

# Starting the management of knowledge in mathematics: The “Jahrbuch über die Fortschritte der Mathematik“

The “Jahrbuch über die Fortschritte der Mathematik“ (1868-1942) is the world’s oldest abstracting journal for mathematics. Its foundation and development describe an interesting chapter in the history of science and even in the history of Germany. Today, many reviews in the Jahrbuch are still indispensable. In connection with the project “ERAM“ (1998-2003) the data of the printed Jahrbuch were digitized. FIZ Karlsruhe, respectively the Zentralblatt editors, played a major role in this project.

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## Introduction

The human race has been dealing with mathematics for hundreds of years. It started with counting and measuring, then calculating, geometry and theory. There is a special feature with mathematics amongst the other sciences: ancient knowledge and most theories do not become obsolete or antiquate. Old theorems and proofs are furthermore accepted as true in the international mathematical community, and the knowledge grows from century to century. Of course mathematics also depends on political and social facts. Periods of stagnation, circuitous and dead ends (e.g. the system of Roman numbers) alternated with periods of fast growth. Thus ancient mathematics is important for historians, as well as for today’s research in mathematics and applications. The “Science Citation Index” notes 25,000 articles for mathematics in 2001 with 8,050 references to articles or books written between 1868 and 1942. 500 cited works were written earlier; the oldest cited book is from 1006.

In the beginning, mathematical knowledge was spread verbally in conversation, discussions or talks in schools, academies, monasteries or universities. Furthermore, in the early days information was written on bricks, papyrus, and in books. For instance the thirteen volumes of Euklid’s famous “Elements“ originated from 300 before Christ. Still today the scientists are reading them, and in most schools worldwide

Euklid’s geometry is taught. The “Elements“ were translated into many languages; the latest edition in German was published in 1997 (Zbl 0933.01030). Facsimiles of older editions are available on the World Wide Web: a handwritten copy in Greek of 888, and one of the first printed editions after the invention of printing 1482 in Latin ([www.claymath.org/library/historical](http://www.claymath.org/library/historical)). It is also essential to note that also letters were very important for information and discussions between the mathematicians.

The first journals containing articles dealing with mathematics were the “Journal des Sçavans“ edited in Paris and the “Philosophical Transactions“ of the “Royal Society of London“, both founded in 1665. The “Philosophical Transactions“ first established the so-called “peer reviewing“. The submitted papers were sent to mostly anonymous specialists who examined whether the paper was good enough for publishing. The editors of the journals, in those days usually theologians, were not able to evaluate all scientific articles. Today “peer reviewing“ is common for all recognized journals.

The first journals dealing only with the subject mathematics were founded at the turn of the 18th to 19th century. The first supra-regional journal for mathematics in Germany, the “Journal für die Reine und Angewandte Mathematik“ (known as “Crelle’s Journal“), was published in 1826. It still exists today.

In the middle of the 19th century the number of mathematical and scientific journals in Europe increased.

It became more and more difficult for a scientist to find all new articles about his subject and to read them. Therefore, some physicists and chemists had the idea to publish abstracting journals, which did not contain complete articles but only biographical descriptions and reviews about new published books or articles. In 1847 the „Deutsche Physikalische Gesellschaft“ started with the „Fortschritte der Physik/Physikalische Berichte“.

### Foundation of the „Jahrbuch über die Fortschritte der Mathematik“

In 1869, Dr. Carl Orthmann and Dr. Felix Müller adopted this idea for mathematics and founded the “Jahrbuch über die Fortschritte der Mathematik”. Publisher was Georg Reimer, later Walter de Gruyter. The two editors C. Orthmann and F. Müller wrote in their introduction of the first volume [3] (“Vorrede”):

“Our intention was on the one hand: To provide a tool for those who are not able to follow all publications on the comprehensive field of mathematics, and to gain a general overview about the development of the science. On the other hand it should help the active scientist to find known facts.”

