STEPHEN F. SIEGEL

Curriculum Vitæ

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1 Employment

Associate Professor, Department of Computer and Information Sciences and Department of Mathematical Sciences, University of Delaware, September 2012 to present

Assistant Professor, Department of Computer and Information Sciences and Department of Mathematical Sciences, University of Delaware, September 2006 to August 2012

Senior Research Scientist, Laboratory for Advanced Software Engineering Research, Department of Computer Science, University of Massachusetts Amherst, August 2001 to August 2006

Senior Software Engineer, Laboratory for Advanced Software Engineering Research, Department of Computer Science, University of Massachusetts Amherst, August 1998 to July 2001

Visiting Assistant Professor, Department of Mathematics, University of Massachusetts Amherst, September 1996 to August 1998

Visiting Assistant Professor, Department of Mathematics, Northwestern University, September 1993 to June 1996

2 Education

Ph.D., Mathematics, University of Chicago, August 1993 (*Advisor*: Prof. Jonathan L. Alperin)

M.Sc., Mathematics, Oxford University, June 1989

B.A., Mathematics, University of Chicago, June 1988

3 Grants

- Principal Investigator, National Science Foundation Award CCF-0953210 Supplement 001, *Extension of TASS to Chapel*, June 1, 2011 – May 31, 2012. Award amount: $99,333.

- Principal Investigator, National Science Foundation Award CNS-0958512, Computing Research Infrastructure program, *II-New: System Acquisition for the Development of Scalable Parallel Algorithms for Scientific Computing*, May 1, 2010 – April 30, 2013. Co-PIs: Peter B. Monk, Douglas M. Swany, and Krzysztof Szalewicz. Award amount: $749,769. *Equipment award used to purchase the Chimera cluster.*

- Principal Investigator, National Science Foundation Award CCF-0953210, *CAREER: Ensuring the Accuracy of Scientific Software: A Formal Approach*, April 1, 2010 – March 31, 2015. Award amount: $411,689

- Principal Investigator, National Science Foundation Award CCF-0541035/CCF-0733035, *Finite-State Verification for High Performance Computing*, April 15, 2006 – March 31, 2010. Co-PI: George S. Avrunin, University of Massachusetts. Lead institution: University of Massachusetts, transferred to University of Delaware. Collaborating Institutions: University of Nebraska (PI Matthew Dwyer), University of Chicago (PI Andrew Siegel). Award amount: $960,000 (total), $546,000 (lead institution)

- Principal Investigator, University of Delaware Research Foundation Grant, *Verifying the Order of Accuracy of Numerical Software*, June 1, 2009 – May 31, 2011. Award amount: $35,000. Awarded Research Experience for Undergraduate supplement for summer 2010: $3,500.

- Targeted Grant for Capstone Experience (with Keith Decker), University of Delaware, summer 2008, $8,658, to develop capstone experience for CISC 475

4 Publications

Refereed Journal Publications

1. Kyle G. Felker, Andrew R. Siegel, and Stephen F. Siegel. Optimizing memory constrained environments in Monte Carlo nuclear reactor simulations. *International Journal of High Performance Computing Applications*, June 2012. Online first, `http://hpc.sagepub.com/content/early/2012/06/04/1094342012445627`.

2. Stephen F. Siegel. Transparent partial order reduction. *Formal Methods in System Design*, 40(1):1–19, February 2012.

3. Ganesh Gopalakrishnan, Robert M. Kirby, Stephen Siegel, Rajeev Thakur, William Gropp, Ewing Lusk, Bronis R. De Supinski, Martin Schulz, and Greg Bronevetsky. Formal analysis of MPI-based parallel programs. *Communications of the ACM*, 54(12):82–91, December 2011.

4. Stephen F. Siegel and Timothy K. Zirkel. TASS: The Toolkit for Accurate Scientific Software. *Mathematics in Computer Science*, 5(4):395–426, 2011.

5. Stephen F. Siegel and Timothy K. Zirkel. FEVS: A Functional Equivalence Verification Suite for high performance scientific computing. *Mathematics in Computer Science*, 5(4):427–435, 2011.

6. Stephen F. Siegel and Andrew R. Siegel. MADRE: The Memory-Aware Data Redistribution Engine. *International Journal of High Performance Computing Applications*, 24(1):93–104, February 2010.

7. Stephen F. Siegel, Anastasia Mironova, George S. Avrunin, and Lori A. Clarke. Combining symbolic execution with model checking to verify parallel numerical programs. *ACM Transactions on Software Engineering and Methodology*, 17(2):Article 10, 1–34, 2008.

8. Stephen F. Siegel. Hochschild cohomology and elementary abelian subgroups. *Trans. Amer. Math. Soc.*, 358(7):2911–2915, July 2006. Appendix to Jonathan Pakianathan and Sarah Witherspoon, Quillen stratification for Hochschild cohomology of blocks.

9. Stephen F. Siegel and George S. Avrunin. Improving the precision of INCA by eliminating solutions with spurious cycles. *IEEE Transactions on Software Engineering*, 28(2):115–128, 2002.

10. Stephen F. Siegel and Sarah J. Witherspoon. The Hochschild cohomology ring of a cyclic block. *Proc. Amer. Math. Soc.*, 128(5):1263–1268, 2000.

11. Stephen F. Siegel. The cohomology of split extensions of elementary abelian 2-groups and Totaro's example. *J. Pure Appl. Algebra*, 145(2):183–198, 2000.

