NIST Digital Repository of Mathematical Formulae

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- **Offshoot project** of **NIST Digital Library of Mathematical Functions** using **MediaWiki** with the **MediaWiki Math extension** providing **MathML** support.

- A platform for **publication** and **interaction** with **Orthogonal Polynomial and Special Function formulae**.

DLMF Macros

- Utilization of **DLMF LaTeX Macros** which tie specific **character sequences** to precisely defined **mathematical functions**.

- **Constants:** \expe,\iunit,\cpi,\EulerConstant

- **Special Functions and Orthogonal Polynomials**
  \EulerGamma@{z}: $\Gamma(z)$: gamma function
  \BesselJ{\nu}@{z}: $J_\nu(z)$: Bessel function 1st kind
  \LegendreQ[\mu]{\nu}@{z}: $Q_\nu^\mu(z)$:
      associated Legendre function of the second kind
  \JacobiP{\alpha}{\beta}{n}@{x}: $P_\nu^{(\alpha,\beta)}(x)$:
      Jacobi polynomial

Seeding/macro replacement effort

- **IDL** & **Python** seeding effort for **DRMF**:
    1. **NIST DLMF** – macros already implemented
    2. **KLS: Hypergeometric Orthogonal Polynomials and Their q-Analogues**
    3. **Koornwinder addendum to KLS**

- **DLMF OPSF Macros** via **LATEXML-server**
    - 546 **semantic DLMF LATEX OPSF** macros
    - **additional** 38 **semantic LATEX macros**
    - **Python** replacement code

Formula home pages

DRMF treats formulae as **first class objects**, describing them in **formula home pages** with:

1. Rendered description of the **formula** (required);
2. **Bibliographic citation** (required);
3. Open section for **proofs** (required);
4. **List of symbols** and links to **definitions** (required);
5. Open section for **notes**;
6. Open section for **external links**;
7. **Substitutions** required to understand the formula;
8. **Constraints** the formula must obey.

Page Discussion

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Formula:tDLMF:25.4+E5

formula in list-of-formulas page

$$(-1)^k \zeta^{(k)}(1-s) = \frac{2}{(2\pi)^s} \sum_{m=0}^{k} \sum_{r=0}^{m} \binom{k}{m}\binom{m}{r} \left(\Re\left(c^{k-m}\right)\cos\left(\tfrac{1}{2}\pi s\right) + \Im\left(c^{k-m}\right)\sin\left(\tfrac{1}{2}\pi s\right)\right)\Gamma^{(r)}(s)\zeta^{(m-r)}(s)$$

Contents [hide]
1 Substitution(s)
2 Constraint(s)
3 Proof
4 Symbols List
5 Bibliography
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Substitution(s)   [edit]

$c = -\ln(2\pi) - \tfrac{1}{2}\pi i$

Constraint(s)   [edit]

$s \neq 0, 1, k = 1, 2, 3, \ldots$

Proof   [edit]

We ask users to provide proof(s), reference(s) to proof(s), or further clarification on the proof(s) in this space.

Symbols List   [edit]

(-1) : (-1) = \opminus : http://dlmf.nist.gov/5.7.E7

ζ : Riemann zeta function : http://dlmf.nist.gov/25.2#E1

π : the ratio of a circle's circumference to its diameter : http://dlmf.nist.gov/5.19.E4

$\binom{a}{b}$: binomial coefficient : http://dlmf.nist.gov/1.2#E1 http://dlmf.nist.gov/26.3#SS1.p1

$\Re a$: real part : http://dlmf.nist.gov/1.9#E2

$\cos$: cosine function : http://dlmf.nist.gov/4.14#E2

$\Im a$: imaginary part : http://dlmf.nist.gov/1.9#E2

$\sin$: sine function : http://dlmf.nist.gov/4.14#E1

Γ : Euler's gamma function : http://dlmf.nist.gov/5.2#E1

$\ln$: principal branch of logarithm function : http://dlmf.nist.gov/4.2#E2

i : imaginary unit : http://dlmf.nist.gov/1.9.i

Bibliography   [edit]

Equation (5), Section 25.4 of **DLMF**.

URL links   [edit]

Formula link in **DLMF** : HTTP://DLMF.NIST.GOV/25.4#E5

formula in list-of-formulas page

Conclusion

Current Development:

- PHP – parsing the **semantic LaTeX**
- JavaScript – **MathJax** customized **menus**
- Java – **mathematical function based search**
- Python – **DLMF** and **KLS seeding** to produce **Wikitext** with **DLMF Macros**

Development instances:

- 2 **XSEDE** CentOS: **demo and deployment**
- 2 **XSEDE** Ubuntu **server**: **LaTeXML, Mathoid**
- 4 **WMF Vagrant** instances

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  - **Jake Migdall** – MathJax menu customization
  - **Amber Liu** – MathJax menu customization
  - **Alex Danoff** – seeding/macro replacement
  - **Jimmy Li** – mathematical search

- The **XSEDE** project and **Wikimedia Foundation**