# Advanced features for publishing mathematics, in PDF and on the Web

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**Abstract**

Increasingly, mathematical, scientific and technical information is being distributed by electronic means, but having a high-quality paper printout remains important. We show here examples of techniques that are available for having both high-quality typesetting, in particular of mathematics, as well as useful navigation features and text extraction within electronic documents.

For HTML, we show some aspects of the use of jsMath within webpages; e.g., for mathematics journals or conference abstracts. With PDF, as well as the usual bookmarks and internal hyperlinks for cross-references and citations, advanced features include: (i) metadata attachments; (ii) copy/paste and searching for mathematical symbols or the underlying TEX coding; (iii) pop-up images of (floating) figures and tables; (iv) mathematical symbols within bookmarks; (v) bookmarks for cross-referenced locations.

A further feature, particularly useful with mathematics papers, is the ability to make batched searches of the American Math. Society's *MathSciNet* database, allowing hyperlinks to be generated for most bibliography entries.

## 1 Introduction

The nature of scientific publication is changing: it is becoming increasingly common for articles to be accessed and read on-line, without the need for printing. However, many researchers still prefer to print out an article, having first obtained it as a PDF file, say. Thus it is necessary to produce the PDFs in such a way as to cater for both online and printed formats. For online reading, one needs navigation aids that give quick and easy access to cross-references, citations, metadata, and such. However, with retro-born versions of books and journal articles, the addition of such aids must not have an effect on the original pagination. Furthermore, for long-term digital archiving, accurate metadata and links to access cited materials become especially important.

There are effects that are possible with current web-based and PDF technologies, but which hitherto have not been widely used with scientific articles. The effects were programmed for processing with pdf-LATEX, along with extra packages and coding to adjust the output produced by LATEX internal macros. Almost no further adjustments were made to the body of files used to produce the original printed version of each paper, apart from the imposition of `\label` and `\ref` commands where they had not formerly been used with cross-references. Where papers had been submitted using AMS-TEX, or even Plain TEX, then some extra markup was needed also with sectioning commands and other environments.

Here such effects are presented in a graphical way, as figures with extensive captions. Some extra text explains aspects that are not immediately apparent from seeing the images alone, along with a short outline of how these were implemented in LATEX, in terms of which (internal) macros needed to be patched, and what extra resources were used.

The HTML examples in Section 3 show use of Davide Cervone's jsMath software,[1] which can be linked to any website to provide proper typesetting of mathematics, as well as high-quality printing. This solves many of the problems that accompany other methods of displaying mathematics within webpages.

## 2 PDF files of full articles

The author has produced retro-born versions of all articles from a complete journal volume[2] as part of a feasibility trial to move from print-only to online access. Bearing in mind the considerations mentioned above, and with pdf-TEX and Unicode support becoming more widely available, much care was taken to incorporate navigational aids that are available

[1] jsMath homepage: http://www.math.union.edu/~dpvc/jsMath/.

[2] Bulletin of the Australian Mathematical Society, Volume 72 (2005); freely available online at http://www.austms.org.au/Bulletin.

with PDF documents. Several new techniques were developed to make these documents as useful as possible to researchers. These are now described briefly.

**a.** *Copy and Paste of blocks of text which include mathematical symbols (see Figure 1).*

This is achieved by adding a character map (CMap) resource[3] to each of the fonts that TeX uses, for typesetting the text and the mathematics. Such resources do not affect the appearance of the typeset material, but associate each (perhaps accented) letter and mathematical symbol with its Unicode code-point. In this way symbols are given a unique identity which can be used for copy/paste to other applications, and for searching within the PDF itself. Currently the actual result of a copy/paste action may depend on the particular software being used; that is, the PDF-browser used to view the article, and the text-editor, or other software, into which the content is pasted.

The author has produced CMap resources for the following old-style TeX font encodings: OT1, OML, OMS, OMX. Articles in the journal volumes[1] also used symbols from the AMS fonts MSAM and MSBM, Euler Fraktur fonts, and a few other characters, so CMap resources have been made for their 'U' (Unknown) encodings; namely files umsa.cmap, umsb.cmap, ueuf.cmap, ueufb.cmap, ulasy.cmap, and upzd.cmap (Zapf Dingbats) and upsy.cmap (Adobe Symbol). Resources have also been created for LY1 (Lucida) and LMR (Lucida Bright Math symbols) encodings.

In the case of the OML encoding, as used with the cmmi math-italic font family, the ordinary letters $A, B, \ldots, a, b, \ldots, z$ are associated with "math alphanumeric symbols" in Unicode Plane 1. Such symbols can be seen as the $M$, $P$, $x$ and $L$ within the **TextEdit** window in the middle image of Figure 1. However, bold symbols from cmmib fonts use the same OML encoding. Thus CMap resources have been constructed that are specific to the font face and style, rather than just to the encoding. Similarly files omlmit.cmap and omlbit.cmap, support the cmmi and cmmib font families respectively. Similarly there is OT1-encoded support for normal, italic, sans-serif (medium and bold) and typewriter alphabets used with mathematics.

A LaTeX package, called mmap.sty, is now available at CTAN.[4] This package provides these .cmap files and coding that causes the CMap resources to be included when the appropriate font is loaded for use with mathematics. Similar support for the full set of Euler fonts is planned, and other symbol fonts also can be supported.

