Interactive Teaching Materials in PDF using JavaScript

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Thessaloniki, July 2nd, 2003,

Abstract

The use of JavaScript scripting language for adding interactivity to portable teaching materials of a high typographical quality in PDF file format is described. An extended version of the program TEX called pdfTEX is extremely useful for such purposes. It is shown that applications similar to those done by a CGI scripting on the web can be done in PDF, exploiting Acrobat forms and the embedded JavaScript engine implementation in Acrobat Reader or other PDF viewers.

An Outline

① Motivation: Teaching Materials needed

② Textbook Mathematical Analysis with Program MAPLE

③ Formats for Electronic Delivery

④ PDF

⑤ TEXnicalities

⑥ Summary and Future Work

Motivation: Teaching Materials for a Course Needed

- Different students, different transport media (paper, braille, electronic digital format), different teaching materials.
- Design appropriate for classical textbook is not appropriate for electronic book to be read on the computer screen (different aspect ratio, different resolution, colors, possibilities of *interaction*).
- Standard error: blind copying of classical textbook design for other media without redesign and taking the advantages of *new media*.
- A picture is worth 1000 words, an animation is worth even more (not only when showing series convergence).

Textbook *Mathematical Analysis with Program MAPLE*

- The same data and multiple formats of delivery: paper and screen designs.
- The textbook design for electronic delivery.
- Animations – Taylor series.
- Animations – Fourier series.
- Both textbook versions generated from *one* LaTeX source (with logical markup) with almost the same texts, but totally different design.

Formats for Electronic Delivery

- PostScript by Adobe used for delivery of scientific papers.
- PDF (Portable Document Format) evolved as replacement of PostScript for digital age (10 years ago).
- HTML, MATHML support in Internet browsers is not yet mature, low quality of typography and mathematics “typesetting”.

PDF

- Object document format, flattened PostScript with hypertex features.
- Acrobat Forms since PDF version 1.2, FDF for collection of data.
- Interactive features since PDF version 1.3: embedded JavaScript code.
- Many tools for generation of PDF: full Acrobat, pdfTeX, PDFLib.

TEXnicalities

- Generated by version of TEX called pdfTEX, now in every good TEX distribution.
- Images for animations are created by any means author wants: by METAPOST, Maple, . . . you name it. Images are *icons for form buttons* in PDF forms.
- TEX macros to automatize the generation process, including *document level JavaScript*.

Summary and Future Work

- Teaching materials should be adapted to the student's needs not only in content, but in a form too: multiple modes of delivery is usually a must, in addition to high portability.
- The way of adding interactivity to mathematical textbook via JavaScript, TEX macros and Acrobat has been succesfully tested.
- The possible other usage of the method are possible: autotesting, multiple choice evaluation, multiple outputs (Braille, XML, . . .), calculator :-).