

SHRIPAD THITE

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EDUCATION

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN, IL, USA
Ph.D., Computer Science 2005

Thesis: Spacetime Meshing for Discontinuous Galerkin Methods
Advisor: Jeff Erickson

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN, IL, USA
M.S., Computer Science 2001

Thesis: Optimum Binary Search Trees on the Hierarchical Memory Model
Advisor: Michael Loui

UNIVERSITY OF PUNE, GOVERNMENT COLLEGE OF ENGINEERING, India
B.E., Computer Engineering 1997

Graduated 1st ranked, awarded Dr. D.Y. Patil Gold Medal

RESEARCH EXPERIENCE

CALIFORNIA INSTITUTE OF TECHNOLOGY
Center for the Mathematics of Information, Information Science & Technology
Postdoctoral Fellow 2007-present

Project: Computational Topology

- Research on algorithmic problems in topology such as computing optimum homotopy between curves and homeomorphism between surfaces.
- This work is an extension of recent results jointly with colleagues in Math and Computer Science at Illinois and at various universities in France.

Project: Computational Geometry

- Preliminary collaboration with Caltech researchers in Computer Science on problems in mesh generation for graphics applications and with researchers in Information Science & Technology on problems in clustering.

TECHNISCHE UNIVERSITEIT EINDHOVEN, Netherlands
Department of Mathematics & Computer Science
Postdoctoral Researcher 2005-2007

Project: External-memory computational geometry

- Jointly with colleagues at TU-Eindhoven and at Bowdoin College, researched fundamental problems in computational geometry such as point location, map overlay, and range searching.
- Derived external-memory algorithms for these problems which are efficient in their cache usage and minimize data transfer between disk, main memory, and cache.
- Results are applicable in Geographic Information Systems, where map data is too massive to fit entirely in main memory; Algorithms are practical and implementable as well as theoretically efficient.
- Results were published at the 18th International Symposium on Algorithms and Computation (ISAAC 2007) and at the 23rd European Workshop on Computational Geometry (2007).

Project: Cache-oblivious algorithms

- Obtained a cache-oblivious IO-efficient version of the algorithm of Frederickson and Johnson for

selecting in sorted $X+Y$ matrices; The matrix selection algorithm is a key building block of many other algorithms.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Computer Science
Research Assistant

1999-2005

Project: Spacetime Meshing

- Gave an adaptive advancing front algorithm for constructing simplicial unstructured spacetime meshes; The meshes we construct are suitable for efficient simulation of time-dependent wave-like physical phenomena using spacetime discontinuous Galerkin finite element methods.
- Research in spacetime meshing, jointly with colleagues at UIUC, makes possible much more efficient and accurate simulations for a wide variety of physical phenomena of interest to scientists and engineers, such as wave propagation in materials and fluid dynamics.
- Collaborations conducted with mathematicians, computer scientists, and engineers at the Center for Process Simulation & Design at UIUC on this NSF-funded project.
- Results appeared at the European Journal on Computational Mechanics (2006), ACM Symposium on Computational Geometry (2004), 21st European Workshop on Computational Geometry (2005), International Meshing Roundtable (2004).
- Work has also been favorably received by practitioners, such as at the US National Congress on Computational Mechanics (2003,2005).

Project: Computational Topology

- Collaborate with computer scientists and mathematicians at UIUC and elsewhere on algorithmic problems in topology.
- Defined the *homotopic Fréchet distance* between curves and developed a polynomial-time algorithm for computing this metric between polygonal curves in the punctured plane.
- Result appeared at the Fall Workshop on Computational Geometry (2007) and has been submitted to the ACM Symposium on Computational Geometry (2008).

Project: External-Memory Data Structures

- Developed algorithms for computing a minimum-cost binary search tree (BST) on a hierarchical memory model of computation; these algorithms are efficient under constraints on the parameters of the memory hierarchy. A BST is a widely used data structure for indexing and retrieving data that is very well-studied on the uniform memory (RAM) model of computation.
- Algorithms are suitable for constructing such a data structure for massive data that is stored across multiple levels of memory devices with vastly different access times.

LOS ALAMOS NATIONAL LABORATORY
Basic & Applied Simulation Science
Graduate Research Assistant

1998, 2001, 2002

Project: Simulation of Large-Scale Auction-Based Markets

- Designed and implemented a computer program for the simulation of a deregulated electrical power market. The project includes being able to simulate power demand and consumption, market forces, external regulatory policies, and physical constraints of the power grid.
- Results appeared at the 6th IAEE European Energy Conference (2004).

