swMATH – an information service for mathematical software and research data

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Agenda

- What is swMATH?
- How it works?
- The information in swMATH
- Open problems and next work

What is swMATH?

- swMATH is a specialized information service on mathematical software
- Content-focused: subject and content of the software are main information facets
- Linked data: swMATH contains data of more than 100,000 (mathematical) publications which reference the software (2016-01-25: 107,524)
- Lean production: the production is widely automatized
- Completeness: swMATH lists more than 10,000 (mathematical) software packages (2016-01-25: 11,700)

How does swMATH work? (I)

swMATH analyses the mathematical literature for software, more exactly the zbMATH data

zbMATH (www.zbmath.org):
bibliographic database on mathematics
with 3,562,902 entries from 1826 until now
fields:
author(s), title, source, references, publication year, language, document type, ...

How does swMATH work? (II)

Starting point: Mathematical software will become more and more important , also in publications
→ A simple idea: The publication-based approach

First step:
Identification of possible software packages in zbMATH data:
(by heuristic means: searching for characteristic patterns and phrases, e.g. 'solver' and 'artificial' words (as 'DiPoG' or 'WIAS-MeFreSim') in title, review/abstract, references in zbMATH)

How does swMATH work? (III)

Second step:
Analysis of the information of software packages:
For this purpose we use information from zbMATH and the Web.

We distinguish between two types of publications
- Standard publications (the software is the topic of the publication)
- Application publications (the software is used as a tool)

The information in zbMATH will be analyzed for swMATH in different way.

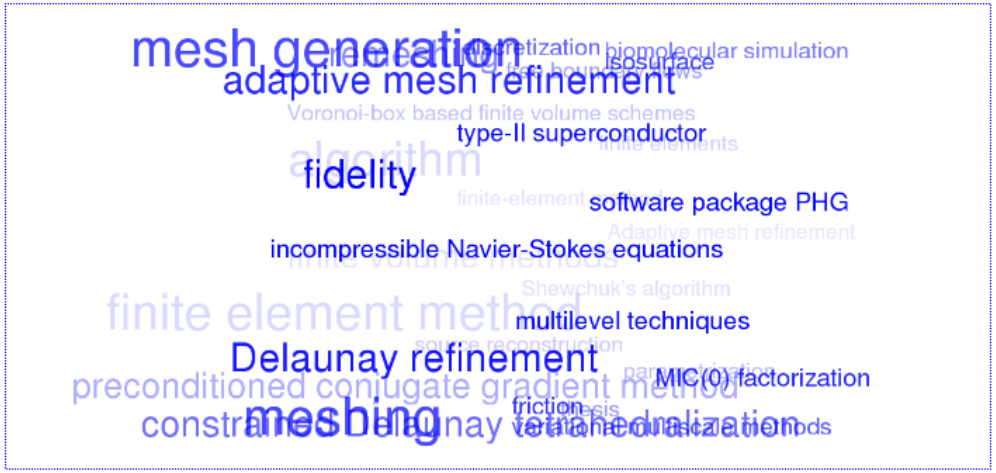
TetGen

TetGen is a program for generating tetrahedral meshes from three-dimensional domains. One of its main applications is to generate suitable meshes for numerically solving PDEs by finite element and finite volume methods. TetGen uses Delaunay-based algorithms which have theoretical guarantees on mesh quality and mesh size.

URL: wias-berlin.de/softwar...
Authors: Dr. Hang Si
Language: C++
Platforms: Unix/Linux, MacOS, Windows
Licence: MIT license with exceptions regarding copyright attribution and commercial use
Current version: 1.4.3 (19.01.2011)

Add information on this software.

Keywords for this software



Related software:

Gmsh
Triangle
Netgen
CGAL
deal.ii
libMesh
FEMSTER
GHS3D
PETSc
UMFPACK

Show more...

References in zbMATH (referenced in 39 articles)

Showing results 1 to 20 of 39.

Sorted by year (citations) 20

1 2 next

1. Caiazzo, Alfonso; Montecinos, Gino; Müller, Lucas O.; Haacke, E.Mark; Toro, Eleuterio F.: Computational haemodynamics in stenotic internal jugular veins (2015)
2. Kim, Sang-Un; Lee, Chang-Ock: Accurate surface reconstruction in 3D using two-dimensional parallel cross sections (2015)
3. Chen, Zhonggui; Wang, Wenping; Lévy, Bruno; Liu, Ligang; Sun, Feng: Revisiting optimal Delaunay triangulation for 3D graded mesh generation (2014)
4. Deckelnick, Klaus; Elliott, Charles M.; Ranner, Thomas: Unfitted finite element methods using bulk meshes for surface partial differential equations (2014)
5. Foteinos, Panagiotis A.; Chrisochoides, Nikos P.: High quality real-time image-to-mesh conversion for finite element simulations (2014)
6. Javani, H.R.; Peerlings, R.H.J.; Geers, M.G.D.: Consistent remeshing and transfer for a three dimensional enriched mixed formulation of plasticity and non-local damage (2014)
7. Kindo, Temesgen M.; Laursen, Tod A.; Dolbow, John E.: Toward robust and accurate contact solvers for large

Article statistics & filter:

