Communications

An invitation to use MathJax*

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The use of mathematical equations in web pages has always been challenging. The first attempts used the standard (ASCII) characters to imitate mathematics so expressions like `x^2+y^2=z^2` could be understood. As LaTeX came into vogue, it was used as an encoding of mathematics so that expressions like `$\int_{-\infty}^\infty \re^{-x^2} \sd x=\sqrt{\pi}$`, while not directly viewable, could at least be interpreted by those sufficiently familiar with LaTeX syntax. It was also possible to cut and paste into a LaTeX file for supplemental viewing.

The next stage of development involved the insertion of graphic files into the web page. Mathematics text in LaTeX format would be specially denoted, and each such snippet would be sent through LaTeX with the output being converted to a graphics format that could then be inserted into the page. For the better part of a decade this method became increasingly refined. The standard became LaTeX2HTML, which is still available and supported by Ross Moore of the Mathematics Department at Macquarie University.

This did allow recognisable mathematics, but it was not without drawbacks: the mathematics would not resize when the page was zoomed resulting in mismatched font sizes between text and mathematics, and the graphics could not reshape itself if the page dimensions changed. At times the images could have visible jagged edges or other pixelation problems. It was, however, an ingenious method that served the mathematical community well.

The arrival of MathJax has completely changed this situation. The different approach is to have the computer supporting the browser use JavaScript to draw the mathematics on the page. This allows a very accurate presentation, with no jaggies (visible pixelation) associated with graphic insertions. It also allows greater access to the things that the browser does best: resizing and reflowing for example.

Furthermore, the newest version (2.0) of MathJax now has greater LaTeX support. The entire AMSmath and AMSsymbol packages are available. This includes the blackboard bold and fraktur fonts. Does this sound interesting? Want to see if it works with your browser? If you're connected to the net, take the little snippet of HTML code following this paragraph and put it into a file on your computer. Then open the file with your browser. If all goes well, you will have a centred

*Based on an article that first appeared in IMU-Net 52: March 2012, the newsletter of the International Mathematical Union.

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equation which will remain centred if you change the width of the display. Also, the mathematics will remain perfectly rendered and crisp as you zoom in.

```
<head>
<script type="text/javascript"
src="http://cdn.mathjax.org/mathjax/latest/MathJax.js?config=TeX-AMS_HTML">
</script>
</head>
<body>
Here is a special equation:
\[ e^{i\pi}+1=0 \]
The five most important mathematical constants, all in one!
</body>
```

A picture is really worth a thousand words. The adventurous might want to replace the equation in the example with their own favourite, or take the LaTeX example from the first paragraph and see how (beautifully) it appears.

There are (intentional) limitations to MathJax. It is designed to render pieces of mathematics rather than complete bodies of text. The browser itself is capable of rendering text quickly, so let it do what it is good at. Don't expect to take your favourite LaTeX paper and just drop it into MathJax. It won't work.

Another limitation is the time it takes JavaScript to render the mathematics. A complicated page with lots of symbols can take many seconds to be completely viewable, especially on a slow computer, so, whenever possible, keep pages short and not too complicated.

Also, the famous 'less than' problems still exists. That is, if you try to use something like `$x<y$` in a file, the '`<`' symbol will never make it to MathJax since it will be interpreted as html code (as in `<head>` above) and generate an error. This problem can be avoided by adding a space: '`$x < y$`'.

Even with these limitations, the range and beauty of LaTeX now displayed by MathJax is impressive. With the newest version, as mentioned before, all of the constructions from the amsmath package, as well as all of the amssymbols are available. In addition, there it is possible to use automatic line numbering and some referencing features, just as in LaTeX. While not without drawbacks, it will certainly make big improvements to mathematics on the web.

Michael Doob, after spending many years doing mathematical research in algebraic graph theory, suddenly took an orthogonal turn and developed interests in the possible roles of the computer in the presention of mathematics in different contexts: in research papers, in journal articles, and on the web. His current interests include the integration of LaTeX, MathJax and Asymptote into mathematical wikis to allow collaborative research.