Access to Electronic Publications in Mathematics through EMIS

(European Mathematical Information Service)

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Abstract. The European Mathematical Information Service (EMIS) has been founded in 1994. It provides a variety of electronic offers in mathematics. Most prominent among them are the Electronic Library ELibM, the collection of databases, and the access to projects dealing with electronic information and communication in mathematics. The service is distributed world-wide by a growing number of mirror sites. In the past ten years the library expanded from a few journals to a collection of more than 60 journals, several monographs and proceedings volumes and some interesting innovative electronic offers. The collection is the biggest repository of freely accessible mathematics on the web.
The general aim of this note is to give a summary of the development and the basic ideas of EMIS, a survey of the main current offers and a description of ongoing activities to keep the service up-to-date and to remain at the front of new developments in information technology for electronic libraries. A special section is devoted to the different strategies to use EMIS and its services as a navigation tool for accessing full text offers in mathematics.

1. The general concept of EMIS

The idea of EMIS emerged as a result of the increasing development of electronic devices for the publication of papers and books in science and technology. The reason for installing

the ELibM has been described in previous articles on EMIS (see [7], [3] for example). The increasing number of links going to and provided by reviewing services in their reference databases made these services an important addition to the full text offers. They and other qualified indexes help scientists to find their way through the tremendous bulk of current and previous mathematical research papers and a lot of additional items of interest, like pre-prints, educational material in mathematics, software, graphical material and others.

From the beginning EMIS tried to bundle freely accessible electronic publications and to deal with all aspects related to methods of electronic publishing and electronic communication in its projects section. Information on conferences, jobs, mathematics society matters etc. can also be obtained there, but the three sections dealing with the ELibM, the databases and the projects are the highlights of this service and the subsequent exposition will concentrate on them.

The central server for EMIS had been installed in March 1995 at the editorial office of Zentralblatt MATH in Berlin in co-operation between FIZ Karlsruhe and the European Mathematical Society EMS. The URL is obvious (http://www.emis.de/), and in general those of the mirror sites are as simple as that of the master site. The mirror sites came up very soon and they form world-wide network now, providing copies of EMIS on all continents now. The updating is done automatically. The mirror sites improve the visibility and the accessibility of EMIS on one side, but being run on a voluntary basis the requirements leading to additional efforts on their side have to be kept at minimum.

The World Wide Web access to the contents of EMIS is free for all users, except for the full usage of some databases. In these restricted cases a link leads directly to the corresponding system of database gateways, and the user is subject to the conditions valid for accessing the databases. In any case, users will be able to do searches. But in the case where his institution does not subscribe to the service, only some restricted information will be available from the hit list.

2. The electronic library

The ELibM more or less succeeded to present a quite comprehensive collection of freely accessible electronic publications. In order to guarantee that the electronic publications stored in the ELibM meet the quality standards required for articles in traditional print journals, the decision on the inclusion of journals, proceedings or monographs is taken in accordance with the Electronic Publishing Committee of the EMS. Hence, no items will enter the library which have not been evaluated and recommended by a referee within the editorial procedures of the corresponding journal or series. Most of the journals in the electronic journals section are completely produced elsewhere, and EMIS only serves as an additional distributor. In some cases, however, the e-journal is produced by EMIS from the original source files provided by the editors.

The e-journals section contains purely electronic journals as well as electronic versions of print journals (dual journals). Most of the dual journals are published at a low-budget level, and hence the risk of loosing subscribers to the print version due to the free electronic offer currently is considered as low by them. Some of them give the electronic offer with a certain delay to EMIS such that the earlier availability will be considered as an advantage of the print

version. Acknowledging that the electronic versions are becoming increasingly important for the users, this delay period had been reorganized. During the period, which is considered by dual journals as the most important one to keep libraries subscribing to them, the access to the electronic version may be provided only to subscribers. To enable the access control for this purpose, the journal is stored on a separate server, though the metadata should be made freely accessible in ELibM. ELibM will offer links to the complete articles. After a period to be decided by the journals themselves (moving wall), the full content is transferred to the system of mirrors of EMIS where it can be read without having a subscription. This structure is arranged to support ideas like posting articles "online first", which speeds up the publication procedure considerably.

Multilingual publications were integral part of the ELibM from the beginning, though most publications are in English, which is a general rule for mathematics. For example, on the Russian part some multilingual journals entered the ELibM in the first years already, but just recently two journals in Russian started their posting in EMIS, the Fundamentalnaya i Prikladnaya Matematika (Fundamental and Applied Mathematics) and the Sibirskij Matematicheskij Zhurnal. The latter is one of the most traditional and prestigious journals from Russia, having also an English translation. Clearly, ELibM only can provide the Russian original for free, because the translation belongs to the more expensive mathematical publications and does not allow for free access.

