Michelle Mills Strout

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Research Interests

Compile-time and run-time transformations for data locality and parallelization, combined static and dynamic program analysis, interaction of compilers with modern architectures, domain-specific compilation, scientific computing, and software engineering.

Education

Doctor of Philosophy degree in Computer Science — July 2003
University of California, San Diego
Advisors: Dr. Larry Carter and Dr. Jeanne Ferrante

Master of Science degree in Computer Science — December 1999
University of California, San Diego

Bachelor of Science degree in Computer Science — June 1997
University of California, San Diego
Honors: Summa Cum Laude

Professional Experience

Assistant Professor at Colorado State University — August 2005 - present
My current research includes representation-independent program analysis and the automation of the run-time reordering transformations.

Enrico Fermi Postdoctoral Scholar at Argonne National Laboratory — September 2003 - July 2005
Research Associate at the University of Chicago (joint appointment)
At Argonne I researched domain-specific program analysis for automatic differentiation.

Research Assistant at University of California, San Diego — September 1997 - June 2003
With my advisors Dr. Jeanne Ferrante and Dr. Larry Carter, I worked on the Hierarchical Tiling project and the Sparse Tiling project. For the Hierarchical Tiling project I developed efficient storage mappings for regular codes. As part of this project, I supervised an undergraduate independent research project and a CRAW summer student project. We received a grant from Lawrence Livermore National Labs for the Sparse Tiling project. I developed full sparse tiling which is a performance optimization for iterative sparse matrix computations. As part of this project I supervised three programmers.

Summer Intern at AT&T Labs Research — Summer 1997
I worked with Dr. Ken Lyons to implement virtual shared memory for PCs running Windows NT with a Myrinet interconnect.

Senior Coder at University of California, San Diego — October 1994 - April 1996
I assisted the system administrator for the Social Sciences Division, Mike O'Hagan, in maintaining a Unix server, Windows NT server, and various Windows and Macintosh based PCs. I created and maintained user resources and assisted users with various problems. I also developed and maintained the Social Science Division's web site.

Teaching Experience

Assistant Professor at Colorado State University

Topics in Programming Language Design and Implementation, CS653	Spring Semester 2008
Undergraduate Compilers, CS453	Spring Semester 2008
Graduate Compilers, CS553	Fall Semester 2007
Topics in Programming Language Design and Implementation, CS653	Spring Semester 2007
Undergraduate Compilers, CS453	Spring Semester 2007
Graduate Compilers, CS553	Fall Semester 2006
Topics in Programming Language Design and Implementation, CS653	Spring Semester 2006
Graduate Compilers, CS553	Fall Semester 2005

Co-Instructor at University of Chicago Spring Quarter 2004
Graduate Computer Architecture, CS32200
Prepared half the lectures, developed homeworks that involved using computer architecture research tools such as SimpleScalar, and guided students through a quarter long research project or survey paper.

Volunteer Instructor for Upward Bound at University of California, San Diego January 2003
Developed a program that demos convolution and then used it to teach a number of two hour sessions to high school students involved in upward bound. *http://www.mcs.anl.gov/~mstrout/UpwardBoundWeb/*

Instructor at University of California, San Diego Summer 2001
Computer Organization and Systems Programming, CSE30, 4 quarter credit hours
Prepared 4 lectures per week, developed 3 assembly language programming assignments, organized grading done by teaching assistants, wrote quizzes, midterm, and final exam.

Volunteer High School Instructor at University City High School January 2000 - June 2000
Web Programming
Designed curriculum, coordinated with 2 other computer science students, lectured, and helped students in the lab. The class introduced students to HTML, cgi-programming, MySQL, Java, etc.

Teaching Assistant at University of California, San Diego Winter 1999
Compiler Construction II, CSE131B, 4 quarter credit hours
Led sections, organized class project, and helped students in the lab.

