

Kelly A. Shaw

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Department of Mathematics and Computer Science
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Interests:

Computer architecture, heterogeneous multiprocessors, GPGPUs, IoT, and workload characterization

Education:

Stanford University

Ph.D. in Computer Science with Distinction in Teaching, 2005
Dissertation: *Resource Management in Single-Chip Multiprocessors*
Advisor: William J. Dally

M.S. in Computer Science, conferred 2001

Duke University

B.S., Summa cum Laude, Computer Science/Economics, 1997

Professional Experience:

University of Richmond: Associate Professor (February 2010-Present)

Reed College: Associate Professor (August 2017-Present)

University of Richmond: Assistant Professor (August 2004-February 2010)

Stanford University: Research Assistant (1997-2004)

Ph.D. student in Department of Computer Science, Concurrent VLSI Architecture group

IBM T. J. Watson Research Center: Research Intern (Summer 1998)

Created rules for optimizing arbitrary information flow graphs in content-based, publish-subscribe messaging system

Duke University: Student Researcher (Summer 1997)

Re-wrote the CProf cache profiling system for use on machines running Solaris

CRA-W Distributed Mentor Project: Research Intern (Summer 1996)

Analyzed impact of different processor cache configurations on application performance

Teaching Experience:

- CMSC 105: Elementary Programming (CS0)
- CMSC 150: Introduction to Computing (CS1)
- CMSC 221: Data Structures (CS2)
- CMSC 288: Computer Science Apprenticeship
- CMSC 301: Computer Organization
- CMSC 321: Operating Systems

- CMSC 330: Theory of Computation
- CMSC 335: Computer Graphics
- CMSC 340: Honors Thesis
- CMSC 340: Independent Study: Chip Multiprocessors
- CMSC 395: Advanced Computer Architecture
- CS 193i: Internet Technologies (Stanford University)
- CSCI 221: CS Fundamentals II (Reed College)
- CSCI 389: Computing Systems (Reed College)
- CSCI 395: Advanced Computer Architecture (Reed College)

Graduate Research Co-advised

- Elba Garza: Co-advised with Margaret Martonosi. Princeton University Masters thesis titled "Efficient Design Space Exploration Techniques in Heterogeneous Systems" (completed Spring 2015)
- Wenhao Jia: Co-advised with Margaret Martonosi. Princeton University PhD thesis titled "Analysis and Optimization Techniques for Massively Parallel Processors" (completed Fall 2014)

Undergraduate Research Supervised

- Trent Freeman: Memory Consistency in the Internet of Things: Is that lock really locked? 2017-2018. Senior Thesis at Reed College.
- Benjamin Black: Efficient Parallelism Detection for Heterogeneous Computing. 2017-2018. Senior Thesis at Reed College.
- Kyong Lee: Create profiling tool to determine working set size. Summer 2015, Spring 2016, Fall 2016, and Spring 2017.
- Radha Venkatasan: Created profiling tool to identify potential parallelism in sequential code. Summer 2015
- Lingmiao Qiu: Created profiling tool to decompose application into segments based on instruction mix and predict best processor core for each segment. Summer 2014 through present.
- Francisco Cuevas: Created profiling tool to decompose application segments based on data working set changes. Summer 2014 through Spring 2016.
- Georgi Lekov: Created profiling tool to identify portions of applications that can be parallelized for either traditional multiprocessors or graphics processing units. Spring – Summer 2013.
- Andreea Iovan: Analyzed benefits of using a new dynamic memory allocation algorithm that makes it easier to detect when to use hardware memory optimizations. Spring – Summer 2011 and Summer 2012.
- Victor Yang: Verified correctness of algorithm for decomposing threads into subthreads based on data usage. Spring 2011.
- Toma Pigli: Created algorithm for decomposing threads into subthreads based on data usage. Summer 2010
- Yigit Aytan: Examined ways to dynamically allocate memory in order to enable easier use of hardware memory optimizations. Fall 2009 – Spring 2010
- Erin Brady: Developed and implemented algorithm to include hardware state information into decisions for dynamic reallocation of buffer pages in server applications. Fall 2009.
- Ivan Jibaja: Senior Honors Thesis in Computer Science, "Redesigning Computer Architecture to Optimize Performance on Data Mining Applications." Spring 2008 – Fall 2008
- Nolan Hughes: Examined cache-to-cache transfers in OLTP database workloads. Summer 2008
- Yuri Dogandjiev: Analyzed shared memory behavior of applications with multiple processes. Summer 2006 – Spring 2008

