Using MathJax and its Accessibility Features

Volker Sorge, Peter Krautzberger

MathJax

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Read along at:
`mathjax.github.io/MathJax-a11y/slides/ahg16.pdf`

What is MathJax?

- MathJax is a JavaScript library for rendering Mathematics in all browsers
- Can take LaTeX, AsciiMath, and MathML as input
- Generates browser output, e.g. HTML/CSS, SVG
- Standard Maths rendering solution for: stackexchange, wordpress blogs, mediawiki, etc.

MathJax is the de facto rendering solution of (nearly) all Mathematics on the web (35 million unique daily rendering requests via CDN)
http://www.mathjax.org

- Use it directly from CDN
- Configure according to the need of your web document
- Local installations possible
- Detailed documentation available at:
  http://docs.mathjax.org
- Large user community and support

- Load directly from <u>C</u>ontent <u>D</u>istribution <u>N</u>etwork
    - Include single line script tag into web document
    - Example with broad, standard configuration

```
<script
 src='https://cdn.mathjax.org/mathjax/latest/MathJax.js?
 config=TeX-AMS-MML_HTMLorMML'></script>
```

- Local configurations to customise for your web content
    - Allows for fine-grained control of MathJax's behaviour
    - Needs to be added BEFORE the CDN call
    - Example for including inline LaTeX formulas:

```
<script type="text/x-mathjax-config">
MathJax.Hub.Config({
  tex2jax: {
    inlineMath: [['$','$'],['\\(','\\)']]
  },
});
</script>
```

- Inbuilt and optional accessibility features
- Selectable in context menu since MathJax v2.7

More details at:
https://www.mathjax.org/
mathjax-accessibility-extensions-v1-now-available/

MathJax's AT Features

- Magnification
- Responsive Equations and Abstraction
- Highlighting
- Interactive Exploration
- Speech Generation

Magnification

- Zoom feature for single math expression
- Magnification up to 500%
- Option selectable in context menu
- Customisable trigger via mouse and keyboard actions

Responsive Equations

- Responsive design enhances reflow and readability of math documents
- Automatic reflow for simplifying layout, adapting to form factor of display and magnification
- Intelligent linebreaking by exploiting semantic enrichment
  - Don't break in the middle of an expression
- Chunking: Abstracting over large elements
  - collapsing mathematically meaningful sub-expressions

- "Walkers" allow to interactively dive into mathematical expression
- Synchronised highlighting together with aural rendering
- Use <shift><space> to explore expressions
- Simple navigation model using arrow keys
- Different types of walkers: syntactic, semantic
- Interactive collapse and expansion of sub-expressions

Aural Rendering and Highlighting

- Speech strings are computed with Speech Rule Engine (SRE)
- Currently uses the MathSpeak rules: verbose, brief, superbrief
  - special summarisations for collapsed parts
  - Other rule sets and localisations in the future
- WAI-ARIA and CSS to implement interactive exploration
  - Speech output by updating ARIA live regions
  - Colour/contrast changes by rewriting CSS properties
- Speech strings can be precomputed or generated on the fly
- Works for all renderers MathJax provides

Exercise

1. Build a web document for the quadratic formula:

   ```
   \[
       x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}
   \]
   ```

2. Include basic MathJax configuration, e.g. take it from
   https://www.mathjax.org/#docs

3. Experiment with the MathJax accessibility extension
   1. Load it from sub menu
   2. Use <shift><space> to explore expressions
   3. Experiment with NVDA screen reader

```
<html>
  <head>
  ... MathJax script tag goes here ...
  </head>

  <body>
  ... Quadratic equation goes here ...
  </body>
</html>
```

Exercise Advanced

After loading the explorer extension, you will see that subtitles are still greyed out in the sub-menu.

④ Switch sub-titles on programmatically in your page
  ① Add a configuration option for MathJax
  ② Make sure to add it BEFORE the call to CDN

```
menuSettings: {
  'Assistive-subtitle': true
}
```

Hint: Full Configuration Tag

```
<script type="text/x-mathjax-config">
  MathJax.Hub.Config({
    menuSettings: {
      'Assistive-subtitle': true
    }
  });
</script>
```

For other demonstrations and experimental tools follow the links at
https://github.com/mathjax/MathJax-a11y

Solution 1

```html
<html><head>
<script
 src='https://cdn.mathjax.org/mathjax/latest/MathJax.js?
config=TeX-AMS-MML_HTMLorMML'>
</script>
</head>

<body>
\[
    x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}
\]
</body>
</html>
```

Solution 1 advanced

```html
<html><head>
<script type="text/x-mathjax-config">
  MathJax.Hub.Config({
    menuSettings: {'Assistive-subtitle': true}});
</script>
<script
 src='https://cdn.mathjax.org/mathjax/latest/MathJax.js?
config=TeX-AMS-MML_HTMLorMML'>
</script>
</head>

<body>
\[
   x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}
\]
</body>
</html>
```

Solution 2

```html
<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML//EN">
<html><head>
<title>AHG Exercise</title>
<script type="text/x-mathjax-config">
  MathJax.Hub.Config({
     menuSettings: {'Assistive-subtitle': true}});
</script>
<script
 src='https://cdn.mathjax.org/mathjax/latest/MathJax.js?
config=TeX-AMS-MML_HTMLorMML'>
</script>
</head>

<body>
<h1>Quadratic Equation</h1>
\[  x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}  \]
<hr>
Last modified: Sun Nov 13 20:11:55 MST 2016
</body> </html>
```