Teaching Assistant at University of California, San Diego Summer 1998
Design and Analysis of Algorithms, CSE101, 4 quarter credit hours

Teaching Assistant at University of California, San Diego Summer 1995
Computer Organization and Systems Programming, CSE30, 4 quarter credit hours

Teaching Assistant at University of Toledo Spring 1993
Problem Solving course for Engineering students

Journal Papers and Book Chapters

1. Gautam Gupta, Lakshminarayanan Renganarayanan, Sanjay Rajopadhye, and Michelle Strout. "Computations on Iteration Spaces." In *The Compiler Design Handbook: Optimization and Machine Code Generation, 2nd edition*, 2007.
2. J. Utke, U. Naumann, M. Fagan, N. Tallent, M. Strout, P. Heimbach, C. Hill, and C. Wunsch. "OpenADF: A Modular, Open-Source Tool for Automatic Differentiation of Fortran Codes." *ACM Transactions on Mathematical Software*.Accepted July 2007, to be published 2008 volume 34, number 4. Also as Preprint ANL/MCS-P1230-0205, 2006.
3. Michelle Mills Strout, Larry Carter, Jeanne Ferrante, and Barbara Kreaseck. "Sparse Tiling for Stationary Iterative Methods." *International Journal of High Performance Computing Applications*, 18(1):95-114, February 2004.
4. Alan Su, Francine Berman, Rich Wolski, and Michelle Mills Strout. "Using AppLeS to Schedule a Distributed Visualization Tool on the Computational Grid." *International Journal of Supercomputer and High-Performance Applications*, Volume 13, Issue 3, pp. 253-262, Fall 1999.

Refereed Conference Papers

1. Andrew Stone, Michelle Mills Strout, and Shweta Behere. "Automatic Determination of May/Must Set Usage in Data-Flow Analysis." In *Proceedings of the Eighth IEEE International Working Conference on Source Code Analysis and Manipulation*, September 2008. (acceptance rate: 23 out of 61, 37.7%)
2. Nissa Ossheim, Michelle Mills Strout, David Rostron, and Sanjay Rajopadhye. "Smashing: Folding Space to Tile Through Time." In *The 15th Workshop on Languages and Compilers for Parallel Computing* (LCPC), July 2008. (acceptance rate: 18 out of 35, 51.4%)