C. Orthmann and F. Müller were mathematicians and high school teachers in Berlin. They were supported by the professors K. Weierstrass, L. Kronecker and K. W. Borchardt of the University in Berlin, and 16 other mathematicians in Germany. The first volume of the Jahrbuch contained 889 reviews of mathematical publications published in 1868 in 78 European journals (Fig. 1).

The editors established the rule to gather all articles of one year and then publish them together in one volume. This was done with only a few exceptions until 1942, but it caused time delays again and again.

The articles were arranged by mathematical subjects. Publications about the same topic were printed one after another; sometimes there was only a joint review for two or even more publications. Many reviews included references to other articles or earlier reviews. Over the years the titles of the sections were changed or divided into more subsections following the current changes of mathematics. Later these sections provided the basis for the “Mathematical Subject Classification (MSC) “.



Fig. 1: First page of the Jahrbuch

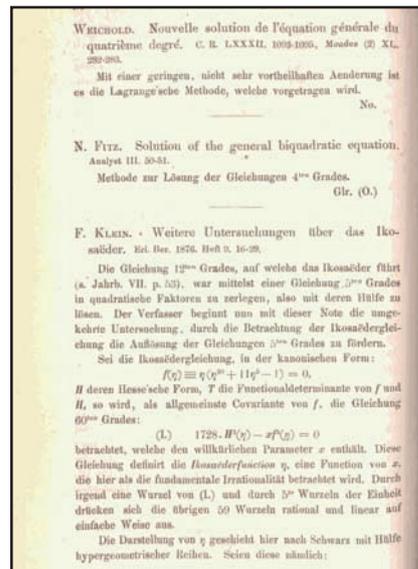


Fig. 2: Example page from volume 8

### Reviews and Reviewers

The number of reviewers (“Herren Referenten“ or “Mitarbeiter“) grew from sixteen in the beginning to up to 300 per volume in the 1930s. About two thirds of the mathematicians were from Germany, the others were scientists from all over the world, mainly from Europe. The first two female reviewers were “Fr. Prof. Noether, Göttingen“ and “Fr. Dr. Wrinch, Cambridge“ in volume 45 (1914). Unlike with other abstracting

journals, reviewers of the Jahrbuch were not professional reviewers but usually active researchers. Among them were today well-known mathematicians as: Salomon Bochner, Arthur Caley, Lothar Collatz, Richard Courant, Gregor Fichtenholz, Hans Freudenthal, David Hilbert, Adolf Hurwitz, Erich Kamke, Felix Klein, Edmund Landau, Sophus Lie, Hermann Minkowski, Richard von Mises, Magnus Mittag-Leffler, John von Neumann, Wladimir Smirnow, Otto Toeplitz, and others.

In general the reviews were short objective abstracts outlining the mathematical content of the article in a few sentences. Sometimes, however, long reports over several pages are to be found. These were usually reviews about outstanding publications or substantial books. Prof. Dr. Emil Lampe (editor 1886-1918) formulated guidelines for reviewing in 1903 [1]:

Readers of the Jahrbuch want to learn about the contents of the publications, not the opinion of the reviewer. For his own research the user wants to know, if there are new ideas in the publication... Only obvious errors are to be signalled in a non-offending way.

But in some cases the reviewers did not mince their words. Some examples:

#### Critical remarks:

JFM 03.0324.01: Incorrect conclusion from a special case to the general case.

JFM 06.0311.01: ...The third part includes four new proofs: the four proofs are wrong...

JFM 07.0001.01: ...It is not worthwhile to cite all false, old disproved propositions; In any case I want to warn against the statements of the author.

JFM 11.0596.03: The author does not know any of the literature about this subject, therefore he misconceives...

JFM 15.0057.03: Incorrect! Herr Weichold confuses necessary and sufficient conditions.

JFM 21.0093.03: A paper written with vain endeavour.