**b.** *Images of figures and tables which pop up (see Figure 2) near the place in the text where the figure/table has been referenced.*

This feature allows figures and tables to be viewed without changing the PDF page that is displayed. It requires JavaScript[5] (or ECMAScript) to be enabled within the PDF browser. If the toggled image pops up in a place that is inconvenient for further reading, then it can be shifted to elsewhere on the page. With further developments of the PDF specifications and browser software, the means to move the image could be redesigned to become more intuitive. (Indeed, it would be nice if browsers had a 'cross-reference spy-glass' feature, providing a small-sized view of a different part of the same PDF, in response to clicks on the cross-reference anchors.[6])

In the event that JavaScript has been disabled in the PDF browser, so that the pop-up mechanism won't work, the toggle button should not appear and the underlying cross-reference hyperlink should work as usual. Unfortunately, not all PDF browsers implement this properly.[7] Even worse, Xpdf and eVince, prior to the v0.8.3 release (4 June 2008) of the Poppler library, would not even load documents built with pdfTeX containing form fields; when built with more recent versions of the library, these now work as intended.

Implementing this pop-up feature was done by altering the expansion of the standard LaTeX macros `\figure` and `\table`, thus changing the way that float contents are handled, and of `\ref` for building the toggle buttons. The first run of the LaTeX job is largely unchanged, apart from recording the number of floats encountered as the expansion of a macro `\hasfloats` within the .aux file, followed by a macro `\testforfloats`. On the next LaTeX run, as the .aux file is read `\testforfloats` is encountered, triggering code that reads the number of floats and causes extra packages to be loaded, such as pdftricks.sty, insdljs.sty for inserting JavaScript coding into a PDF, and pdfpopup.sty which has coding

[3] See Adobe CMap and CID specifications at `http://www.adobe.com/devnet/font/pdfs/5014.CIDFont_Spec.pdf`.

[4] ...in the directory location `.../tex-archive/macros/latex/contrib/mmap/`.

[5] See `http://en.wikipedia.org/wiki/JavaScript`.

[6] In fact the Skim browser for Macintosh (Mac OS X) has such a feature, providing an extra window to be opened, focusing on that portion of a document surrounding the target of a cross-reference hyperlink. This tool could be improved by respecting any destination *view* that may have been specified within the PDF.

[7] For example, Apple's Preview browser, at least up to version 3.0.9, neither supports JavaScript, nor respects the button flags. Hence not only do pop-up images fail to work, but also the underlying hyperlink cannot be accessed.