3. Daegon Kim, Lakshminarayanan Renganarayana, Dave Rostron, Sanjay Rajopadhye, and Michelle Mills Strout. "Multi-level Tiling: m for the Price of One." In *Proceedings of the International Conference for High Performance Computing, Networking, Storage, and Analysis (SC)*, November 2007. (acceptance rate: 54 out of 268, 20.1%)
4. David Bolme, Michelle Mills Strout, and Ross Beveridge. "FacePerf: Benchmarks for Face Recognition Algorithms." In *Proceedings of The IEEE International Symposium on Workload Characterization (IISWC)*, September 2007. (acceptance rate: 4 out of 8, 50%)
5. Lakshminarayanan Renganarayana, Daegon Kim, Sanjay Rajopadhye, and Michelle Mills Strout. "Parameterized Tiled Loops for Free." In *Proceedings of the ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*, June 2007. (acceptance rate: 45 out of 178, 25%)
6. Paul Hovland, Boyana Norris, Michelle Mills Strout, and Jean Utke. "Term Graphs for Computing Derivatives in Imperative Languages." *Electronic Notes in Theoretical Computer Science*. May 2007. Also Preprint ANL/MCS-P1311-0106, January 2006.
7. Michelle Mills Strout, Barbara Kreaseck, and Paul Hovland. "Data-Flow Analysis for MPI Programs." In *Proceedings of the The International Conference on Parallel Processing (ICPP)*, August 2006. (acceptance rate: 64 out of 200, 32%)
8. Michelle Mills Strout and Paul Hovland. "Linearity Analysis for Automatic Differentiation." In *Proceedings of the The Workshop on Automatic Differentiation: Tools and Applications at ICCS 2006*, May 28-31, 2006. (acceptance rate: 9 out of 15, 60%)
9. Barbara Kreaseck, Luis Ramos, Scott Easterday, Michelle Mills Strout and Paul Hovland. "Hybrid Static/Dynamic Activity Analysis." In *Proceedings of the The Workshop on Automatic Differentiation: Tools and Applications at ICCS 2006*, May 28-31, 2006. (acceptance rate: 9 out of 15, 60%)
10. U. Naumann, J. Utke, Carl Wunsch, C. Hill, P. Heimbach, M. Fagan, N. Tallent, and M. Strout. "Adjoint Code by Source Transformation with OpenAD/F." In *Proceedings of the European Conference on Computational Fluid Dynamics (ECCOMAS CFD)*, 2006.
11. Paul Hovland, Boyana Norris, Michelle Mills Strout, Sanjukta Bhowmick, and Jean Utke. "Sensitivity Analysis and Design Optimization through Automatic Differentiation." In *Proceedings of SciDAC 2005, Journal of Physics: Conference Series*, volume 16.
12. Michelle Mills Strout, John Mellor-Crummey, and Paul D. Hovland. "Representation-Independent Program Analysis." In *Proceedings of the The sixth ACM SIGPLAN-SIGSOFT Workshop on Program Analysis for Software Tools and Engineering*, September 5-6, 2005. (acceptance rate: 17 out of 42, 40.45%)
13. Michelle Mills Strout and Paul Hovland. "Metrics and models for reordering transformations." In *The Proceedings of the Second ACM SIGPLAN Workshop on Memory System Performance (MSP)*, June 2004. (acceptance rate: 7 out of 12, 58.33%)
14. Michelle Mills Strout, Larry Carter, and Jeanne Ferrante. "Compile-time Composition of Run-time Data and Iteration Reorderings." In *Proceedings of the ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*, June 2003. (acceptance rate: 28 out of 131, 21%)
15. Michelle Mills Strout, Larry Carter, Jeanne Ferrante, Jonathan Freeman, and Barbara Kreaseck. "Combining Performance Aspects of Irregular Gauss-Seidel via Sparse Tiling." *The 15th Workshop on Languages and Compilers for Parallel Computing* (LCPC), College Park, Maryland, July 25-27, 2002. LNCS 2481, Springer-Verlag, 2005. (acceptance rate: 26 out of 32, 81%)
16. Michelle Mills Strout, Larry Carter, and Jeanne Ferrante. "Rescheduling for Locality in Sparse Matrix Computations." *International Conference on Computational Science (ICCS)*, May 2001. Published in Springer Lecture Notes in Computer Science LNCS 2073.
17. Michelle Mills Strout, Larry Carter, Jeanne Ferrante, and Beth Simon. "Schedule-Independent Storage Mapping in Loops." In the proceedings of *Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, San Jose, CA, October 1998. (acceptance rate: 28 out of 123, 23%)

Other Papers

1. Erik G Boman, Doruk Bozdag, Umit V Catalyurek, Karen D Devine, Assefaw H Gebremedhin, Paul D Hovland, Alex Pothen, and Michelle Mills Strout. "Enabling high performance computational science through combinatorial algorithms." In *Proceedings of the SciDAC*, Journal of Physics: Conference Series, Volume 78, June 2007.
2. Michelle Mills Strout, Larry Carter, and Jeanne Ferrante. Proof of Correctness for Sparse Tiling of Gauss-Seidel. UCSD Department of Computer Science and Engineering, Technical Report #CS2003-0741, April 2003.

Refereed Talks and Posters

1. Michelle Mills Strout. "Using Hypergraphs and Bipartite Graphs for Run-Time Data and Computation Reordering." Talk abstract for SIAM Workshop on Combinatorial Scientific Computing, February 17-18, 2007. (acceptance rate: 58%)
2. Michelle Mills Strout and Paul Hovland. Using Hypergraphs to Improve Iteration Reordering Heuristics. Talk abstract for SIAM Workshop on Combinatorial Scientific Computing, February 27-28, 2004.
3. Michelle Mills Strout, Larry Carter, and Jeanne Ferrante. "Managing Tile Size Variance in Serial Sparse Tiling." Poster presented at *Supercomputing* 2001, Denver, Colorado.
4. Tung Nguyen, Michelle Mills Strout, Larry Carter, and Jeanne Ferrante. "Asynchronous Dynamic Load Balancing of Tiles." In the proceedings of *Ninth SIAM Conference on Parallel Processing for Scientific Computing*, San Antonio, Texas, March 22-24, 1999.

