

DLMF Content Dictionaries

The Next Iteration

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DLMF Project

DLMF Content
Dictionaries
The Next Iteration

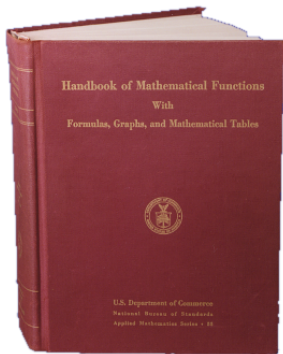
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Background

Special Function
Catalog

DLMF Content
Dictionaries

Conclusion



Digital
Library of
Mathematical
Functions

<https://dlmf.nist.gov/>

Goals

Background

Special Function Catalog

DLMF Content Dictionaries

Conclusion

- ▶ Up-to-date source of Properties of Mathematical Special Functions and Applications
- ▶ Preserve the character of a Handbook Primarily for Physicists, Engineers,
- ▶ More than *Book on the Web* But *not* a CAS or ATP on the Web.
- ▶ Quarterly releases
Errata; Clarifications; Additions; . . .

Hear more from Adri Olde Daalhuis, Thursday morning.

Technical Goals

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Conclusion

- ▶ Maintainable,
- ▶ Current with web-technologies
- ▶ Presentation MathML.
- ▶ Permalinks for reference data

Future Technical Goals

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Conclusion

- ▶ Machine-readable data/metadata
- ▶ Interoperability with other systems
Mathematica, Maple, Sage, ...
- ▶ System Agnostic:
Content MathML, OpenMath
- ▶ (semi-)formalize representation of Math in DLMF.
(path to doing similar in general \LaTeX)

- ▶ We use L^AT_EX.
- ▶ Depending on the markup you adopt
 - ▶ purely presentation, ambiguous,
 - ▶ clear semantics
 - ▶ anywhere inbetween!

Semantic Macros

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- ▶ We've adopted a system of semantic macros
- ▶ Most egregious offenders: Special Functions, first.
- ▶ Many ambiguities resolved; many remain.

Semantic Macros; Examples

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<code>\BesselJ{\mu}</code>	J_{μ}
<code>\BesselJ{\mu}@{z}</code>	$J_{\mu}(z)$
<code>\BesselJ{\mu}''@{z}</code>	$J_{\mu}''(z)$
<code>\BesselJ{\mu}^2@{z}</code>	$J_{\mu}^2(z)$

Disambiguation Project

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Conclusion

- ▶ Begun intense effort with Deyan Ginev
- ▶ Resolve ambiguities — by hook-or-crook:
Declarations, richer markup, inference
whatever it takes for DLMF.
- ▶ Why?
 - ▶ *It's time!*
 - ▶ Provide (small) annotated data set for machine-learning
See Abdou Youssef's talk, Tuesday afternoon.

Back to Special Functions

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Conclusion

- ▶ We have Semantic Markup.
- ▶ We have clear notion of each function is, mathematically.

But

- ▶ How do they relate to Wolfram's? Maplesoft's? NAG's?
- ▶ Not always clear!
Sometimes same, Sometimes different!
 - ▶ Arguments,
 - ▶ Branch cuts,
 - ▶ Generalizations.
 - ▶ ...
- ▶ GDML's Special Function Concordance
Need a basis from which to start discussions

Caveats

- ▶ I'm not a Special Functions expert,
or even a Mathematician.
- ▶ Concordance can be tricky and subtle (to me).

Approach

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- ▶ Publish OpenMath Content Dictionaries for DLMF's Special Functions
- ▶ In case of doubt, err on side of
 - ▶ Define DLMF versions of (almost) everything
 - ▶ Assume *Alignments* established by others.

Plausible organization

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- ▶ Based on DLMF Chapters
- ▶ Subdivided according to zeros, magnitudes, q -analogs, ...
 - ▶ DLMF_AI
 - ▶ DLMF_AI_gen
 - ▶ DLMF_AI_mag
 - ▶ DLMF_AI_z

Plausible Naming

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- ▶ Based on DLMF Macro set (to be published)
- ▶ Limitations/Abbreviations subject to \LaTeX requirements
- ▶ But avoid multiple naming conventions.

Defining URL's

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Conclusion

- ▶ See `https://math.nist.gov/~BMiller/DLMF-CDS/`

JSON Encoding

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Conclusion

- ▶ Virtual CDs
- ▶ Currently simplistic

What we're working on

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- ▶ OpenMath CD, DefMP's, MP's
(or Content MathML)
- ▶ Refine defining URL's
 - ▶ Smallest containing unit,
 - ▶ permalink
 - ▶ Ultimately more formal
eg. DE + boundary conditions

Debating points

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- ▶ Currying
- ▶ Derivatives

Please Comment

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