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Education: Ph.D. Applied Mathematics, Cornell University, 1993
M.S. Applied Mathematics, Cornell University, 1991
B.S. Applied Mathematics, Engineering & Physics,
University of Wisconsin-Madison, 1988.

Ph.D. Thesis: "*Mesh Generation with Provable Quality Bounds*", S. A. Vavasis, 1993

Positions: Principal Member Technical Staff, Computer Science & Informatics, 2007-present
Manager, Optimization and Uncertainty Estimation Dept, 2002-2007
Principal Member Technical Staff, Parallel Computing Sciences Department, 2001-2002. Cubit Project Leader, 2000-2002.
Senior Member Technical Staff, Parallel Computing Sciences Department, Sandia National Laboratories, 1994-2001
Limited Term Employee, (AMS Fellow a.k.a. von Neumann Fellow), Applied and Numerical Mathematics Department, Sandia National Laboratories, 1992-1994
Summer Research Intern, Xerox PARC, 1991

Citizenship: United States, Department of Energy Security Clearances

Statement of Work and Interests

I am currently doing research, development and applications in discrete math, informatics, and computational science. Recent projects include designing and prototyping a mobile ad-hoc networking protocol; researching validation guidelines for computer models of humans cognition; design and development of the military logistics simulation CoreSim; researching and leading a small group on computational topology; and leading a team on "forecasting" (prediction, uncertainty, and statistics) over large-scale informatics graphs.

I managed Sandia's optimization and uncertainty estimation department from 2002-2007. This included growing the staff, increasing the number of people from 5 to 8, and mentoring and career planning. The department produces the DAKOTA optimization and uncertainty quantification software, a key component of DoE's Advanced Simulation and Computing program (ASC, http://www.sandia.gov/NNSA/ASC/), the foundation for Science Based Stockpile Stewardship. From 2002-2005 I served on the Laboratory Directed Research and Development, Science & Technology, Computer and Information Sciences, Investment Area Team (LDRD S&T CIS IAT), which determines the general direction of the most fundamental computer and information science research at Sandia. I also served on the ASC Algorithms and ASC Validation & Verification programs. My staff did additional research and development under Computer Science Research

Foundation, CSRF; and Mathematical, Information, and Computational Sciences, Applied Mathematical Sciences, DOE Office of Science, and had several commercial and university partnerships.

I lead Sandia's Cubit project. This project is a key component of Sandia's ASC (then ASCI) program. I was responsible for developing and guiding the technical agenda of the group. I represented the project internally and externally. I was responsible for overseeing and integrating the technical work of 30 people including 15 full-time Sandians and contractors; several commercial, university, and lab R&D collaborations; and a three-person subteam doing production meshing. Prior to being the project leader, for six years I researched new meshing algorithms and developed production level software. My "existence proof" for hexahedral meshes showed that, contrary to folklore, a topologically-correct hexahedral mesh exists that is compatible with a prescribed boundary mesh, given very mild necessary and sufficient conditions on the boundary mesh. Conditions for obtaining a geometrically-correct hexahedral mesh remain an open problem 13 years later.

Prior to 1995, I researched tetrahedral and triangulation algorithms with provable element shape and element count guarantees. My PhD thesis described the first algorithm for tetrahedral meshing with these kinds of guarantees.

University and Corporate programs

I served as a Sandia representative for research contracts with University of Michigan (2009); University of Iowa (2009); Lawrence Livermore National Laboratory (2006); Harvey Mudd College Clinic (2004); Brigham Young University (1999-2002); Caterpillar (2001-2002); Goodyear (2001-2002). I frequently host summer graduate and undergraduate college students, which includes developing a research project with them and guiding their work.

Publications

In addition to the following original research papers, I've represented Sandia technical groups (Cubit project, Optimization dept) in many overview talks, software demonstrations, training classes, project reports, and funding requests given to sponsors, review panels, and potential customers. Examples include Tri-lab conferences; ASCI PI project meetings; external center reviews; Cubit overviews to Unigraphics and Coventor companies and Sandia student interns; Cubit user tutorials; ASCI, CSRF, LDRD, and MICS reports and funding proposals.

Some software based on these papers, and the papers themselves, are available at http://www.cs.sandia.gov/~samitch/csstuff/csguide.html http://www.cs.sandia.gov/~samitch/mesh-biblio.html

Distance-Avoiding Sets for Extremely Low-Bandwidth Authentication, Michael J. Collins and Scott A. Mitchell, SAND report SAND2007-4543C, and Int'l Conf. on Sequences and Their Applications (SETA 2008).

A Technical History of Hexahedral Mesh Generation, Scott Mitchell, 11th International Meshing Roundtable, short course, http://www.imr.sandia.gov/11imr/main.html, 15 Sept 2002.