Research Grants

Principle Investigator, "CAREER: Parallelization using Inspector/Executor Strategies (PIES)", NSF Faculty Early Career Development (CAREER), January 2008 through December 2012, $397,235, has been recommended for funding.

URI Mentor, College of Natural Sciences Undergraduate Research Institute Award, $4000 funded to one undergraduate student for 10 weeks of research under my supervision, summer 2007.

CRA Mentor, Distributed Mentor Project for undergraduate summer research (sponsored by CRA, funded by NSF), Funded $6000 to 2 undergraduate students for 10 weeks of research under my supervision, summer 2007.

Co-PI, "SciDAC Institute: Combinatorial Scientific Computing and Petascale Simulations (CSCAPES)", January 2007 through December 2011, $132,000 to CSU, PI: Alex Pothen at Old Dominion University (ODU), Co-PIs: Florin Dobrian and Assefaw Gebremedhin at ODU, Erik Boman, Bruce Hendrickson, and Karen Devine at Sandia National Laboratory, Paul Hovland, Boyana Norris, and Jean Uteke at Argonne National Laboratory, and Umit Catalyurek at Ohio State University.

Principle Investigator with Co-PI Paul Hovland at Argonne National Laboratory, "Collaborative Research: Representation-Independent Compiler Technology for Domain-Specific Analysis with the OpenAnalysis Toolkit", DOE DE-FG02-06ER25724, March 2006 through February 2009, $213,281 at CSU, $497,532 at Argonne.

Invited Talks

"Communication Avoidance for Sparse Applications Using Full Sparse Tiling", presented at the MiniSymposium *Communication Avoiding Linear Algebra* held at SIAM Conference on Computational Science and Engineering, February 12-13, 2008.

"Domain-Specific Program Analysis with OpenAnalysis", presented at the MiniSymposium *Trends in the Evolution of Scientific Computing Software* held at SIAM Conference on Computational Science and Engineering, February 19-23, 2007.

"Representation-Independent Compiler Analysis and Data-flow Analysis for MPI Programs", presented at Cornell April 2006.

"Automatic Generation of Run-time Reordering Inspectors", presented at High Level Programming for High Performance Embedded Computing Systems Retreat, HiPHiPECS May 2006.

"Domain-Specific Data-Flow Analysis and Other Analysis Problems", presented at High Level Programming for High Performance Embedded Computing Systems Retreat, HiPHiPECS May 2005.

"Performance Transformations for Irregular Applications", presented at William and Mary, Williamsburg, Virginia, April 2004.

"Performance Transformations for Irregular Applications", presented at Colorado State, Fort Collins, Colorado, February 2004.

Service Activities

Scholarship committee for Grace Hopper Celebration of Women in Computing, GHC 2008.

NSF Panel, 2008.

Program committee member for Supercomputing 2008.

Program committee member for Programming Language Design and Implementation, PLDI 2008.

Program committee member for the IEEE International Parallel and Distributed Processing Symposium, IPDPS 2008.

Outside reviewer for the U.S. Department of Energy (DOE), Experimental Program to Stimulate Competitive Research (DOE/EPSCoR), 2007.

Outside reviewer for The International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS 2008).

Program committee member for the ACM SIGPLAN Symposium on Library-Centric Software Design, LCSD 2007.

Undergraduate committee member, July 2007 to present.

Scholarship committee for Grace Hopper Celebration of Women in Computing, GHC 2007.

Tutorials chair for Programming Language Design and Implementation, PLDI 2007.

Outside reviewer for Programming Language Design and Implementation, PLDI 2007.

Committee member for Sites/Regelson Scholarship, 2006 and 2007.

Panel member for UPE session on giving talks, November 2006.

Facilities committee member, Fall 2006 through June 2007.

Program committee member for the International Conference on Parallel Processing, ICPP 2007.

Program committee member for the 13th IEEE International Conference on High Performance Computing, HiPC 2006.

Program committee member for the International Conference on Parallel Processing, ICPP 2006.

Technical program committee member for Supercomputing 2005.