- Brittany Williams: Modeled communication between multiple processes in chip multiprocessors. Summer 2007
- Brian Salmons: Created software to remove distortion from atomic force microscopy images. Summer 2006. (Co-advised)
- Brittany Kwait: Examined recurring sequences of data accesses across multiple processes for database workloads. Summer 2006. (CRA-W Distributed Mentor Project participant from Fordham University)

Grants and Fellowships:

- National Science Foundation. Proposal Title: "CPS: Towards Secure, Privacy-Preserving, Verifiable Cyberphysical Systems." October 1, 2017-September 30, 2020. \$63,553.
- National Science Foundation. Proposal Title: "Student Travel Support for the 2017 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS-2017)". Feb 1, 2017 – July 31, 2017. \$10,000.
- University of Richmond Arts and Sciences Faculty Research Summer Fellowship. Proposal Title: "Design Space Exploration for Heterogeneous Chips." June 2015 – August 2015. \$6,000.
- University of Richmond Arts and Sciences Faculty Travel Grant. September 2013. \$1200.
- University of Richmond Arts and Sciences Faculty Travel Grant. June 2012. \$1200.
- University of Richmond Arts and Sciences Faculty Research Summer Fellowship. Proposal Title: "Using Memory Management to Improve the Selective Use of Hardware Optimizations." June 2010 – August 2010. \$6,000.
- National Science Foundation proposal number 0702689 (Foundations of Computing Processes and Artifacts program). "RUI: Managing Memory Demands of Data Intensive Workloads in Chip Multiprocessors." May 2007 – April 2010. \$135,000. Extended through April 2011.
- University of Richmond Arts and Sciences Faculty Research Summer Fellowship. Proposal Title: "Reducing Communication Demands and Latency in Multiprocessor Systems via Data Rearrangement." June 2005 – August 2005. \$5,000.

Publications:

- Themistoklis Melissaris, Kelly Shaw, and Margaret Martonosi. "Locomotive: Optimizing Mobile Web Traffic Using Selective Compression" in the *2017 IEEE 18th International Symposium on "A World of Wireless, Mobile, and Multimedia Networks" (WoWMoM)*, June 2017.
- Wenhao Jia, Elba Garza, Kelly A. Shaw, and Margaret Martonosi, "GPU Performance and Power Tuning Using Regression Trees" in *ACM Transactions on Architecture and Code Optimization (TACO)*, vol. 12, issue 2, May 2015.
- Kelly A. Shaw, "Organizing Your Research and Developing Your Skills," *IEEE Potentials*, vol. 33, issue 3, May-June 2014.
- Wenhao Jia, Kelly A. Shaw, and Margaret Martonosi, "MRPB: Memory Request Prioritization for Massively Parallel Processors," *20th International Symposium on High Performance Computer Architecture (HPCA 2014)*, February 2014.
- Wenhao Jia, Kelly A. Shaw, and Margaret Martonosi, "Starchart: Hardware and Software Optimization Using Recursive Partitioning Regression Trees" in the *Proceedings of the 22nd International Conference on Parallel Architectures and Compilation Techniques (PACT)*, September 2013.
- Kelly A. Shaw, "Getting Started in Undergraduate Research" in *IEEE Potentials*, June 2013, vol. 32, issue 3.
- Wenhao Jia, Kelly A. Shaw, and Margaret Martonosi, "Characterizing and Improving the Use of Demand-Fetched Caches in GPUs" in the *26th International Conference on Supercomputing (ICS)*, June 2012.