Mesh Generation tutorial, Supercomputing 2000.
Cubit software demonstration, Tri-labs ASCI booth, Supercomputing 2000.

The Cleave and Fill Tool: An All-Hexahedral Refinement Algorithm for Swept Meshes, Michael Borden, Steven Benzley, Scott A. Mitchell, David R. White and Ray Meyers, Proceedings, 9th International Meshing Roundtable, Sandia National Laboratories, pp. 69-76, October 2000

Methods for Multisweep Automation", Shepherd, Jason, Scott A. Mitchell, Patrick Knupp, and David White, Proceedings, 9th International Meshing Roundtable, Sandia National Laboratories, pp. 77-87, October 2000

Interval assignment for volumes with holes, Shepherd, Jason, Steven Benzley and Scott A. Mitchell, International Journal for Numerical Methods in Engineering, John Wiley, Vol 49, Num 1, pp. 277-288, September 2000

Integration of Mesh Optimization with 3D All-Hex Mesh Generation, LDRD Subcase 3504340000, Final Report, Patrick Knupp and Scott A. Mitchell, SAND99-2852, Unlimited Release, November 1999.

A method for controlling skew on linked surfaces, R. A. Kerr, S. E. Benzley, D. R. White, S. Mitchell, Proc. 8th International Meshing Roundtable `99, 377- 385 (1999).

Quality Mesh Generation in Higher Dimensions, Scott A. Mitchell and Stephen A. Vavasis, SIAM Journal on Computing Volume 29, Number 4, pp. 1334-1370. 1999.

The Graft Tool: an all-hexahedral transition algorithm for creating a multi-directional swept volume mesh, S. R. Jankovich, S. E. Benzley, J. F. Shepherd, S. A. Mitchell, Proc. 8th International Meshing Roundtable `99, 387-392 (1999).

Reliable Whisker Weaving via curve contraction, N. T. Folwell, S. A. Mitchell, Proc. 7th International Meshing Roundtable `98, 365-378, (1998).

The all-hex geode-template for conforming a diced tetrahedral mesh to any diced hexahedral mesh, S. A. Mitchell, Proc. 7th International Meshing Roundtable `98, 295-305 (1998), and Engineering with Computers, 15: 228-235.

The geode algorithm: combining hex/tet plastering, dicing and transition elements for automatic, all-hex mesh generation, R. W. Leland, D. J. Melander, R. W. Meyers, S. A. Mitchell, T. J. Tautges, Proc. 7th International Meshing Roundtable `98, 515-521 (1998).

High fidelity interval assignment, S. A. Mitchell, Proc. 6th International Meshing Roundtable `97, 33-44 (1997), and International Journal of Computational Geometry and Applications Vol. 10, No. 4 (2000) 399-415.

An immersive environment for exploration of CUBIT meshes, C. J. Pavlakos, J. S. Jones, and S. A. Mitchell, Proc. 6th International Meshing Roundtable `97, 47-65 (1997).

A global optimization approach to quadrilateral meshing, J. Jung, C. Dohrmann, W. Witkowski, P. Wolfenberger, W. Gerstle, S. Mitchell, M. Panthaki, D. Segalman, Proc. 6th International Meshing Roundtable `97, 155-167 (1997).

Choosing corners of rectangles for mapped meshing, S. A. Mitchell, Proc. Thirteenth annual symposium on Computational Geometry, 87-93 (1997).

Forming and resolving wedges in the spatial twist continuum, T. D. Blacker, S. A. Mitchell, T. J. Tautges, P. Murdoch, S. Benzley, Engineering with Computers 13:35-47 (1997).

The Whisker Weaving Algorithm: a connectivity based method for constructing all-hexahedral finite element meshes, T. J. Tautges, T. D. Blacker, S. A. Mitchell, Int. J. Numer. Methods Engrg. 39:19 (1996), pp. 3327-3350.

A characterization of the quadrilateral meshes of a surface which admit a compatible hexahedral mesh of the enclosed volume, S. A. Mitchell, Proc. 13th Annual Symposium on Theoretical Aspects of Computer Science (STACS `96), Lecture Notes in Computer Science 1046, Springer, pages 465-476, 1996.

An Aspect Ratio Bound for Triangulating a d-Grid Cut by a Hyperplane. S. A. Mitchell and S. A. Vavasis, Proc. 12th Annual Symposium on Computational Geometry, (1996) 48-57.

The spatial twist continuum: A connectivity based method for representing all-hexahedral finite element meshes, P. Murdoch; S. Benzley; T. Blacker; S.A. Mitchell, Finite Elements in Analysis and Design, Volume 28, Number 2, 15 December 1997, Elsevier, pp. 137-149(13)

Pillowing doublets: refining a mesh to ensure that faces share at most one edge, S. A. Mitchell, T. J. Tautges, Proc. 4th International Meshing Roundtable, 231-240 (1995).