JFM 27.0042.03: ...Deficits in scientific precision and rigour. The author lives in his own world of thoughts and requires that the reader follows him blindly.

JFM 68.0100.01: ...It is very distressing, that this book could be published.

#### Laudatory reviews:

JFM 22.0615.01: ...Because this denoted problem seems to be very interesting, we cannot close this review without expressing the desire that this beautiful study be continued and completed by someone else.

JFM 23.0703.01: ...This is a general survey of the work, which will be of outstanding and everlasting value within the mathematical literature.

JFM 31.0081.01: ...This book will give various proposals for teachers of mathematics and physics...

JFM 56.0193.03: The author presents a well-done introduction in calculus.

JFM 63.0689.05: ...This work is rich in interesting ideas, in partly new and original topics.

By means of such reviews the Jahrbuch gained some kind of control over the mathematical literature – not only registration, abstracting and classification of new articles and books. “The most important aid to judge contemporaneous work is furnished by a German publication known as the Jahrbuch über die Fortschritte der Mathematik”, the American G. A. Miller wrote in 1912 [2]. At this time the Jahrbuch had a quasi-monopoly position, because there were no other comprehensive abstracting journals for mathematics. Similar French, Russian, Dutch or American institutions were only founded later.

All reviewers earned one Reichsmark per review – not a big salary. Furthermore, the first editors of the Jahrbuch worked extra-officially and voluntarily. Dr. Max Henoch, editor from 1883 to 1887, supported the publication yet on a private basis, donating his inheritance to the publication. As recently as in 1927, when Prof. Dr. Leon Lichtenberg felt himself unable to continue with this burden of work, a full-time editor (“Hilfsarbeiter“) Dr. Georg Feigl, and an assistant (“Hilfskraft“) were appointed by the „Preußische Akademie der Wissenschaften“. Occasionally the “Notgemeinschaft der Deutschen Wissenschaft“ supported the publication as well. Now four, later even ten, “Hilfskräfte“ were employed with an annual contract of about 50 up to 300 Reichsmark per month. In these years many graduates or postgraduates were hit by unemployment. Therefore the jobs were in demand despite the bad pay. Some of the “Hilfskräfte“ later became well-known mathematicians, for example Dr. Hans Freudenthal, Dr. Helmut Grunsky, Dr. Rudolf Kochendörffer, Dr. Maximilian Pinl, Dr. Willi Rinow and

Dr. Helmut Wieland. Furthermore, two of the rare female full professors in the 1940s and 1950s, Hanna Neumann and Hilda Geringer, were temporarily members of the editorial staff.

### The End of the Jahrbuch

World War I had caused gaps which were difficult to fill by the Jahrbuch editorial team. Additionally mathematics boomed in the twenties. More and more articles per year were published (about 5,000). Therefore the Jahrbuch had fallen behind even though it had more “Hilfskräfte“. In this situation mathematicians in Göttingen and at the Springer publishing house took the initiative and founded a second German abstracting journal in 1931, the “Zentralblatt für Mathematik und ihre Grenzgebiete“ (see also next chapter). The Zentralblatt was published several times per year. The reviews were shorter and more objective, and it was allowed to write them not only in German but also in English, French or Italian. While the Jahrbuch maintained the principles of “completeness“ and “classification of all articles of one year“, the Zentralblatt counted on “promptness“ and “internationality“ [5].

During the Nazi era the editorial team of the Jahrbuch first tried to continue working as before. Dr. Helmut Grunsky, head of the team in 1935, even engaged some more Jewish mathematicians, because it was difficult for them to get a job somewhere else. But in the course of time he was more and more pressed to remove them. A dunning letter written by Prof. Dr. Ludwig Bieberbach, chairman of the “Preußische Akademie der Wissenschaften“ and editor-in-chief of the Jahrbuch, in 1938 is preserved, in which he complains that too many Jewish reviewers are working for the Jahrbuch [4]. A short time after this letter was written, H. Grunsky resigned from his position. The National Socialist Dr. Harald Geppert became “Generalredakteur“ for the two abstracting journals Jahrbuch and Zentralblatt. However, during the war the editorial teams continued to operate mostly autonomously; only occasionally they shared the reviews. Dr. H. Geppert had ambitious aims to reorganize the international abstracting services under Germany's leadership. But this concept was not realized.