- Wenhao Jia, Kelly A. Shaw, and Margaret Martonosi, "Stargazer: Automated Regression-Based GPU Design Space Exploration" in the *Proceedings of the 2012 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)*, March 2012. Best paper nominee.
- Ivan Jibaja and Kelly A. Shaw. "Understanding the Applicability of CMP Performance Optimizations on Data Mining Applications," in *Proceedings of the 2009 IEEE International Symposium on Workload Characterization (IISWC)*, 2009.
- Kelly A. Shaw and Margaret Martonosi. "Pairing Software-Managed Caching with Decay Techniques to Balance Reliability and Static Power in Next-Generation Caches," *University of Richmond Math and Computer Science Technical Report TR-09-01*, May 2009.
- Cosmin Pancratov, Jacob M. Kurzer, Kelly A. Shaw, and Matthew L. Trawick. "Why Computer Architecture Matters: Thinking Through Trade-offs in Your Code," *IEEE Computing in Science and Engineering*. September/October 2008, vol. 10, no. 5.
- Cosmin Pancratov, Jacob M. Kurzer, Kelly A. Shaw, and Matthew L. Trawick. "Why Computer Architecture Matters: Memory Access," *IEEE Computing in Science and Engineering*. July/August 2008, vol. 10, no. 4.
- Cosmin Pancratov, Jacob M. Kurzer, Kelly A. Shaw, and Matthew L. Trawick. "Why Computer Architecture Matters," *IEEE Computing in Science and Engineering*. May/June 2008, vol. 10, no. 3.
- Kelly A. Shaw. "Understanding the Working Sets of Data Mining Applications," *Eleventh Workshop on Computer Architecture Evaluation using Commercial Workloads (CAECW-11)*. February 2008.
- Kelly A. Shaw. "Resource Management in Single-Chip Multiprocessors," Doctoral Dissertation. Stanford University. March 2005.
- Kelly A. Shaw and William J. Dally. "Migration in Single-Chip Multiprocessors," *IEEE Computer Architecture Letters*. Volume 1, November 2002.
- Guruduth Banavar, Marc Kaplan, Kelly Shaw, Rob Strom, Daniel Sturman, and Wei Tao. "Information Flow Based Event Distribution Middleware," *Proceedings of the Nineteenth IEEE International Conference on Distributed Computing Systems (ICDCS) Workshops*. May 1999, pp. 114–121.
- Margaret Martonosi and Kelly Shaw. "Interactions between Application Write Performance and Compilation Techniques: A Preliminary View," *IEEE Technical Committee on Computer Architecture (TCCA) Newsletter*. June 1997.
- Margaret Martonosi and Kelly Shaw. "Interactions between Application Write Performance and Compilation Techniques: A Preliminary View," *High Performance Computer Architecture (HPCA) Workshop on Interactions between Compilers and Computer Architectures*. February 1997.

Talks:

- Kelly A. Shaw. "Research Strategies," Computing Research Association's Committee on the Status of Women in Computing (CRA-W)'s *Workshop on Managing the Academic Career for Women Faculty in Undergraduate Computing Programs* co-located with the *48th Technical Symposium on Computer Science Education (SIGCSE)*, Seattle, WA, March 8, 2017.
- Kelly A. Shaw. "How to Get Involved in Undergraduate Research," at the *2017 ACM Capital Region Celebration of Women in Computing Conference (CAPWIC)*, Washington, DC, February 25, 2017.
- Kelly A. Shaw. "High Performance on Modern Graphic Processors," James Madison University, Harrisonburg, VA, February 22, 2017.
- Kelly A. Shaw. "Helping Software Exploit Hardware," Duke University *Computer Systems and Engineering Seminar Series*, Durham, NC, April 1, 2016.

- Kelly A. Shaw. "Helping Software Exploit Hardware", *Capital Region Celebration of Women in Computing (CAPWIC)* as part of the *CRA-W/CDC Distinguished Lecture Series (DLS)*, Newport News, VA, March 4, 2016.
- Kelly A. Shaw. "Research Strategies," Computing Research Association's Committee on the Status of Women in Computing (CRA-W)'s *Workshop on Managing the Academic Career for Women Faculty in Undergraduate Computing Programs* co-located with the *44th Technical Symposium on Computer Science Education (SIGCSE)*, Denver, CO, March 4, 2015.
- Kelly A. Shaw. "Research Strategies," Computing Research Association's Committee on the Status of Women in Computing (CRA-W)'s *Workshop on Managing the Academic Career for Women Faculty in Undergraduate Computing Programs* co-located with the *44th Technical Symposium on Computer Science Education (SIGCSE)*, Denver, CO, March 6, 2013.
- Kelly A. Shaw. "Research Strategies," Computing Research Association's Committee on the Status of Women in Computing (CRA-W)'s *Workshop on Managing the Academic Career for Women Faculty in Undergraduate Computing Programs* co-located with the *42nd Technical Symposium on Computer Science Education (SIGCSE)*, Dallas, TX, March 9, 2011.
- Kelly A. Shaw. "Understanding the Applicability of CMP Performance Optimizations on Data Mining Applications," *IEEE International Symposium on Workload Characterization (IISWC)*, Austin, TX. October 6, 2009.
- Kelly A. Shaw. "Understanding the Working Sets of Data Mining Applications," *Eleventh Workshop on Computer Architecture Evaluation using Commercial Workloads (CAECW-11)*. Salt Lake City, UT. February 17, 2008.
- Princeton Electrical Engineering Department Seminar. "Passing Information Across the Hardware/Software Boundary in Multi-core Chips." Princeton University. April 2, 2007.