Technical program committee member for Supercomputing 2004.

Helped organize the Workshop on Domain-Specific Languages for Numerical Optimization (DSLOpt) held at Argonne National Laboratory, August 2004.

Organized four brown-bag lunches for postdocs and graduate students in the MCS at Argonne to discuss issues such as grant proposals and job hunting.

BOF program committee member for Grace Hopper Celebration of Women in Computing Conference 2004.

Organized "How to get a job seminar," Fall 2003.

"Introduction to CVS, Autoconf, and Doxygen," talk given for Graduate Enrichment Series, February 2002.

Graduate Co-chair of Women in Computing (WIC@UCSD), 1999-2000.
Authored the initial constitution and organized the startup of the group.

Representative for the Graduate Student Association (GSA), 1999-2000.
Successfully lobbied for TA lockers.

"Introduction to Mathematica," talk for Graduate Enrichment Series, April 1999.

Reviewer for IEEE Transactions on Parallel and Distributed Systems (TPDS), IEEE Transactions on Software Engineering (TSE), IEEE Transactions on Programming Languages and Systems (TOPLAS), IEEE Transactions on Design Automation of Electronic Systems (TODAES), International Journal of High Performance Computing Applications (IJHPCA), the International Conference on Parallel Processing (ICPP), ASPLOS 2008, PLDI 2007, EuroPar, Frontiers, IPDPS, LCPC, and ICA3PP2K.

Other Talks and Posters

"Parallelizing Irregular Gauss-Seidel Using Full Sparse Tiling" presented at Front Range Architecture, Compilers, Tools, and Languages Workshop (FRACTAL), April 26, 2008.

"Generation of Pointer Cognizant Data-Flow Analyses From Succinct Specifications" presented at Front Range Architecture, Compilers, Tools, and Languages Workshop (FRACTAL), October 14, 2007 presented by Andrew Stone.

"Smashing Periodic Domains" presented at FRACTAL, October 14, 2007 presented by Nissa Osheim and David Rostron.

"Representation-Independent Alias Analysis and Data-Flow Analysis," presented at Front Range Architecture, Compilers, Tools, and Languages Workshop (FRACTAL), February 10, 2007.

"Combinatorial Scientific Computing and Petascale Simulations (CSCAPES) SciDAC Applied Math Institute," poster by Alex Pothen, Florin Dobrian and Assefaw Gebremedhin, Old Dominion University Erik Boman, Karen Devine and Bruce Hendrickson, Sandia National Laboratories Paul Hovland, Sanjukta Bhowmick, Boyana Norris and Jean Utke, Argonne National Laboratory, Umit Catalyurek, Ohio State University, Michelle Strout, Colorado State University, SciDAC Organizational Meeting, February 2007.

"Automatic Generation of Bit-vector Analysis Using OpenAnalysis," poster by Shweta Behere, Michelle Strout, and Paul Hovland, ISTeC Student Research Poster Contest, November 29, 2006.

"Linearity Analysis: An Example Domain-Specific Analysis," talk presented at the Workshop on Domain-Specific Languages for Numerical Optimization (DSLOpt) August 18-20, 2004.

"Using the OpenAnalysis Toolkit with OpenAD", Poster at the 4th International conference on Automatic Differentiation, July 2004.

"Performance Transformations for Irregular Applications," talk presented at the University of Chicago Computation Institute Brown Bag Lunch, October 30, 2003.

"Tiling for Iterative Sparse Matrix Computations", talk presented at Research, Careers, and Computer Science: A Maryland Symposium, Fall 2001.

"Storage Allocation for Register Tiling", talk presented at Dagstuhl, Instruction Level Parallelism, April 1999.

Awards and Honors

AT&T Labs Grant and Fellowship, 1997-2003

National Science Foundation Fellowship, 1997-2000

Goldwater Scholarship, 1996-1997

ACM Departmental Poster Contest 1st prize, September 1996

Society of Women Engineers - San Diego County Scholarship recipient, 1996-1997

Society of Women Engineers/Microsoft Corporation Scholarship, 1995-1996

Microsoft National Women's Technical Scholarship, 1995-1996