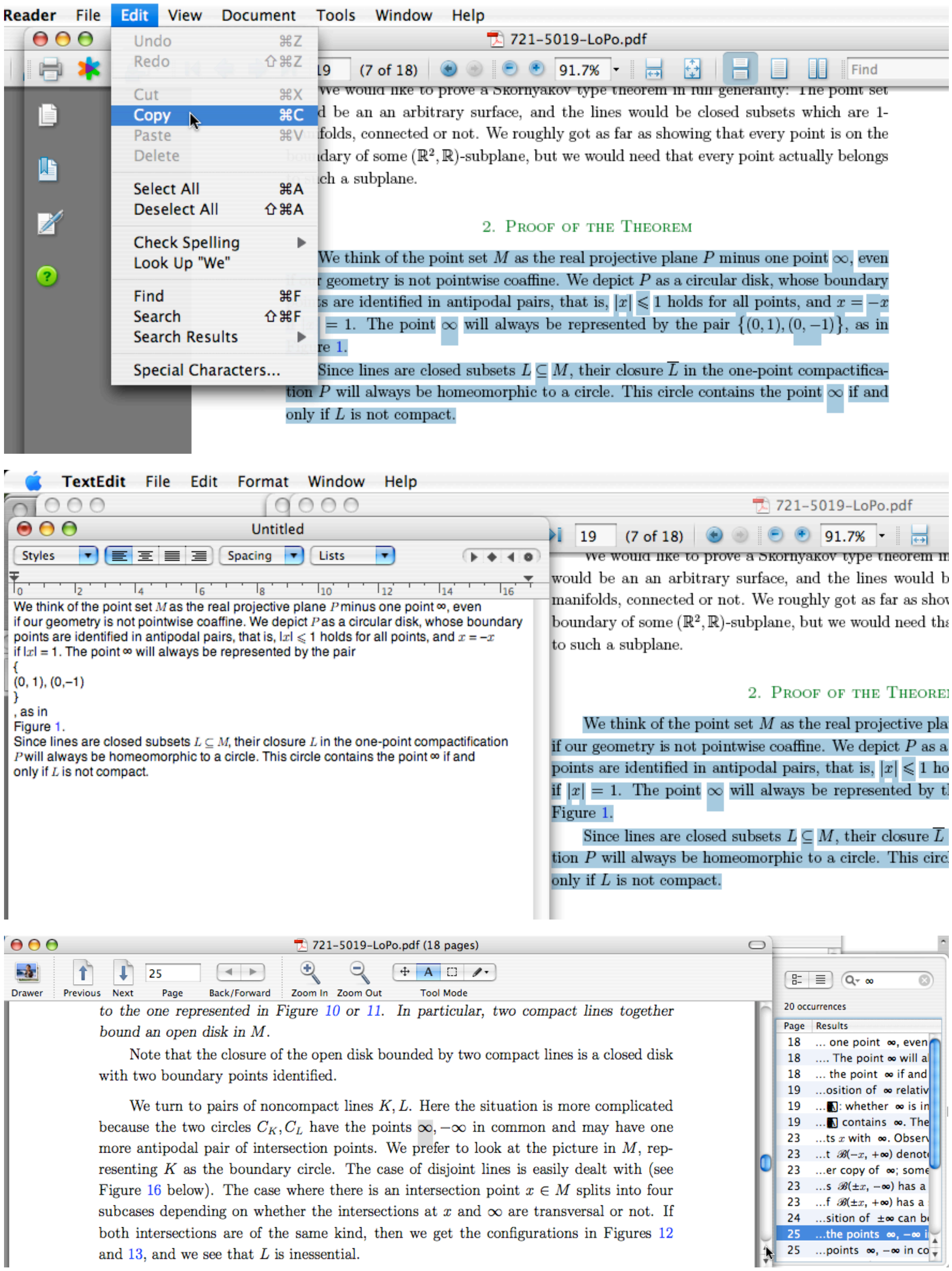
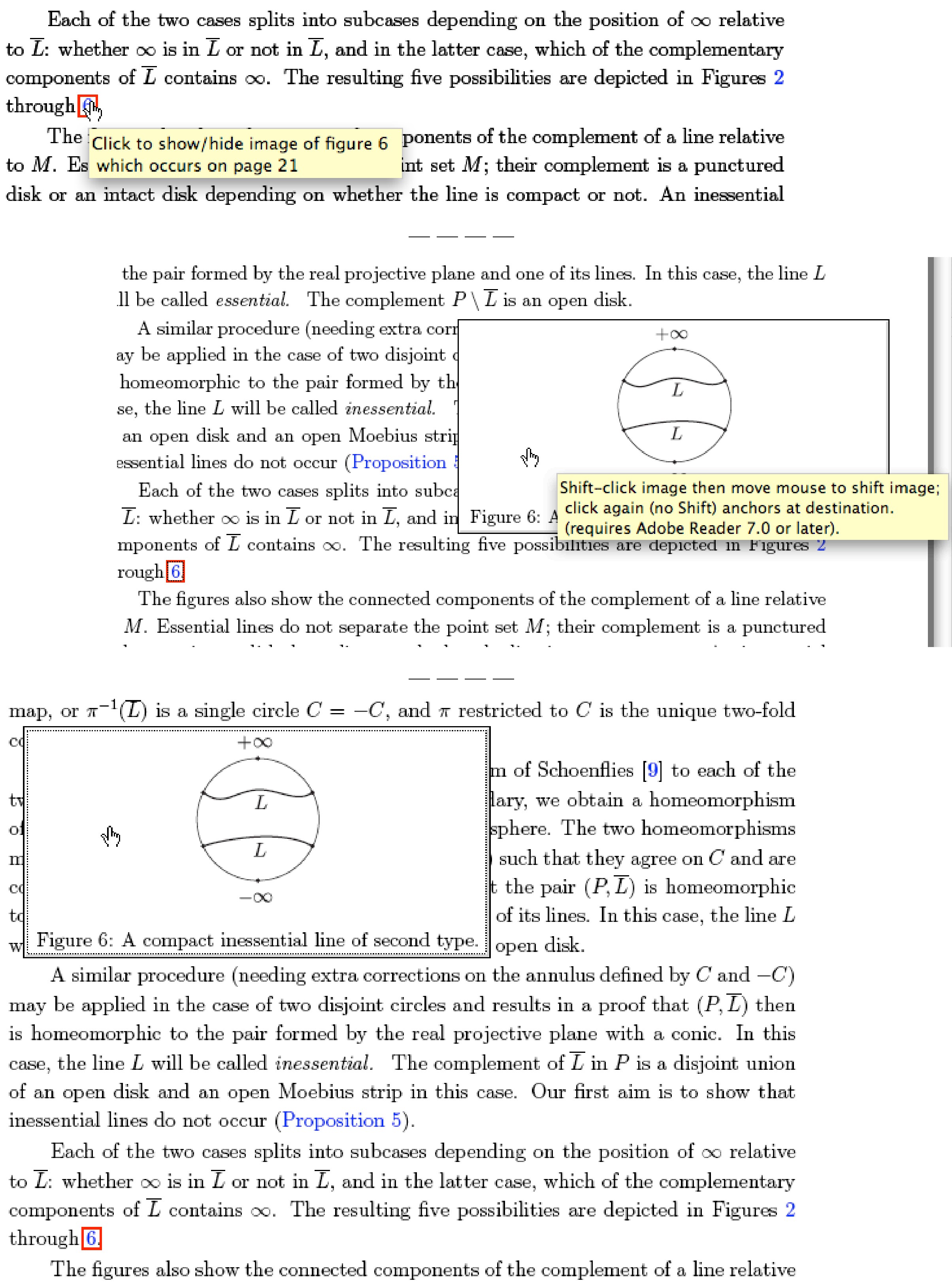



**Figure 1**: Copy/Paste of mathematical content: the middle image shows the result of pasting the contents that have been selected and copied, as shown in the upper image. The actual result of a copy/paste action may depend on the particular software being used; that is, the PDF-browser used to view the article. The lower image shows how searching for mathematical symbols is done, with suitably enabled PDF viewers.



Each of the two cases splits into subcases depending on the position of $\infty$ relative to $\overline{L}$: whether $\infty$ is in $\overline{L}$ or not in $\overline{L}$, and in the latter case, which of the complementary components of $\overline{L}$ contains $\infty$. The resulting five possibilities are depicted in Figures 2 through 6.

The Click to show/hide image of figure 6 which occurs on page 21 ponents of the complement of a line relative to $M$. Es int set $M$; their complement is a punctured disk or an intact disk depending on whether the line is compact or not. An inessential

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the pair formed by the real projective plane and one of its lines. In this case, the line $L$ ll be called *essential*. The complement $P \setminus \overline{L}$ is an open disk.

A similar procedure (needing extra corr ay be applied in the case of two disjoint c homeomorphic to the pair formed by th se, the line $L$ will be called *inessential*. an open disk and an open Moebius strip essential lines do not occur (Proposition

$+\infty$ $L$ $L$

Figure 6: A

Shift–click image then move mouse to shift image; click again (no Shift) anchors at destination. (requires Adobe Reader 7.0 or later).

Each of the two cases splits into subca $\overline{L}$: whether $\infty$ is in $\overline{L}$ or not in $\overline{L}$, and in mponents of $\overline{L}$ contains $\infty$. The resulting five possibilities are depicted in Figures 2 rough 6.