The total number of journals in ELibM is more than 60 at present. In the past ten years only three offers were discontinued, though their older volumes are still available. As a rule full texts posted through EMIS never can be removed from the system because this cannot be enforced at the mirror sites, and last but not least, the preservations of the content should have high priority for ELibM. The total number of full text articles in these all sections of ELibM is more than 14.000 at present. In addition to this about 20 electronic monographs are available in ELibM, and two collected works (Riemann and Hamilton).

After ten years of EMIS several features are on the way of modification and modernization. As already mentioned, the request for PDF-files became a must, because the pre-installed readers at electronic access facilities in libraries and desktop-computers of research mathematicians already point into that direction. For other offers special measures have to be taken to make the article readable or printable. For example, most of the installations at libraries ask the reader to enlarge his reading facilities when he wants to access PS-file. It is not hard to do this, but it needs some time and in most cases the reader is frustrated, because he wanted to read the article and not to handle some web resources before.

In the section of innovative offers, a link to a full text database of high-quality geometric models and animations has been arranged. This is still under development as far as the display in EMIS will be concerned. It has to be investigated how the data of these models could be stored in a convenient way, to make them accessible within the same menu as is provided for searching mathematical articles. But as a first solution the different entries will be reviewed in Zentralblatt MATH, because they consist of fully peer-reviewed articles on their own, though in contrast to conventional mathematical publications they are providing a lot of geometric enhancements. The offer at the master site is fully functional.

3. The databases section

This section contains four items: MATH – the online version of Zentralblatt MATH, MATHDI – the online version of a similar service for education in mathematics, Compuscience – a database service for computer science, and MPRESS – a global pre-print index. A special offer for logics is under construction. Furthermore, the reference database STMA, dealing with information on statistics, has decided to enter a joint venture with Zentrablatt, just when this article was written, and it will be displayed and made accessible in EMIS under the new name STMA/Z. More detailed descriptions of Zentralblatt MATH and MATHDI have been given at other occasions and can be found in previous articles like [5] and [4]. Here only a short account should be made. Some details will be given below in connection with the access facilities.

The databases Zentralblatt MATH and MATHDI are accessible for subscribers only, though a restricted access on the free level is possible. MPRESS is provided as a freely accessible service. It stores combined information on mathematics pre-prints available on the web. The gathering of information is done by robots, which are run by national brokers for harvesting of metadata. This procedure leads to a data structure, which only allows for simple search facilities. MPRESS has no ambition to offer a pre-print server itself, only links to full texts are provided. The service is supervised by EMS among others. Countries, which support the harvesting, are Germany, France, Austria, and Italy. In addition to this some special servers are harvested by MPRESS. Among them are the Topology Atlas and the arXiv.

4. The projects

This part of EMIS hosts or provides a link to the homepage of several projects dealing with electronic information and communication in mathematics or mathematics knowledge management. For the description of the projects themselves reference is given to separate articles on these projects. Details also can be found by consulting their offer in EMIS. Here only a list with short description should be provided.

LIMES: The objective of the LIMES project is to upgrade the database Zentralblatt MATH into a European-based world-class database for mathematics and its applications by a process of technical improvement and wide Europeanization. Upgrading the existing database, improving the present system and developing a new distributed system both for the input and output of the data are necessary to allow Zentralblatt MATH to use the latest developments and to anticipate future developments of electronic technologies. A detailed description of the LIMES project is given in [4]. LIMES was finished in March 2004. Meanwhile several of the achievements obtained within LIMES have been implemented successfully.

EULER: The EULER project took place from 1998 to 2000 and was customized until 2002 by a smaller project called EULER-TAKEUP project. The main goal of these projects was to integrate different, electronically available information resources in the field of mathematics. Today, EULER is a European based world-class real virtual library for mathematics with up-to-date technological solutions, a sound sustainable business model, well accepted by users. In particular, EULER provides a world reference and delivery service, transparent to the end

user and offering full coverage of the mathematics literature world-wide, including bibliographic data, peer reviews and/or abstracts, indexing, classification and search, transparent access to library services, co-operating with commercial information providers (publishers, bookstores). It is run by the EULER Consortium now, which is a registered incorporated society (association), according to German law.

ERAM: The aim of the Jahrbuch-Project, which officially is called ERAM (Electronic Research Archive in Mathematics), is to capture the "Jahrbuch über die Fortschritte der Mathematik" as a classical bibliographic service in mathematics in a database and to use this activity to select important publications from the Jahrbuch period (1868–1943) for digitisation and storage in a digital archive. Finally the digital archive (built up in connection with the database) will cover selected publications as well as whole series going beyond the Jahrbuch period. It is linked to Zentralblatt MATH and the Jahrbuch database. The Jahrbuch database is complete now and provided as a first release. The digital archive offers almost 1.200.000 pages, including digital copies of several mathematics journals of high reputation. See also [6] and [2] for details.

