Two Digital Libraries

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> *Book Reviews bring interesting mathematical sciences and education publications drawn from across the entire spectrum of mathematics to the attention of the CMS readership. Comments, suggestions, and submissions are welcome.*

Two Digital Libraries Reviewed by Karl Dilcher

Book reviews are usually about new publications, which of course makes sense. In this issue, however, I'd like to do something quite different: not just write about older books, but about *very* old books. In particular, I will present two web resources that deserve to be widely known; both of them are co-hosted and supported by our sister society, the Mathematical Association of America (MAA).

The Euler Archive

There is hardly any part of pure or applied mathematics that cannot be traced back to Leonhard Euler (1707—1783). He is widely considered the most prolific and one of the greatest mathematicians of all time. Fortunately, almost all his very numerous articles and books are freely available in one place, in the excellent Euler Archive (http://eulerarchive.maa.org) which bears the subtitle "A digital library dedicated to the work and life of Leonhard Euler".

This web resource is best described by quoting from the text of its main page: "The Euler Archive is an online resource for Leonhard Euler's original works and modern Euler scholarship. This dynamic library and database provides summaries of and access to digitized versions of original publications, and references to available translations and current research.

"The Archive is centered on individual web pages corresponding to (and containing information about) each work written by Leonhard Euler (more than 850 of them). Most pages also contain copies of the original publications of these works. These collected works exist on a Digital Commons platform at the University of the Pacific […].

"The Euler Archive was created by Dominic Klyve (Central Washington University) and Lee Stemkoski (Adelphi University). It was hosted by Dartmouth College from 2003 to 2011, and by the MAA from 2011 to 2018. The site has been hosted jointly by the MAA and the University of the Pacific since 2018. It is currently managed by Erik Tou (University of Washington, Tacoma) and Chris Goff (University of the Pacific)."

The Archive can be searched by subject, date written, publication source, and Eneström number, an enumeration named after the Swedish mathematician Gustav Eneström who, in 1913, completed a comprehensive survey of Euler's work and enumerated 866 distinct items. Each entry in the Euler Archive comes with a title page containing complete bibliographic information, including the original language (mostly Latin), a helpful content summary in English and, of course, a download button for a scan of the original work.

The Archive also has a list of currently 207 publications which have been translated into a modern European language, often English; however, not all of these translations seem to be available for download. Particularly nice for those who know some Latin, or want to study mathematical Latin,

are side-by-side translations; one such translation is of E134, "Theoremata circa divisores numerorum".

A separate list of Euler's books can be found under "Publication Source" and then "Books and Pamphlets". It includes the famous 2-volume "Introductio in analysin infinitorum" of 1748 (E101, E102), but also the less known "Neue Grundsätze der Artillerie" of 1745 (E77), or "Tentamen novae theoriae musicae", published in 1739 (E33). The titles of these last two books, so different from what we usually consider Euler's work, will need no translation.

Further content of the Euler Archive includes historical information with brief articles on 18th century Europe and on important locations in Euler's life, brief paragraph-length biographical sketches of Euler's most important contemporaries (not only mathematicians), and links to biographies and related information about Euler. The Archive's final section, "Other Features", includes the relatively new electronic *Euleriana Journal*; a page devoted to Euler's correspondence, with many letters available for download; links to Ed Sandifer's online MAA column *How Euler Did It*; and a useful page containing further reading on Euler's work and on his life and times.

The Euler Archive is a fascinating resource that should be of interest to any mathematician. It will be particularly useful for historians of mathematics and for researchers who work in fields most strongly influenced by Euler, such as classical analysis, special functions, and elementary, analytic and combinatorial number theory.

The Euler Archive makes it easy to follow Laplace's famous dictum, "*Lisez Euler, lisez Euler, c'est notre maître à tous.*"

"Convergence", including "Mathematical Treasures"

While the Euler Archive is mostly devoted to a single author and is aimed towards historians and researchers, the purpose and format of *Convergence* (https://www.maa.org/press/periodicals/convergence) are quite different. To quote from its main page: "This MAA publication offers a wealth of resources to help you teach mathematics using its history." In the first place, *Convergence* is an electronic journal, now in its 19th year, with interesting articles that are in line with this brief description.

What made me include *Convergence* in this Book Reviews column is the *Mathematical Treasures* column, edited by Frank J. Swetz. It is a growing collection of "[…] images of mathematical objects and of selected pages of mathematical manuscripts and texts from various libraries, museums, and private collections." Indeed, the general index contains links to several hundred items, in alphabetical order by author, from Abel to Zubler. Many of the authors have multiple items listed; not surprisingly, the author with the most entries is Anonymous, with over 70 items, from 20,000—25,000 years ago (the Ishango Bone) to ca. 1960 (an RCA Flowcharting template).

Other *Mathematical Treasures* include items as varied as a Cambodian stone inscription of an early zero as a placeholder, dated 683 CE, and a few pages from Émile Borel's "*Élements de la Théorie des Ensembles", published in 1949. All items are well presented, with high-quality scans or photographs, and are accompanied by historical notes which explain the significance of the book or other item in question.*

In the case of books, typically a few key pages are given, with descriptions. Moreover, in some cases there are links to full texts of the books in question, either for viewing or for downloading through external web resources, such as Google Books, the Internet Archive, or resources listed in the *Mathematical Treasures* main page.

It is not surprising that very few women appear in the *Mathematical Treasures* index. One of them is Maria Gaetana Agnesi (1718—1799), now mainly known for a curve commonly called the *Witch of Agnesi*. This is an unfortunate mistranslation Agnesi's description of a cubic curve she treated in her book "*Instituzioni analitiche ad uso della gioventù italiana*" *(Foundations of Analysis for the Use of Italian Youth)*, published in 1748 in Italian and in 1801 in English translation by the Rev. John Colson. This book was actually one of the earliest treatments of calculus published on the European continent. Several pages from both the Italian and the English edition are reproduced in *Mathematical Treasures*, and the brief article accompanying the images tells the story of the translation and explains the mistranslation mentioned above.

This is just another example of the many real treasures that can be found in *Convergence*. This excellent resource is well worth exploring, and the many images with the accompanying facts and stories will indeed be great resources for the classroom or for student projects.