The figures also show the connected components of the complement of a line relative $M$. Essential lines do not separate the point set $M$; their complement is a punctured

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map, or $\pi^{-1}(\overline{L})$ is a single circle $C = -C$, and $\pi$ restricted to $C$ is the unique two-fold

$+\infty$ $L$ $L$ $-\infty$

Figure 6: A compact inessential line of second type.

m of Schoenflies [9] to each of the lary, we obtain a homeomorphism sphere. The two homeomorphisms such that they agree on $C$ and are t the pair $(P, \overline{L})$ is homeomorphic of its lines. In this case, the line $L$ open disk.

A similar procedure (needing extra corrections on the annulus defined by $C$ and $-C$) may be applied in the case of two disjoint circles and results in a proof that $(P, \overline{L})$ then is homeomorphic to the pair formed by the real projective plane with a conic. In this case, the line $L$ will be called *inessential*. The complement of $\overline{L}$ in $P$ is a disjoint union of an open disk and an open Moebius strip in this case. Our first aim is to show that inessential lines do not occur (Proposition 5).

Each of the two cases splits into subcases depending on the position of $\infty$ relative to $\overline{L}$: whether $\infty$ is in $\overline{L}$ or not in $\overline{L}$, and in the latter case, which of the complementary components of $\overline{L}$ contains $\infty$. The resulting five possibilities are depicted in Figures 2 through 6.

The figures also show the connected components of the complement of a line relative

**Figure 2**: Pop-up figures & tables: the images show how when the mouse hovers over a reference to a figure, it highlights a button to toggle showing and hiding a floating image. This image is moveable in case its natural position is inconvenient; e.g., obscuring where you wish to read.

for building buttons to show and hide the pop-up images.

Now when a float is encountered, the full contents of the environment is written out into a file, named according to the figure or table number, as part of a new LaTeX job which includes a preamble loading most of the same packages as in the main job. This subsidiary job is run, using LaTeX followed by dvips/ps2eps/epstopdf to get a single-page PDF with correct bounding box. The file is loaded back into the main job using `\pdfrefximage` within a `\setbox`, and its PDF object reference number is recorded for later use in placing the image on a JavaScript button field, when an appropriate `\ref` occurs. The object reference is also written into the .aux file as the expansion of a macro having its name derived from the figure number. This allows the reference to be used on the next run, with any `\ref` command that occurs before the float has been encountered, and also allows checking to see whether the reference number has changed, in which case a message is written to the .log file warning that another LaTeX run is required. Finally, the tokens for the float environment are recovered and processed normally.

On subsequent LaTeX runs, the image files do not need to be rebuilt, but are loaded from the PDF images created on an earlier run. If editing of the main document source changes the order of floats, the toggle buttons may become associated with the wrong images. Simply delete those images from the current directory; the correct ones should be generated afresh on the next LaTeX run. In case the content of a float contains `\ref` and `\eqref` commands or citations, the subsidiary job that creates an image also loads a copy of the .aux file from the main job, which copy was made at the end of the previous run. It's possible that cross-references have not fully stabilised, so simply delete any affected image; after two more runs it will have been regenerated and included.

If browser software had a 'cross-reference spyglass' feature (as suggested in the first paragraph of this item), then not only would there be no need for the PDF to contain JavaScript coding for the extra buttons, but also there would not be doubling-up of the information contained in figure and table floats. Furthermore, such a pop-up-like feature would 'just work' also for cross-references to section headings, numbered equations, etc., as well as to the floats, and perhaps also for citations and 'back-references' from the bibliography (see Figure 7, for example). This is surely the way that such a feature ought to be implemented; ideally it should not be necessary for a scientific document to include explicit programming which controls how its content be displayed, but just have declarations of which browser-supplied functions are to be used. The implementation presented here is mainly to demonstrate the usefulness and practicality of such a 'pop-up' feature for cross-referenced material, so that browser vendors might be encouraged to incorporate a similar feature within their own publicly-available software. However, there are certainly other, simpler uses for pop-ups to show extra images that are not found elsewhere among the usual pages of a document.

**c.** *Extended use of bookmarks (see Figure 3), . . .* Use of bookmarks is quite common for the major sections of a document; this is automatic when using `\usepackage{hyperref}` with a LaTeX document. This is here extended further to creating bookmarks for definitions, Theorems, Lemmas, etc., and also for figures, tables, and some equation displays. To avoid the bookmark window becoming too cluttered, only those equations that have actually been cross-referenced within the document are given their own bookmark.[8]

Having such bookmarks means that there are named destinations with the PDF at all the important places for the structure and content of the document. Furthermore these names are available in a separate file, so potentially this can be used to construct hyperlinks directly to these important places. This could be extremely useful in the context of a digital archive.

For figures and tables, a meaningful string to be the textual anchor in the 'Outline' window is obtained as the first sentence in the caption. This is obtained by reading the caption from the .lof or .lot file and parsing to locate the first full stop ('.'). With Theorems, Lemmas, Propositions, etc., the anchor-text uses the appropriate numbering, as seen in Figure 3. The limiting of bookmarks to only those referenced is achieved by patching the `\@setref` internal macro to implement a 'memory' of referenced labels. A line is written into the .aux file; this defines a macro, with name derived from the label. The coding for placing equation numbers is patched so that `\df@tag` now also places an anchor, and a bookmark for this anchor when the memory indicates that the equation has been referenced — which is known on the 2$^{\text{nd}}$ and subsequent LaTeX runs.

[8] It can be argued that if an equation is not referenced then it doesn't need an equation number. However, many articles have been written where the author has not followed this maxim. For creation of bookmarks, this maxim has been programmed-in.