Hexahedral mesh generation via the dual, S. Benzley, T. D. Blacker, S. A. Mitchell, P. Murdoch, T. J. Tautges. Proc. 11th Annual Symp. on Computational Geometry, C4-C5 (1995).

Cardinality Bounds for Triangulations with Bounded Minimum Angle, S. A. Mitchell, Sixth Canadian Conference on Computational Geometry (1994), 326-331.

Linear-Size Nonobtuse Triangulation of Polygons, M. Bern, S. A. Mitchell and J. Ruppert, 10th Annual Symposium on Computational Geometry (1994), 121-130; and Disc. Comput. Geom. 14 (1995) 411-428.

Refining a Triangulation of a Planar Straight-Line Graph to Eliminate Large Angles, S. A. Mitchell, Thirty-fourth Annual Symposium on Foundations of Computer Science (FOCS '93), 583-591.

Finding a Covering Triangulation Whose Maximum Angle is Provably Small, S. A. Mitchell, Seventeenth Annual (Australasian) Computer Science Conference, (1994) 55-64; and 1993 ARO/MSI Stony Brook Workshop on Computational Geometry; and International Journal of Computational Geometry and Applications, vol. 7, number 1/2, pp. 5-20, 1997.

Approximating the MaxMin-Angle Covering Triangulation, S. A. Mitchell, Proc. Fifth Canadian Conference on Computational Geometry (1993), 36-41. Also Cornell CS TR92-1327 (thesis) and Computational Geometry: Theory and Applications 7 (1997) 93-111.

Mesh Generation With Provable Quality Bounds, S. A. Mitchell, Applied Math Cornell PhD Thesis, Cornell CS Tech Report TR93-1327 (1993).

Edge-Insertion for Optimal Triangulations, M. Bern, H. Edelsbrunner, D. Eppstein, S. A. Mitchell, and T. S. Tan, Proc. Latin American Theoretical Informatics 1992, 46-60. Also Discrete & Computational Geometry 10:47-65 (1993) Springer-Verlag New York Inc.

Quality Mesh Generation in Three Dimensions, S. A. Mitchell and S. A. Vavasis, Proc. 8th Annual Symposium on Computational Geometry (1992), 212-221. Also presented a two-dimensional implementation (Xerox PARC) at the 1991 SUNY Stony Brook Workshop on Computational Geometry.

Patents & Technical Advances

Hex mesh grafting

Method for Generating a Mesh Representation of a Region Characterized by a Trunk and a Branch Thereon. Inventors: Jason F. Shepherd, Scott A. Mitchell, Steven R. Jankovich, Steven E. Benzley. U.S. Patent No 7,219,039. Issued 15 May 2007. SD-6533.1 S-93,794

Hex mesh Whisker Weaving

Connectivity-Based, All-Hexahedral Mesh Generation and Apparatus, Inventors: Timothy James Tautges, Scott A. Mitchell, Ted D. Blacker, Peter Murdoch. U.S. Patent 5,768,156. Issued June 1998.

All-Hex Geode-Template Mesh Generation and Apparatus, Sandia technical Advance filed 1999, SD-6389. U.S. Patent Rejected.

Awards

Department of Energy, Defense Programs Award of Excellence, NNSA, 2006

Professional Activities

Intel International Science and Engineering Fair 2007 Grand Awards Judge (Mathematics)
Committee Member, Applied, Sixteenth Annual Symposium on Computation Geometry, 2000.
Middle School Math Textbook screener, 1998-1999 Instructional Materials Commission of the New Mexico Board of Education
Session Chair, International Meshing Roundtable, 1995, 1997, 1998, and 1999.
Discussion chair and invited talk 2002.
Conference Chair, 5th International Meshing Roundtable, October 1996.
Session Chair, U.S. National Congress on Computational Mechanics, August 1999
Reviewer for a variety of journals and refereed conferences, ongoing, including
International Journal of Computational Geometry and Applications (IJCGA); Computational Geometry, Theory and Applications; Engineering with Computers; SICOMP; and IEEE Transactions on Parallel and Distributed Systems, International Meshing Roundtable.

Professional Memberships

Association for Computing Machinery (ACM)

Academic Honors Fraternities

Phi Beta Kappa
Tau Beta Pi

Teaching experience

Graduate Teaching Assistant, Cornell University, 1988-1991
Calculus, Game Theory.
Assisted students with sample problems and homework in classroom setting and during regular office hours.

Volunteer Activities

Presidential Volunteer Service Award, Gold Level, 2006-2008
Boy Scouts of America, Scoutmaster 2003-2008 (Assistant 2002, 2009)
American Youth Soccer Organization, AYSO
Coach 2002-2005
Referee 1997-2003

References

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