Little influence of the Nazis is to be seen concerning the content of the reviews and the selection of mathematical articles. Only in the chapter “Science of Education“ in volumes 59, 60, 61 there are articles with titles “Mathematical Instruction in the Third

Reich“, “Mathematics Serving for National Socialistic Education“, “Translating mathematical terms into German“. In the last volumes of the Jahrbuch the subject “Science of Education“ did not appear any more. Papers of displaced persons or refugees were reviewed as before. For instance, many articles of R. Courant, W. Döblin, A. Einstein, F. Hausdorff, H. Rademacher were reviewed. Dr. Erika Pannwitz, member of the editorial team since 1930, wrote in 1947: „There was no case when a review was notably short or excluded because the author was Jewish.“ [4].

The first issue of volume 68 (1942) was the last printed volume of the Jahrbuch at the end of war. After World War II the Jahrbuch was not taken up again. There were several discussions and negotiations. But most mathematicians did not want two similar abstracting services in Germany. The principle of the Jahrbuch to wait for all articles for one year seemed to be no longer up to date. The Zentralblatt was re-established in 1947.

### Jahrbuch Project

A new era for the abstracting services began in the 1980s with the development of databases, CD-ROMs and the Internet. Aside from the printed edition, Zentralblatt provided electronic services, nowadays the database ZMATH on the World Wide Web. The new services had considerable advantages compared to the printed services: firstly, they have much more possibilities for searching, secondly, updating is now possible day-to-day, and thirdly, the data are globally accessible via the Internet.

In 1998, Prof. Dr. Bernd Wegner (Technische Universität Berlin) and Prof. Dr. Keith Dennis (University Cornell) had the idea to digitize the “Jahrbuch über die Fortschritte der Mathematik“. They recommended to design a database which is publicly available. With financial support of the “Deutsche Forschungsgemeinschaft (DFG)“ a project was launched, the “Jahrbuch-Projekt“ or “Electronic Research Archive for Mathematics (ERAM)“ with the partners TU Berlin, Staats- und Universitätsbibliothek Göttingen and FIZ Karlsruhe. The objective of the project was on the one hand to include all data of the printed edition of the “Jahrbuch über die Fortschritte der Mathematik“ in a database, and on the other hand to completely digitize the most important articles from the period 1868-1942. Up to now the Digital Library at the Staats- und Universitätsbibliothek in Göttingen ([www.gdz-cms.de/](http://www.gdz-cms.de/))

comprises about twenty-five mathematical journals. Among them are for instance the “Mathematische Annalen”, “Mathematische Zeitschrift”, and “Commentarii Mathematici Helvetici”, and also some books, dissertations and literary remains.

All bibliographic data and reviews contained in the printed Jahrbuch were typed and entered into a database. This job was done from 1998 to 2002 in cooperation with the editorial team of the Zentralblatt/FIZ Karlsruhe in Berlin. But the work is not yet completed. To meet the requirements of a modern literature database, keywords, titles in English, and classification according to MSC 2000 are necessary. About thirty volunteers from different countries are involved in indexing and editing the old data. If necessary, they add comments and references such as: “Remark: A basic contribution: the famous Voronoi sum formula is introduced.” (JFM 35.0220.02). Additionally, some revisions are currently under preparation: newly designed Web pages and an updated journal database. Moreover, bibliographical data of the “Journal über die Reine und Angewandte Mathematik” beginning in 1826 were added.