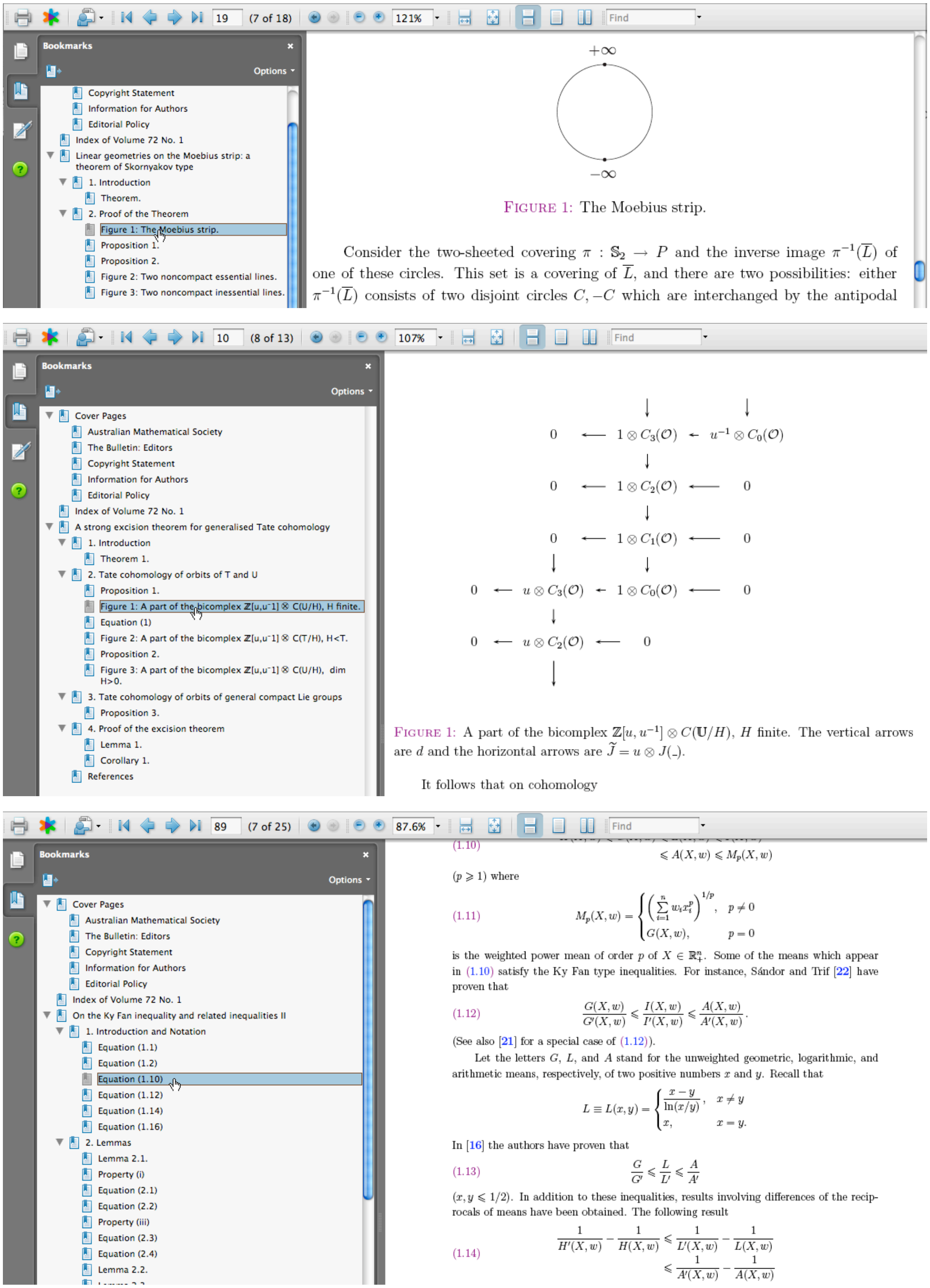


**Figure 3**: Bookmarks: these three images, taken from different articles, illustrate various aspects of the automatically created 'bookmarks'. These provide easy access to the important parts of the document, including front-matter as well as sections of the mathematical article itself; such as definitions, theorems, proofs, remarks and figures. The middle image shows that mathematical symbols can be used within bookmarks, while from the lower one it can be seen that a bookmark is not produced for every numbered equation, but only for those that are cross-referenced within the article itself.

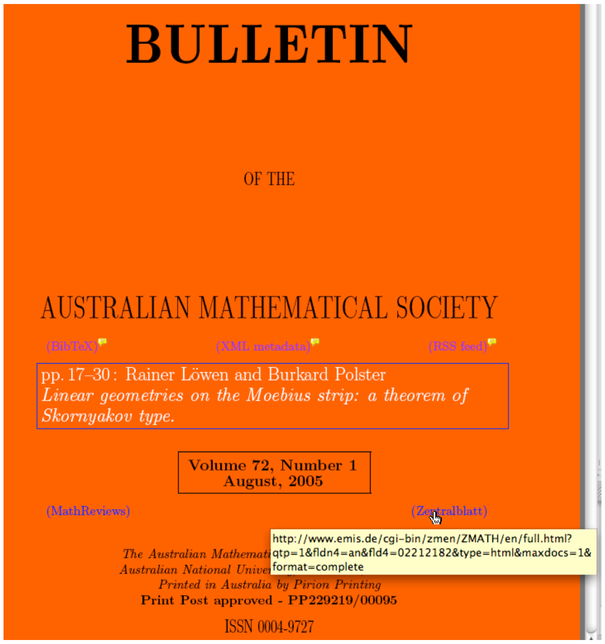


**Figure 4**: Cover page: this includes hyperlinks to recover the embedded metadata attachments, in various formats. Also there are links to the websites of the *Mathematical Reviews* and *Zentralblatt Math* reviewing agencies, where this article has been reviewed. The large button enclosing the title links directly to the start of the article proper.

