# MathBook XML
# Sage Edu Days 6
# University of Washington

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## 1  Introduction

Problem: It is hard to make a good-looking mathematics book for display in a browser.

Opportunity: There are lots of great things you can put on a web page (think Sage Cell Server).

Solution: very structured source, amenable to translation to a variety of outputs —traditional, new and unimagined

## 2  Philosophy

- Structure of a text = hierarchical tree (chapter/section/subsection)

- Markup to *clearly* reflect structure, *no* presentation allowed

- Powerful and flexible processing tools, designed for the job

Conclusion:

- XML (eXtensible Markup Language) –simple syntax

- XSL (eXstensible Stylesheet Language) –declarative, complex and powerful

- An "XML application" –design of the elements ("tags")

## 3  Goals

- Simple markup: sensible names, abbreviations, few attributes

- Excellent support for *authors*

- Knowledge embedded in system (think MathJax configuration)

- Flexibility through processing switches (e.g. numbering depth)

- XSLT converters to LaTeXand HTML (reference design)

- Low-level routines modularized

- Readable LaTeXoutput (insurance for the cautious)

All of this is possible with few compromises

# 4   Status

Primary (only) product: the XML application, the elements and their posssible arrangements
    Converters are to aid design and demonstrate potential (besides being useful)

- Specification is close to complete, seeing very few changes

- Converters are progressing –usable, but more to do

- Writing to a shared HTML specification:

    - David Farmer (AIM) is converting straight from LaTeX
    - Mike DuBois (UPS student, UTMOST) is creating CSS and Javascript

- About five book-length projects with about five authors involved

# 5   Examples I

One Sage worksheet, multiple output formats –LU decomposition for mathematics majors

- LaTeX → PDF

- HTML, with Sage Cell Server

- Sage Notebook (*.sws packaged via a Python script)

- SageMathCloud (small Python script to inject UUID's)

- iPython Notebook (HTML in JSON)

- MathBook XML source

# 6   Examples II

- Tyler Ueltschi's semester research project

- RAB & Godsil, Explorations in Algebraic Graph Theory with Sage

- RAB, A Second Course in Linear Algebra

- Tom Judson, *Abstract Algebra: Theory and Applications*, well underway

- Hitchman and Judson, *The Ordinary Differential Equations Project*, in-progress

- William Trench, *Introduction to Real Analysis*, to be converted by Albert Schueller

- RAB, *A First Course in Linear Algebra*, conversion from one-off XML to MathBook XML

- `sample-article.xml` from project documentation

# 7    Sage

Plans for further Sage integration

- `<sageplot>` element to produce graphics

- `doctest=""` attribute

- Larger works into worksheets by chapters or sections

- Improvements to CSS for SMC output (refactor existing)

- `%mathbook` magic for SMC

# 8    To Do

Development priority: user requests

- Restructure front matter: preface, acknowledgement, copyright, etc

- Generate back matter automatically: index, notation list, list of . . .

- Further widget support: audio, video (FlowPlayer), GeoGebra, WeBWork

- Further graphics support: tikz, Asymptote

- Conversion to ? (perhaps EPUB 3 EDUPUB Profile)

- Formulate a DTD (Document Type Definition) and/or schema

- Skulpt: browser widget to execute Python code

- WebRTC (real time communications API)

- Suggestions welcome!

# 9    Conclusion

- MathBook XML is fairly stable now

- Ready for authoring, if . . . you are prepared for *some* changes

- Converters are catching up, and provide modular base for other formats

- Main site: http://mathbook.pugetsound.edu

- Announcements and discussion at the mathbook-xml-support Google Group