Pelzel cites eighteen Zeplichal papers, including two mathematical papers.

Joannes Schmidel is also mentioned by Pelzel [18].

Joannes Schmidel. He was born in 1733. He was professor of mathematics at Academia Wratislaviensi. Pelzel [18] attributes him *Institutiones calculi differentiales et integrales*. Vratislaviae 1775 and the book [21]. The first book is identical with a part of [20] under the title *Calculi differentialis elementa. Pars prior. [...] Pars II. Practica*, consisting from the pages 1–39 identical with corresponding pages of [2]. Thus we can conclude that Schmidel is the author of [2], although his name is there absent. For much detailed description of [2] cf. [34]. The text [21] contains a systematic course of spherical trigonometry (p. 1–63). Moreover we find there tables of sinus, tangens, Log. sin., Log. tang. (p. 84-93), seven-digit logarythmic tables (*Logarithmi Numerorum naturalium* $N = 1, \dots, 934$) and numerical examples of solving spherical triangles.

There are also interesting manuscripts ([5], [28], [37]) containing lectures of mathematics given at Leopoldina. The notes prepared H.C. de Mattuschka. The text [5] is based on *Elementa algebrae* de la Caille and [37] is based on Christian Wolff 's *Elementa Analyseos.* Numerous books of both authors were very popular at European universities in XVIII century.

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[10] —, OBSERVATIONES Cyclometricae [...], ibidem MDCLXXXV (1685), 394–398.

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