**d.** *. . . including support for mathematical symbols and some super-/subscripts.*

The identifying strings displayed in the bookmarks window allow for the full range of Unicode code-points. This means that mathematical symbols can appear, which is most appropriate for figure captions, and mathematics is used with (sub-)section titles and theorem names, say. Even though the Unicode specification does not allow for complete alphabets of super-scripted and sub-scripted letters, an attempt is made to make good use of those that are available. Some further work is needed on this aspect of bookmarks.

**e.** *Inclusion of attachments (see Figure 4), containing metadata for the article, in various useful formats.*

The metadata for a scientific paper is important for various purposes, not least of which is citation within future works. By distributing a document with its own metadata, common difficulties can be avoided, such as the incorrect spelling of an author's name, or wrong affiliation, etc., or just getting the page numbers wrong. These PDFs come with text-file attachments containing various amounts of

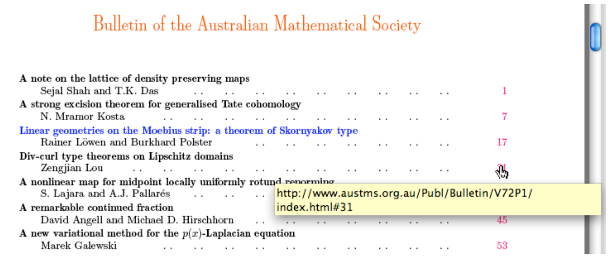


**Figure 5**: Index page: containing links to the Australian Mathematical Society's website, for accessing each of the articles from the same journal issue.

metadata in useful formats: (i) a BibTeX entry suitable for adding to a `.bib` file; (ii) a short HTML-formatted entry, suitable for an RSS feed; (iii) an extensive metadata file in XML format, which includes the complete bibliography of the article, as well as its own publishing details.

Each of these metadata files is generated "on-the-fly" by suitable TeX macro coding, using the information provided for typesetting the PDF document itself. Thus, barring mistakes in the various format translations required for this, the metadata is guaranteed to be consistent with what appears in print.[9] Access to these files is made easy by anchors on the cover page (see Figure 4) located above the white text of the article title and authors, which itself anchors a hyperlink to the start of the article proper.

When available, database codes for reviews of the article are included with the BibTeX and XML metadata files. In this case, the cover page has further anchors, for hyperlinks which give direct access to the review at Math Reviews[10] and Zentralblatt-MATH.[11] The same typesetting run that produces the PDF also builds an HTML webpage for the article.[12] This presents all the metadata and has the same hyperlinks, and more. Some format translations are also required when building such webpages.

Part of the metadata for an article is the context in which it has been published; namely, the complete journal issue. For this, we have chosen to

[9] This is a useful feature for freshly published articles, but is not really appropriate for a digital library or preprint archive, which would presumably have its own database of metadata already prepared and checked for the documents that it serves.

[10] A subscription to MathSciNet is required to make use of this hyperlink.

[11] Unregistered users have reduced access to the features available at this site.

[12] `http://www.austms.org.au/Publ/Bulletin/V72P1/721-5019-LoPo/index.shtml`

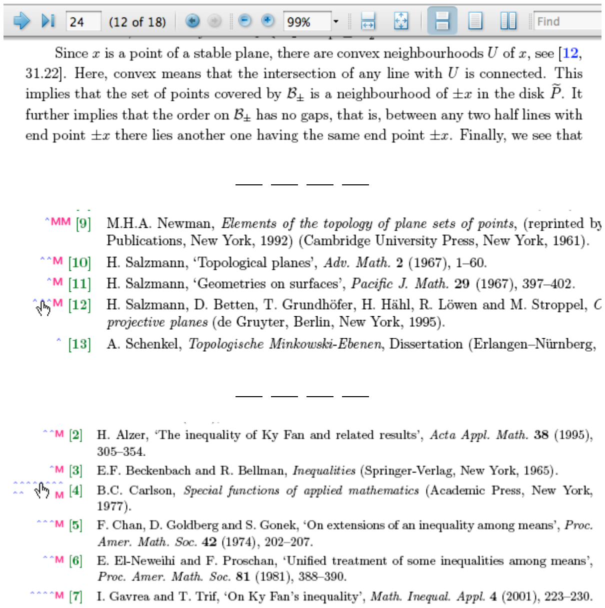


**Figure 6**: Back-reference hyperlinks: the middle image indicates how the caret (^) in the left margin is the anchor for an active hyperlink, which jumps to the location where the particular reference has been cited. The upper image shows the resulting change of focus. As there can be several citations of the same item, the carets are right-aligned, with up to eight in a row, as in the lower image.

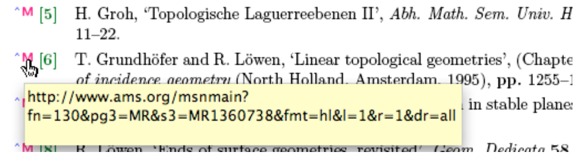


**Figure 7**: Hyperlinks to MathSciNet: the small raised M is the anchor for a hyperlink that connects to the American Mathematical Society's website. It links to the review of this cited bibliography item. It is possible to have multiple such links, as can be seen in entry [9] in the middle image of Figure 6.

include the complete front-matter that would appear in the printed version of the journal. The images of Bookmarks in Figure 3 show the kind of material that is included: Editors, Copyright Statement, Information for Authors, etc. Of course the Index page (see Figure 5) lists all other articles appearing within the same issue. For each article there is an active hyperlink, using the page number as the visible anchor, that directs a web browser to the public page at the Australian Mathematical Society's website where the article's abstract can be read, and its metadata (including references) examined. Also, the name of the article itself is the anchor for another hyperlink to the start of the article proper.