Project: Wireless Networking

- Conducted research on theoretical and practical problems associated with wireless radio networks. This work intersects the areas of graph theory, computational geometry, and networking.
- Algorithms for distance-2 edge coloring and matching in graphs modeling ad-hoc wireless networks can be applied to designing routing protocols for such networks and for predicting the intrinsic network bandwidth.
- Results appeared at the IEEE Conference on Pervasive Computing and Communications Workshop on

Foundations and Algorithms for Wireless Networking and in the IEEE Journal on Selected Areas in Communications issue on Fundamental Performance Limits of Wireless Sensor Networks (2004).

Project: External-Memory Algorithms

- Extended blocking algorithms for matrices to improve memory-efficiency of matrix operations.
- Implemented and simulated the same on an SGI Origin multiprocessor system, and empirically demonstrated a significant improvement in performance.
- Implemented a blocking algorithm for graphs, as proposed by Awerbuch *et al.* and investigated its performance.

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING, India

Student Intern

1996-1997

- Constructed a model in VHDL for a Fast Ethernet switch and performed system-level simulation and analysis using VHDL tools. This work, jointly with a colleague, became our undergraduate senior thesis.

PUBLICATIONS

Erin Wolf Chambers, Éric Colin de Verdière, Jeff Erickson, Sylvain Lazard, Francis Lazarus, **Shripad Thite**.
"Walking your Dog in the Woods in Polynomial Time."

17th Fall Workshop on Computational Geometry, November 2007. Submitted to SoCG 2008.

Mark de Berg, Herman Haverkort, **Shripad Thite**, Laura Toma.

"I/O-Efficient Map Overlay and Point Location in Low-Density Subdivisions."

18th International Symposium on Algorithms and Computation (ISAAC 2007), LNCS 4835, Springer; Also appeared at the 23rd European Workshop on Computational Geometry, pp. 73–76, March 2007.

Sheung-Hung Poon, **Shripad Thite**.

"Pants Decomposition of the Punctured Plane."

22nd European Workshop on Computational Geometry (EuroCG), pp. 99–102, March 2006.

Sheung-Hung Poon, **Shripad Thite**.

"Few Optimal Foldings of HP Protein Chains on Various Lattices."

22nd European Workshop on Computational Geometry, pp. 63–66, March 2006.

Reza Abedi, Robert Haber, **Shripad Thite**, Jeff Erickson.

"An h -Adaptive Spacetime-Discontinuous Galerkin Method for Linearized Elastodynamics."

Spacetime Adaptive Strategies for Time-Dependent Transient Problems, B. Tie and D. Aubry eds.,
Revue Européenne de Mécanique Numérique (European Journal on Computational Mechanics), vol. 15,
no. 6/2006, pp. 619–642, September 2006.

Christopher L. Barrett, Gabriel Istrate, V.S. Anil Kumar, Madhav V. Marathe, **Shripad Thite**, Sunil Thulasidasan.

"Strong Edge Coloring for Channel Assignment in Wireless Radio Networks."

IEEE Conf. Pervasive Computing and Communications (PERCOM), Workshop on Foundations and Algorithms for Wireless Networking, pp. 106–110, 2006.

Shripad Thite.

"A Unified Algorithm for Adaptive Spacetime Meshing with Nonlocal Cone Constraints."

21st European Workshop on Computational Geometry, pp. 1–4, March 2005. Submitted to CGTA.

Shripad Thite.

"Efficient Spacetime Meshing with Nonlocal Cone Constraints."

13th Int'l Meshing Roundtable (IMR), pp. 47–58, September 2004.

Reza Abedi, Shuo-Heng Chung, Jeff Erickson, Yong Fan, Michael Garland, Damrong Guoy, Robert Haber, John M. Sullivan, **Shripad Thite**, Yuan Zhou.

"Spacetime Meshing with Adaptive Refinement and Coarsening."
ACM Symp. Computational Geometry (SoCG), pp. 300-309, June 2004.

Hari Balakrishnan, Christopher L. Barrett, V. S. Anil Kumar, Madhav V. Marathe, **Shripad Thite**.