Search for articles

Clear

MSC classification

- Top MSC classes
  - **35** Partial differential...
  - **65** Numerical analysis
  - **68** Computer science
  - **74** Mechanics of deformable...
  - **76** Fluid mechanics
- Other MSC classes

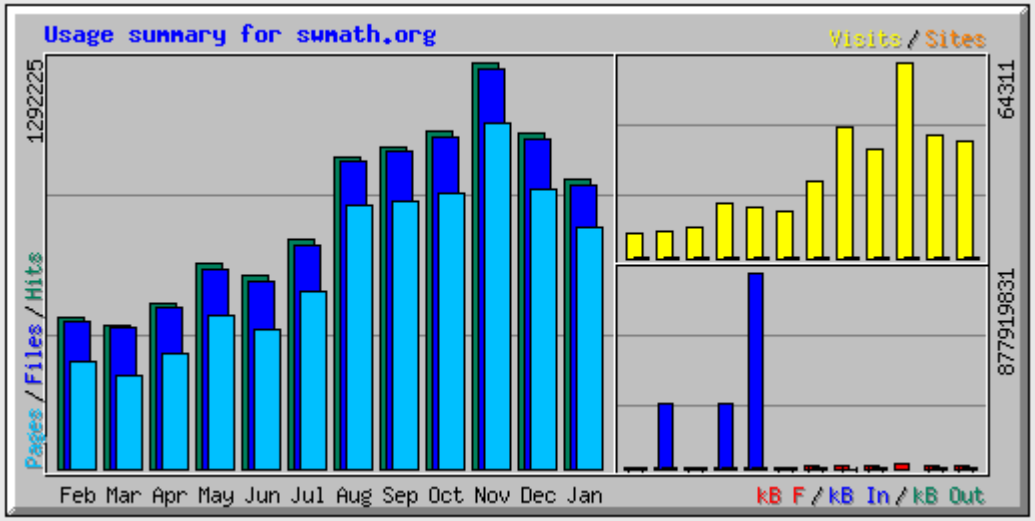
Publication year

- 2010 - today
- 2005 - 2009
- 2000 - 2004

Remarks (I)

- The focus of swMATH is currently mathematical software but it also contains data (e.g. benchmarks)
- swMATH is the most comprehensive database on mathematical software.
- swMATH is not a repository.
- swMATH data will be created from different resources by different heuristic and statistic methods.
- Some fields are difficult, not all information is perfect!
- swmath needs Your feedback! http://www.swmath.org/feedback
- swMATH is a free service for the mathematical community.

Remarks (II)



Summary by Month

Month	Daily Avg				Monthly Totals							
	Hits	Files	Pages	Visits	Sites	kB F	kB In	kB Out	Visits	Pages	Files	Hits
Jan 2016	36680	36155	30782	1536	10	9223634	14	673	38408	769550	903893	917021
Dec 2015	34421	33851	28658	1293	7	12124183	6	289	40106	888401	1049381	1067057
Nov 2015	43074	42429	36697	2143	6	22507867	0	0	64311	1100930	1272876	1292225
Oct 2015	34509	33954	28226	1150	7	11309721	2	97	35663	875016	1052574	1069782
Sep 2015	34092	33554	28281	1428	7	11021630	0	12	42864	848450	1006647	1022771
Aug 2015	32028	31501	26991	805	7	9951629	21	1032	24983	836748	976547	992898
Jul 2015	23477	22905	18237	502	10	7781414	11	548	15592	565359	710055	727811
Jun 2015	20463	19886	14831	550	6	6529287	877919831	367	16513	444951	596588	613911
May 2015	21012	20500	15606	573	5	7362930	292639958	910	17780	483806	635503	651389
Apr 2015	17575	17151	12246	338	6	5514088	9	513	10149	367409	514541	527267
Mar 2015	14779	14390	9593	284	6	4866961	292639950	423	8807	297384	446103	458174
Feb 2015	17127	16779	12065	284	6	5173890	6	284	7962	337847	469838	479564
Totals						**113367234**	1463199807	**5147**	**323138**	**7815851**	**9634546**	**9819870**

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Open problems and further work (I)

swMATH should be improved in several ways:

- Typing of resources
  swMATH contains not only references to mathematical software but also mathematical services (e.g. OEIS or DMLF) and data (e.g. benchmarks, test data etc.)
  Basic types: software / models/ services / data
- Standards for the description of the metadata:
  - citation standard for mathematical software (BibLaTeX, Biber)
    → secure identification of the objects (without heuristics) and additional information, especially version
    standards for technical parameters and usage conditions

Open problems and further work (II)

swMATH should be improved in several ways:

- Markup of high-quality mathematical software

  Software journals: ACM Transactions on Mathematical Software / The Archive of Numerical Software Future / Journal of Machine Learning Research / Journal of Multiscale Modelling and Simulation / Journal of Parallel and Distributed Computing / Journal of Software for Algebra and Geometry, Journal of Statistical Software, Knowledge-Based Systems, LMS Journal of Computation and Mathematics, The Mathematica Journal, Mathematical Programming Computation, Numerical Algorithms, The R Journal, Science of Computer Programming
  Peer reviewing contains the evaluation of the software
  Special Markup in swMATH?
- Author identification (together with zbMATH)
- Last but not least: Long-term archiving/repositories

www.swmath.org

Thanks!

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