**f.** *Hyperlinking from the bibliography to the place within the text (i.e. back-referencing) where the citation occurred (see Figure 6), and to reviews at MathSciNet (see Figure 7).*

Including back-references is not new, nor is having hyperlinks within the bibliography, when such are supplied by the article's author. However, for articles where the original printed version did not have these features, there is the problem of how to include the extra information without upsetting the pagination. Figure 7 shows an elegant solution that places the hyperlink anchors discreetly into the left margin. The caret-accent character has been chosen to be suggestive of an upward link; that is, to the material preceding the bibliography, which is the main body content.

The second problem, which is perhaps the more difficult one, is that of how to automate the collection of data required to build hyperlinks to reviewing services, such as MathSciNet and Zentralblatt-MATH, or other online archives of scientific material. For these PDFs the author made use of a small program called bmref, which is essentially a 'batched' version of MathSciNet's Mref tool.[13] Provided by Patrick Ion (Associate Editor of Mathematical Reviews, AMS), this short Perl program sends a carefully constructed XML file as a query to the MathSciNet database, as an HTTP 'POST' to `http://www.ams.org/batchmref`. The result returned is an XML file containing the same data, but with extra fields added for (i) the number of matches found, (ii) the reference numbers (MR-number) of found matches, and (iii) full bibliographic information, for each bibliographic item included in the original submission.

This allows the MR-numbers to be obtained for all items in the bibliography (well, all those that have been reviewed), with a single submission. Each MR-number is sufficient to build the desired hyperlink. Of course this is not 100% reliable, and some searching at MathSciNet can uncover MR-numbers for items that were not found in the automated search; but the bulk[14] of the job is done automatically. TeX coding was developed to analyse the author-supplied bibliography prior to constructing the XML file for use with bmref. Taking advantage of

[13] See `http://www.ams.org/mathscinet-mref`.

[14] Of 516 separate cited items from 51 papers, 67 were not found automatically; 19 of these were found with some manual searching. The remainder were to journals not covered at MathSciNet, or to unpublished theses, etc.

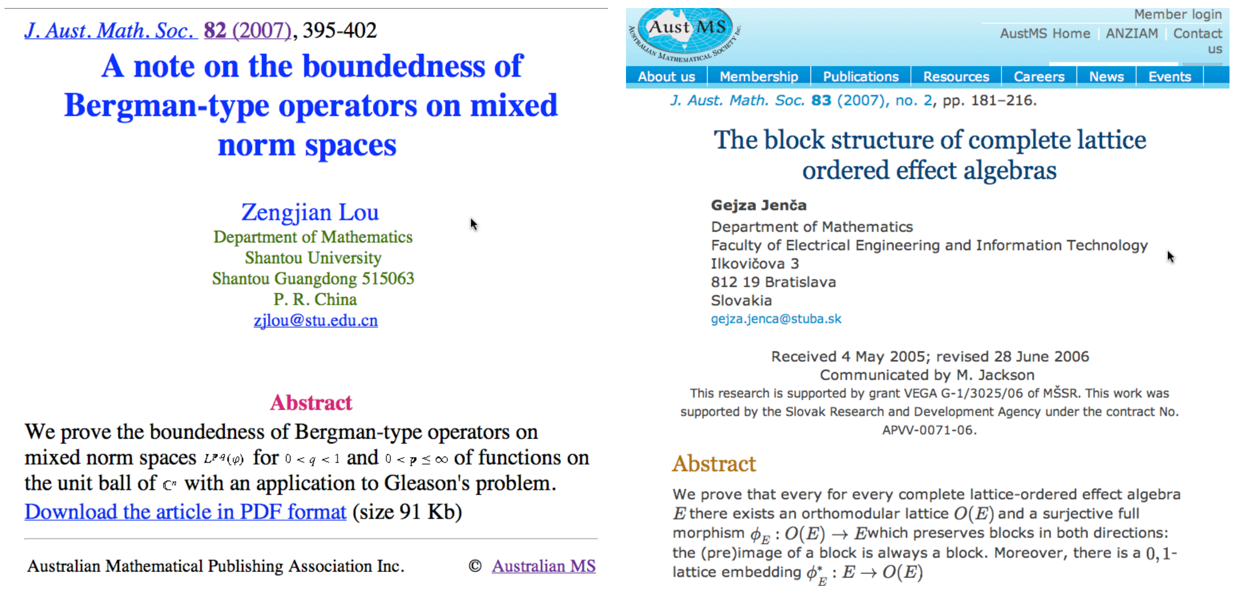


**Figure 8**: jsMath in webpages: the image at right illustrates the high quality and proper scaling of mathematical expressions within a webpage that uses the jsMath applet software. This contrasts starkly with the image at left, displaying poorer quality and lack of scalability in the static images, used with older web technologies.

TEX's `\write18` feature to run external commands and await the reply, the whole process can be fully automated and integrated with the typesetting run: craft the XML file, send to MathSciNet, analyse the result, extract the MR-numbers, then make these available for creation of hyperlinks. After a successful result of one such run, there is no need for the same tasks to be repeated on subsequent typesetting runs.

The bibliographic information returned can be requested to be in any of the usual formats: bibtex, amsrefs, TeX, html or as an HTML hyperlink. Thus this information could be used to check the bibliographic details provided by the author, or could even replace it altogether. This was not done with these tests, due to the desire to have the online content be the same as what was printed; however, if any factual errors were noticed (such as incorrect Volume or page numbers) then these were corrected.

In the hope of finding capabilities comparable to bmref, the author also searched Zentralblatt-MATH and other journal archives, for the availability of online tools for batched searches — unfortunately without success. Searches for a single article could be automated, but with fuzzy-matching this would result in multiple hits, requiring significant extra processing to determine whether the sought-after article actually had been located at that site.