Panels and BOFs:

- Farzana Rahman, Suzanne Matthews, Andrea Danyluk, and Kelly Shaw. "Can we really do it? - Conducting Significant Computer Science Research in Primarily Undergraduate Institutions (PUIs)," Birds of a Feather discussion at the *48th Technical Symposium on Computer Science Education (SIGCSE)*, Seattle, WA, March 9, 2017.
- Marie desJardins, Cristina Nita-Rotaru, Kelly Shaw, Laurie Williams, and Sara Sprenkle. "Getting Off to a Great Start in Academia: Advice from the Other Side of the Tenure Track," at the *Grace Hopper Celebration of Women in Computing* conference, Atlanta, GA, October 1, 2010.

Honors:

- ACM Senior Member (2016)
- Distinction in Teaching, Stanford School of Engineering (2005)
- Gabilan Stanford Graduate Fellowship (1997-2000)
- National Science Foundation Graduate Research Fellowship (1997-2000)
- Computing Research Association Outstanding Undergraduate Honorable Mention (1997)

Professional Service:

Technical

- Program Committee Chair: *International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2019
- Program Committee Co-Chair for Architecture and Networks area for *The International Conference for High Performance Computing, Networking, Storage and Analysis (SC)*, 2014

- Program Committee Member: *IEEE International Symposium on Workload Characterization (IISWC)*, 2018
- Program Committee Member: *International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2010, 2012, 2017, 2018
- Program Committee Member: *IEEE International Parallel and Distributed Processing Symposium (IPDPS) Software Track*, 2017
- Program Committee Member: *International Conference on Parallel Processing (ICPP)*, 2016, 2018
- Program Committee Member: *International Workshop on Accelerators and Hybrid Exascale Systems (AsHES)*, 2014-2018
- Program Committee Member: *10th IEEE International Conference on Networking, Architecture, and Storage (IEEE NAS)*, 2015
- Program Committee Member: *International Conference on Supercomputing (ICS)*, 2011
- Program Committee Member: *WOSP/SIPEW International Conference on Performance Engineering*, 2011
- Program Committee Member: *International Conference for High Performance Computing, Networking, Storage, and Analysis (SC)*, 2009 and 2010
- External Program Committee Member: *International Symposium on Computer Architecture (ISCA)*, 2017
- External Review Committee Member: *International Conference on Supercomputing (ICS)*, 2017
- Student Travel Grants Chair: *IEEE International Symposium on High-Performance Computer Architecture (HPCA)*, 2018
- Student Travel Grants Chair: *International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2017
- Publicity Co-chair: *International Conference on Supercomputing (ICS)*, 2018
- Publicity Chair: *International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2015
- Vendor Co-Chair: *Consortium for Computing Sciences in Colleges Eastern Conference*, 2006
- Advisory Board Member: Owen Astrachan's NSF CISE Distinguished Education Fellow grant, 2007-2008
- Judge: ACM Student Research Competition Grand Finals, 2013-2018
- Judge: ACM Student Research Competition (posters) at *44th Technical Symposium on Computer Science Education (SIGCSE)*, 2013
- Judge: ACM Student poster competition at *Grace Hopper Celebration of Women in Computing*, 2006
- Reviewer: NSF panels, 2007, 2008, 2009, 2010, 2012, 2013, 2015
- Reviewer: *IEEE Transactions on Parallel and Distributed Systems*, 2016
- Reviewer: *IEEE/ACM International Symposium on Microarchitecture (MICRO)*, 2013 and 2014
- Reviewer: *Journal of Parallel and Distributed Computing (JPDC)*, 2013
- Reviewer: *ACM/IEEE International Symposium on Computer Architecture (ISCA)*, 2013
- Reviewer: *IEEE Transactions on Computers*, 2010
- Reviewer: *Design Automation Conference (DAC)*, 2007 and 2008
- Reviewer: *IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2006 and 2013
- Reviewer: *IEEE International Symposium on High-Performance Computer Architecture (HPCA)*, 2006 and 2012
- Reviewer: *IEEE Computer Architecture Letters (CAL)*, 2006, 2014
- Reviewer: *Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, 2005