The Jahrbuch database contains many links to completely digitized articles or books. There are about 6,000 links to facsimiles of the Digital Library in Göttingen, 500 links to the “Cornell Historic Math Book Collection”, 600 links to the “University of Michigan Historical Math Collection”, 8,500 links to the project GALLICA of the “Bibliothèque nationale de France”, and 2,300 links to the project NUMDAM (“Numérisation de documents anciens mathématiques”). Thus the “Jahrbuch Projekt” provides not only free information about mathematical literature but also complete articles or books – a first step towards the “World Digital Mathematics Library” (see chapter five in this brochure).

The Jahrbuch database is available at: [www.emis.de/projects/JFM](http://www.emis.de/projects/JFM). Access and all information is free (Fig. 3).

Most data of the Jahrbuch database are also contained in ZMATH, the database of the “Zentralblatt für Mathematik”: [www.zentralblatt-math.org/](http://www.zentralblatt-math.org/). Therefore ZMATH now covers a period of more than 140 years.

The Jahrbuch Project received the “2005 PAM Division Award” of the “Special Libraries Association, Physics - Astronomy - Mathematics Division” (PAM). The state-

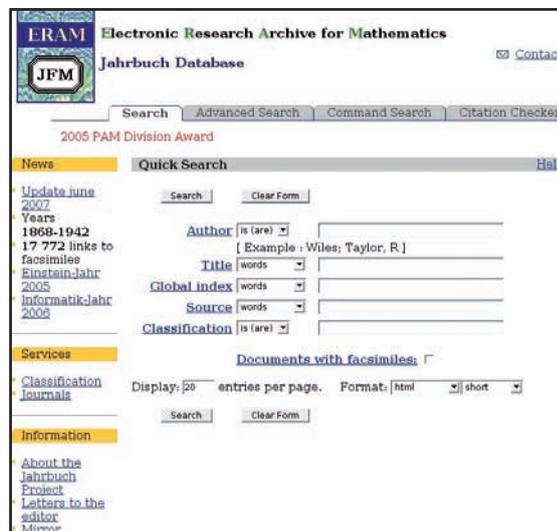


Fig. 3: Simple Search

ment was: “The Division Award recognizes a significant contribution to the literature in physics, astronomy, and/or mathematics that benefits libraries, enhances the ability of librarians to provide service, and improves the exchange of information.”

#### Literature:

- [1] Emil Lampe: “Rückblick und Ausblick.” Jahrbuch über die Fortschritte der Mathematik. Band 33. Berlin: G. Reimer. (1904)
- [2] G. A. Miller: “Some thoughts on modern mathematical research.” Science 35, S. 877-887 (1912) (JFM 43.0088.03)
- [3] Felix Müller, Carl Orthmann: “Vorrede.” Jahrbuch über die Fortschritte der Mathematik. Erster Band. Berlin: G. Reimer. (1871)
- [4] Reinhard Siegmund-Schultze: „Mathematische Berichterstattung in Hitlerdeutschland.“ Göttingen: Vandenhoeck & Ruprecht. (1993) (Zbl 0795.01015)
- [5] Reinhard Siegmund-Schultze: “Scientific control“ in mathematical reviewing and German-U.S.-American relations between the two World Wars.” Hist. Math. (Providence) 21 (3), S. 306-329 (1994) (Zbl 0806.01032)
- [6] Reinhard Siegmund-Schultze: “The effects of Nazi rule on the international participation of German mathematicians: An overview and two case studies.” Hist. Math. (Providence) 23, S. 335-357 (2002) (Zbl 1004.01527)
- [7] Reinhard Siegmund-Schultze: “Helmut Grunsky (1904-1986) in the Third Reich: a mathematician torn between conformity and dissent.” In: Oliver Roth, Stephan Ruscheweyh (eds.): “Helmut Grunsky. Collected papers.” Lemgo: Helderermann (2004) (Zbl 1065.01017)

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