"The Distance-2 Matching Problem and its Relationship to the MAC-layer Capacity of Ad-hoc Wireless Networks."

IEEE Journal on Selected Areas in Communications issue on Fundamental Performance Limits of Wireless Sensor Networks, vol. 22, no. 6, pp. 1069-1079, August 2004.

Karla Atkins, Chris Barrett, Christopher M. Homan, Achla Marathe, Madhav V. Marathe, **Shripad Thite**.

"Marketecture: A Simulation-Based Framework for Studying Experimental Deregulated Power Markets."
6th IAEE European Energy Conference, September 2004.

Jeff Erickson, **Shripad Thite**, Fred Rothganger, Jean Ponce.

"Capturing a Convex Object with Three Discs."

IEEE Transactions on Robotics, vol. 23, no. 6, pp. 1133-1140, December 2007.

Also in IEEE International Conference on Robotics and Automation (ICRA), pp. 2242-2247, 2003.

PAPERS SUBMITTED:

Shripad Thite.

"Spacetime Meshing for Discontinuous Galerkin Methods."

Submitted to *Computational Geometry: Theory and Applications*, September 2006.

PAPERS IN PREPARATION:

Shripad Thite.

"Pants Decomposition of the Punctured Plane."

Shripad Thite.

"Weakly Covering a Point Set with Few Disjoint Unit Disks."

Mark de Berg, **Shripad Thite**.

"Cache-Oblivious Selection in Sorted $X+Y$ Matrices."

Jeff Erickson, Robert Haber, Jayandran Palaniappan, **Shripad Thite**.

"Adaptive Spacetime Meshing with Zero Projection Error."

ABSTRACTS:

Shripad Thite.

"Tight Bounds on the Complexity of Recognizing Odd-Ranked Elements."

arXiv:cs.CC/0606038, 2006.

Shripad Thite.

"On Covering a Graph Optimally with Induced Subgraphs."

arXiv:cs.DM/0604013, 2006.

Shripad Thite, Jayandran Palaniappan, Jeff Erickson, Robert Haber.
"Adaptive Spacetime Meshing in 2D×Time for Nonlinear and Anisotropic Media."
Minisymposium on Mesh and Geometry Generation at the 8th US National Congress on Computational Mechanics, January 2005.

Shripad Thite, Jeff Erickson, Shuo-Heng Chung, Reza Abedi, Jayandran Palaniappan, Robert Haber.
"Meshing in 2D×Time for Front-Tracking DG Methods."
Minisymposium on Mesh and Geometry Generation at the 8th US National Congress on Computational Mechanics, January 2005.

Jeff Erickson, Robert Haber, Jayandran Palaniappan, John Sullivan, **Shripad Thite**.
"Efficient Spacetime Meshing with Nonlocal Cone Constraints."
4th Symposium on Trends in Unstructured Mesh Generation at the 7th US National Congress on Computational Mechanics, July 2003.

Reza Abedi, Shuo-Heng Chung, Jeff Erickson, Yong Fan, Robert Haber, John Sullivan, **Shripad Thite**.
"Spacetime Meshing with Adaptive Coarsening and Refinement."
4th Symposium on Trends in Unstructured Mesh Generation at the 7th US National Congress on Computational Mechanics, July 2003.

L. V. Kale, Robert Haber, Jonathan Booth, **Shripad Thite**, Jayandran Palaniappan.
"An Efficient Parallel Implementation of the Spacetime Discontinuous Galerkin Method Using Charm++."
4th Symposium on Trends in Unstructured Mesh Generation at the 7th US National Congress on Computational Mechanics, July 2003.

THESES:

Shripad Thite. Ph.D. thesis: Spacetime Meshing for Discontinuous Galerkin Methods.
Department of Computer Science, Report no. UIUCDCS-R-2005-2612 (UILU-ENG-2005-1803),
University of Illinois at Urbana-Champaign, August 2005.

Shripad Thite. M.S. thesis: Optimum Binary Search Trees on the Hierarchical Memory Model.
Department of Computer Science, CSL Technical Report UILU-ENG-00-2215 ACT-142,
University of Illinois at Urbana-Champaign, January 2001.

