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Petr Sojka: Interactive Teaching Materials in PDF using JavaScript
Thessaloniki, July 2nd, 2003.

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 $\text{T}_{\text{E}}\text{X}$ called pdf $\text{T}_{\text{E}}\text{X}$ 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.

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An Outline 3

- ① Motivation: Teaching Materials needed
- ② Textbook Mathematical Analysis with Program MAPLE
- ③ Formats for Electronic Delivery
- ④ PDF
- ⑤ $\text{T}_{\text{E}}\text{X}$ niceties
- ⑥ Summary and Future Work

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Motivation: Teaching Materials for a Course Needed 4

- ☞ 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).

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Textbook *Mathematical Analysis with Program MAPLE* 5

- ☞ 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* $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ source (with logical markup) with almost the same texts, but totally different design.

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Formats for Electronic Delivery 6

- ☞ 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”.

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- ☞ Object document format, flattened PostScript with hypertext 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.

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- ☞ 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*.

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Summary and Future Work

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- ☞ 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 successfully tested.
- ☞ The possible other usage of the method are possible: autotesting, multiple choice evaluation, multiple outputs (Braille, XML, ...), calculator :-).

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