- Reviewer: *International Conference on Computer Design (ICCD)*, 2005
- Reviewer: Elsevier journal *Performance Evaluation*, 2005
- Reviewer: *ACM Transactions on Architecture and Code Optimization (TACO)*, 2005, 2015
- Reviewer: *ACM Transactions on Computer Systems (TOCS)*, 2005
- Member: Association for Computing Machinery (ACM), ACM SIGARCH (Special Interest Group on Computer Architecture), ACM SIGCSE (Special Interest Group on Computer Science Education)

Improving Diversity

- Co-chair: *National Center for Women and Information Technology (NCWIT) Virginia/DC Affiliate Award for Aspirations in Computing*, 2015-2016
- Selection Chair: *National Center for Women and Information Technology (NCWIT) Virginia Affiliate Award for Aspirations in Computing*, 2015-2017
- Organizing Committee Member: *Women in Computer Architecture (WICARCH)*, 2017-2018
- Organizing Committee Member: *National Center for Women and Information Technology (NCWIT) Virginia/DC Affiliate Award for Aspirations in Computing*, 2013-2016
- Organizing Committee Member: *CRA-W/CDC Discipline Specific Workshop for Computer Architecture*, August 2012
- Committee Member: *Grace Hopper Celebration of Women in Computing: Faculty Track*, 2018
- Committee Member: *Grace Hopper Celebration of Women in Computing: New Investigators Forum*, 2012
- Program Committee Member: *Grace Hopper Celebration of Women in Computing*, 2007
- Organizing Committee Member and Panel Moderator: *CRA-W/CDC Computer Architecture Summer School*, 2006
- Reviewer: *Grace Hopper Celebration of Women in Computing* scholarship applications, 2007-2015, 2018

University Service:

- Academic Advisor: Undeclared student and majors (2005 - 2017)
- Committee chair: A&S Undergraduate Research Committee (2015 - 2016)
- Committee member: A&S Undergraduate Research Committee (2013 - 2016)
- Faculty adviser for Women in Math and Science Living Learning community (2013 - 2016)
- Panel session moderator: A&S NEXT (2016)
- Facilitator: A&S Cellar Chat (2017)
- Organizer: 3 Talks by Diversity and Inclusion Consultant Valerie Aurora (2017)
- Co-organizer: Math and Computer Science Department Junior Faculty Mentoring Program (2017)
- Co-moderator: Women and Leadership in Higher Education panel discussion (2017)
- Co-organizer: Math and Computer Science junior faculty mentoring program (2017)
- Committee Member: Reed College Computing Policy Committee (2017-2018)
- Committee Member: Computer Science faculty search (2015)
- Committee Member: Biology faculty search (2013)
- Committee Member: Career Services search (2014)
- Panel session moderator: A&S @Work (2014)
- Committee Member: Physics faculty search (2012 - 2013)
- Committee Member: Richmond Science Scholars (2011)
- Committee Member: Clare Boothe Luce Scholarship (2007 - 2011)
- Committee Member: Grainger and A&S Undergraduate Summer Research Fellowships (2010, 2011)

- Committee Member: HHMI Summer Scholarship for Undergraduate Research (2010, 2011)
- Committee Member: Speech Selection Committee for student graduation speeches (2010, 2011)
- Maintainer: Women In Math and Science (WIMS) webpage (2009 - 2010)
- Committee Member: Computer Science Department Curriculum Review (2008 - 2009)
- Department Representative: Classroom Master Plan (2005)
- Library Liaison: Department of Mathematics and Computer Science (2005 - present)