TEACHING EXPERIENCE

TECHNISCHE UNIVERSITEIT EINDHOVEN, Netherlands
Co-Instructor, Department of Mathematics and Computer Science 2005-2006
Course: Seminar on I/O-Efficient Algorithms

- The course was a graduate seminar with around 20 students. I helped grade final projects which were short survey papers, met with students to help prepare class presentations, conducted office hours, and gave a lecture in class on my own related research.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Teaching Assistant, Department of Computer Science 1997-1999
Course: C and C++ programming laboratory

- The class was designed for teaching programming and basic software engineering principles to graduate students in departments other than Computer Science. I taught two sessions a week, each with 10-15 students.
- Duties included planning and giving lectures, assigning and grading small- and medium-scale programming projects, assigning grades.

Course: Introduction to the Theory of Computation

- This was the second in the sequence of three required theory classes, taken by all undergraduates in their junior year. The class consisted of about 50 students.
- Duties included conducting office hours, discussion sessions, and helping design and grade homework assignments and exams.

Course: Combinatorial Algorithms

- This was one of the two required theory classes, probably the hardest class offered by the department. The class consisted of about 150 students with roughly equal number of undergraduate and graduate students. I was one of two Teaching Assistants, both Ph.D. theory students, for two semesters.
- Duties included conducting office hours, discussion sessions, and helping design and grade homework assignments and exams.

Course: Automata, Formal Languages, and Computational Complexity

- This was one of the two required theory classes, taken by all undergraduates and some graduate students. The class consisted of about 50 students with roughly equal number of undergraduate and graduate students.
- Duties included conducting office hours, discussion sessions, and helping design and grade homework assignments and exams.

PRESENTATIONS

Spacetime Meshing for Discontinuous Galerkin Methods, Kolloquium der Angewandten Mathematik, Oberseminar Informatik, Department of Mathematics and Computer Science, Westfälische Wilhelms-Universität Münster, Germany, 2006

Pants Decomposition of the Punctured Plane, Workshop on Topological Methods in Combinatorics, Computational Geometry, and the Study of Algorithms, Mathematical Sciences Research Institute (MSRI), Berkeley, CA, 2006

A Unified Algorithm for Adaptive Spacetime Meshing with Nonlocal Cone Constraints, 21st European Workshop on Computational Geometry (EWCG), Eindhoven, Netherlands, 2005

Efficient Spacetime Meshing with Nonlocal Cone Constraints, 13th Int'l Meshing Roundtable (IMR), Williamsburg, VA, 2004

Spacetime Meshing with Adaptive Refinement and Coarsening, ACM Symposium on Computational Geometry (SoCG), Brooklyn, NY, 2004

Efficient Spacetime Meshing with Nonlocal Cone Constraints, 7th US National Congress on Computational Mechanics (USNCCM), Albuquerque, NM, 2003

Capturing a Convex Object with Three Discs, IEEE International Conference on Robotics and Automation (ICRA), Taipei, Taiwan, 2003.

Slides and videos of some talks are available on webpage.

EXTRAMURAL ACADEMIC SERVICES

Served as referee at various times for articles submitted to:

ACM Symposium on Computational Geometry (SoCG), ACM Symposium on Theory of Computing (STOC), ACM Symposium on Discrete Algorithms (SODA), European Symposium on Algorithms (ESA), Workshop on Approximation and Online Algorithms, Discrete and Computational Geometry, Journal of Information and Computation, Information Processing Letters, International Meshing Roundtable, IEEE Journal on Selected Areas in Communications, IEEE Communications Letters, Annual Conference of the IEEE Industrial Electronics Society.

Served on the Fellowships, Assistantships, and Admissions (FAA) Committee of the Computer Science department at the University of Illinois at Urbana-Champaign:

Members of this committee are faculty and senior graduate students, who evaluate entrance requirements and recommend applicants to graduate school for admissions, fellowships, and assistantships (2002-2003)

Organized the 44th biannual Midwest Theory Day:

One-day meeting on theoretical computer science, at the University of Illinois at Urbana-Champaign (2001)

Member of the Association for Computing Machinery (ACM) and SIGACT

Volunteered for MathManiaCS project:

Introduced elementary school students to finite state automata and sorting algorithms.

MathManiaCS is a group of volunteer academics who aspire to bring the excitement of mathematics and computer science to children of all ages.

Volunteered for ASHA for Education:

Non-profit organization supporting projects related to basic education of underprivileged children in India.

REFERENCES

PROF. LEONARD SCHULMAN

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Virginia Bioinformatics Institute
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