MoWGLI: This stands for "Mathematics on the Web – Get it by Logics and Interfaces". MoWGLI is supported by the 5th Framework Programme of the EU. It deals with mathematics knowledge management for usage of formulas and proofs in the web. XML technology is applied to develop interoperable documents with export and import facilities for formulas. Searches in databases of proofs and theorems are enabled and links are provided accordingly. Integration of proof assistants in papers for research and education will be possible. A report on ideas and state of the project can be found in [1].

MONET: The aim of the MONET project is to demonstrate the applicability of the latest ideas for creating a semantic web to the world of mathematical software, using sophisticated algorithms to match the characteristics of a problem to the advertised capabilities of available services and then invoking the chosen services through a standard mechanism. The resulting framework will be powerful, flexible and dynamic, yet robust and easy to navigate, putting state-of-the-art algorithms at the disposal of users anywhere in the world.

EMANI: This stands for "Electronic Mathematics Archiving network Initiative". The project is co-operational system of reference libraries and content providers like publishers and editors. It has been set up to serve for the following purposes: To store the digital content in mathematics from the content providers at the reference libraries, to retrodigitise printed publications in mathematics from the content providers at the reference libraries, to care about the long-term preservation of this content in readable form, to improve the usability of the retrodigitised publications by introducing advanced linking and searching facilities, to provide convenient and affordable access to the stored content for mathematicians and professionals using mathematics world-wide, to serve as a reference system for other libraries which want to store and provide part of the content or refresh their existing offers by updated material, to develop new business models for a distribution of mathematical publications in a combined enterprise between reference libraries and content providers.

EMANI combines the expertise of the partner libraries and of members of the Mathematical Community and applies it to the task of managing growing digital back files and digital publications in mathematics. The result will be an archiving and online dissemination

system for math materials that is responsive to needs of academic libraries and the scholarly communities they serve. A comprehensive description can be found in [8].

5. Access to full text

The simple access to the journals in EMIS still is organized conventionally by clicking through web pages and lists of contents. Clicking on the journals section of the ElibM will give the user two lists of journals, a short and an extended one, where the short one is default, because it gives a quick comprehensive glance at the full collection. The extended lists provides full displays of the titles including logos and directing to background information on the editorial policy of the corresponding journal and instructions how to submit an article. In some cases style files for such a submission can be found on this level.

Selecting the journal will lead to a list of issues. From there the user can go to the list of contents and choose an article. At the beginning of EMIS for most articles DVI- and PostScript-files were available, sometimes also TeX-source codes can be found in addition to that. PDF offers came up rapidly during the recent years and will be obligatory for new installations. By clicking one of these files, the content is transferred to the computer of the user and can be viewed there. Also, printing or storage of these files is possible at the site of the user, but he is requested to respect the copyright policy according to the rules of the corresponding journal.

Clearly, this access will not be appropriate, if the user has author and title of an article in mind without knowing volume and issue. Here the demand of an integrated access to the collection comes up as it partially is provided with other collections. There are also demands for integrated access to groups of collections or possibly to all of them. This will make special efforts to do this for ELibM obsolete, if branding questions will be left aside. Here services like EULER or the reference databases in mathematics have to be taken into account. Using EULER integrated search in a group of offers including ElibM is possible. The user gets a list of sites where and in which form the document could be obtained, and in the case of an electronic offer he can click to the full text. Admittedly, the coverage provided by EULER is not comprehensive.

Using reference databases like Zentralblatt MATH a comprehensive offer could be reached. There is no need to subscribe to Zentralblatt for this purpose, because for non-subscribers every search displays only the first three items of a hit list. If somebody is looking for a special paper, he most probably has sufficiently precise information on the author, title or journal such that the entries to the search mask will lead to a list with at most three hits. The full entry in Zentralblatt provides the user with two links, one to the full text if electronically available, the other to a set of document delivery services where a copy of the article could be ordered.

In addition to these primary links between articles and Zentralblatt an advanced navigation through Zentralblatt to get to an article of interest is possible. This works when an electronic article provides reference links and when the user is interested to get to a cited article. The links may rely on DOIs or other more affordable systems of digital object identifiers. The Zentralblatt MATH accession numbers are one choice for that. They can be used for a one item search, and after that the user can proceed like in the previous paragraph.

For this kind of access it is important to increase the digital content available in mathematics. Most of the dual journals in ELibM have back volumes, which had been available in printed form only. With the support of the ERAM project mentioned below (see also [6]) these back volumes have been scanned and made accessible through a document server at SUB Göttingen. These holdings of back files are connected with the digitally born offer of the journal in ELibM providing open access for the whole life period of that journal.

The same applies to other journals covered by ERAM. With a licence obtained through EMANI several journals of high reputation offer their full period of back volumes for free access. Also the articles published in "Journal für die Reine und Angewandte Mathematik" (Crelle's Journal) can be found there. All these offers are linked with Zentralblatt, and using the access facility described above, they can be accessed by mathematicians worldwide through EMIS.

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