In the context of a digital library or preprint archive, there may well be a large database of metadata readily available which could be easily searched instead. Indeed then it might be possible to include links not just to reviews of an article, but to the article itself. Some appropriate icon or symbol would then be used to indicate the kind of information to be found at the target of the hyperlink.

## 3 HTML pages for abstracts, etc.

At the end of 2007, the Australian Mathematical Society made a complete change in the hosting arrangements of its website,[15] as well as a change in the publication arrangements for its journals. There were still several journal issues[16] that were not covered by the new arrangements, for which PDFs were still to be served from the Society's site. This necessitated the need for abstract pages which were publicly available, having hyperlinks to the PDFs which are accessible only with a subscription. The job of creating these pages fell to the current author, in the rôle of web-editor for the Society.

The same techniques that were used for the Bulletin PDFs were used for this task, only now there was no full article PDF being produced. Thus the principal outputs were the HTML pages and metadata files. MR-numbers were obtained in the same

[15] Australian Mathematical Society's website: `http://www.austms.org.au/`.

[16] J. Austral. Math. Soc., Vol. 83 (1) & (2): `http://www.austms.org.au/Publ/JAustMS/`, and ANZIAM Journal, Vol. 49 (1) & (2): `http://www.austms.org.au/Publ/ANZIAM/`.

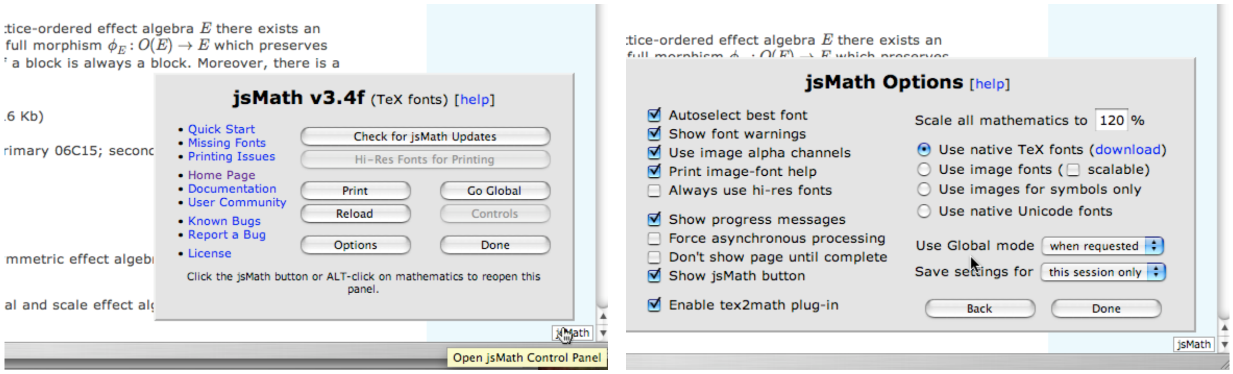


**Figure 9**: Help, Options & fonts with jsMath: the image at right shows how to bring up the jsMath control panel, displaying the ready availability of options and help features. In the Options panel, shown at right, one sees the great flexibility in the way different fonts or images may be used to construct the mathematics. Best quality is obtained by downloading and installing the jsMath fonts, or using local Unicode fonts.

way as described above, only now the reference data was presented in a different way, as LaTeX-formatted `.bbl` files. There were other differences in the metadata too, requiring some minor adaptations of coding used previously.

A significant addition however, was the choice to use jsMath for the mathematical expressions that appeared in titles, abstracts and occasionally within the names of cited papers. Davide Cervone's jsMath software[1] is a JavaScript applet that is effectively a cut-down version of a TeX compiler that does proper typesetting of stand-alone[17] mathematical expressions. The author had used this before with the ≈ 5000 abstract submissions for the ICIAM07[18] Congress, and had made several suggestions for bug-fixes and other improvements that Cervone willingly implemented. As well as providing a better quality presentation of mathematics within webpages, jsMath also gives proper printing using fonts rather than images, and solves the problem of rescaling the mathematics to suit a web-surfer's choice of font size. Figure 8 displays this, by giving a comparison with a page produced using older methods.

A lot of help is readily available, as Figure 9 shows. The jsMath 'Options' panel allows various choices of fonts to use with the mathematics being shown. Specially prepared TeX fonts can be downloaded. When installed in the local OS, these can be used with pages from any website that employs jsMath. This not only gives the best possible quality of image (since it leverages font-rendering machinery on the local operating system), but also speeds up processing since less information needs to be downloaded from that site. Alternatively, a local Unicode font could be used for similar speed gains, but the resulting layout of complicated mathematical expressions might not be as finely tuned as with the jsMath TeX fonts. Now Copy/Paste and searching refer to the Unicode code-points for mathematical symbols, whereas otherwise these operations would use the position in traditional TeX encodings.

## Conclusion

Here we have described several advanced features applicable in particular to the electronic publication and presentation of mathematical papers, but which have much wider utility. The emphasis is more on the nature of these features rather than on any specific means of implementation, since various forms of implementation can be possible appropriate to the particular circumstances of distribution and production. The existence of example documents[2] is "proof of concept" that these are achievable with current TeX software. Indeed these can serve as a test bed for some of the features where there are inconsistent levels of support within current browsers; e.g., Copy/Paste and searching with regard to mathematical symbols, handling of overlaid annotations, spy-glass views, etc.

Hopefully, in the near future, some of these ideas will become standard practice, with consistent support across browser software, for the benefit of academics and researchers in mathematics and of the scientific community generally.

[17] It doesn't do full pages, nor handle counters, cross-referencing, citations, etc.

[18] Browse at the ICIAM07 timetable: `http://www.iciam07.ethz.ch/timetable/`.