12. Stephen F. Siegel and Sarah J. Witherspoon. The Hochschild cohomology ring of a group algebra. *Proc. London Math. Soc.*, 79(1):131–157, 1999.

13. Stephen F. Siegel, Vassily Gorbounov, and Peter Symonds. The cohomology of the Morava stabilizer group $\mathbb{S}_2$ at the prime 3. *Proc. Amer. Math. Soc.*, 126(3):933–941, 1998.

14. Stephen F. Siegel. On the cohomology of split extensions of finite groups. *Trans. Amer. Math. Soc.*, 349(4):1587–1609, 1997.

15. Stephen F. Siegel. The spectral sequence of a split extension and the cohomology of an extraspecial group of order p^3 and exponent p. *J. Pure Appl. Algebra*, 106(2):185–198, 1996.

16. Leonard Evens and Stephen F. Siegel. Generalized Benson-Carlson duality. *J. Algebra*, 179(3):775–792, 1996.

17. Stephen F. Siegel. Projective modules for A_9 in characteristic three. *Communications in Algebra*, 19(11):3099–3117, 1991.

Refereed Conference and Workshop Publications

18. Stephen F. Siegel and Timothy K. Zirkel. Loop invariant symbolic execution for parallel programs. In Viktor Kuncak and Andrey Rybalchenko, editors, *Verification, Model Checking, and Abstract Interpretation: 13th International Conference, VMCAI 2012*, volume 7148 of *Lecture Notes in Computer Science*, pages 412–427. Springer, January 2012.

19. Stephen F. Siegel and Timothy K. Zirkel. Automatic formal verification of MPI-based parallel programs. In Calin Cascaval and Pen-Chung Yew, editors, *Proceedings of the 16th ACM SIGPLAN Annual Symposium on Principles and Practices of Parallel Programming (PPoPP '11), short paper and poster*, pages 309–310. ACM, January 2011.

20. Stephen F. Siegel and Timothy K. Zirkel. Collective assertions. In Ranjit Jhala and David Schmidt, editors, *Verification, Model Checking, and Abstract Interpretation: 12th International Conference, VMCAI 2011, Austin, TX, January 23–25, 2011, Proceedings*, volume 6538 of *Lecture Notes in Computer Science*, pages 387–402, 2011.

21. Stephen F. Siegel and Andrew R. Siegel. A memory-efficient data redistribution algorithm. (Video). In Matti Ropo, Jan Westerholm, and Jack Dongarra, editors, *Recent Advances in Parallel Virtual Machine and Message Passing Interface, 16th European PVM/MPI User's Group Meeting, Proceedings*, volume 5759 of *Lecture Notes in Computer Science*, pages 219–229. Springer, 2009.

22. Stephen F. Siegel and Andrew R. Siegel. MADRE: The Memory-Aware Data Redistribution Engine. In Alexey Lastovetsky, Tahar Kechadi, and Jack Dongarra, editors, *Recent Advances in Parallel Virtual Machine and Message Passing Interface, 15th European PVM/MPI User's Group Meeting, Proceedings*, volume 5205 of *Lecture Notes in Computer Science*, pages 218–226. Springer, 2008.

23. Stephen F. Siegel and Louis F. Rossi. Analyzing BlobFlow: A case study using model checking to verify parallel scientific software. In Alexey Lastovetsky, Tahar Kechadi, and Jack Dongarra, editors, *Recent Advances in Parallel Virtual Machine and Message Passing Interface, 15th European PVM/MPI User's Group Meeting, Proceedings*, volume 5205 of *Lecture Notes in Computer Science*, pages 274–282. Springer, 2008.

24. Stephen F. Siegel and George S. Avrunin. Verification of halting properties for MPI programs using nonblocking operations. In Franck Cappello, Thomas Hérault, and Jack Dongarra, editors, *Recent Advances in Parallel Virtual Machine and Message Passing Interface, 14th European PVM/MPI User's Group Meeting, Paris, France, September 30 - October 3, 2007, Proceedings*, volume 4757 of *Lecture Notes in Computer Science*, pages 326–334. Springer, 2007.

25. Stephen F. Siegel. Model checking nonblocking MPI programs. In Byron Cook and Andreas Podelski, editors, *Verification, Model Checking, and Abstract Interpretation: 8th International Conference, VMCAI 2007, Nice, France, January 14–16, 2007, Proceedings*, volume 4349 of *Lecture Notes in Computer Science*, pages 44–58, 2007.

26. Stephen F. Siegel, Anastasia Mironova, George S. Avrunin, and Lori A. Clarke. Using model checking with symbolic execution to verify parallel numerical programs. In Lori L. Pollock and Mauro Pezzé, editors, *Proceedings of the ACM SIGSOFT International Symposium on Software Testing and Analysis, ISSTA 2006, Portland, Maine, USA, July 17–20, 2006*, pages 157–168. ACM, 2006.

27. Stephen F. Siegel and George S. Avrunin. Modeling wildcard-free MPI programs for verification. In *Proceedings of the ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, pages 95–106, Chicago, IL, June 2005.

28. George S. Avrunin, Stephen F. Siegel, and Andrew R. Siegel. Finite-state verification for high performance computing. In Philip M. Johnson, editor, *Proceedings of the Second International Workshop On Software Engineering For High Performance Computing System Applications, St. Louis, Missouri, USA, May 15, 2005*, pages 68–72, 2005.

29. Stephen F. Siegel. Efficient verification of halting properties for MPI programs with wildcard receives. In Radhia Cousot, editor, *Verification, Model Checking, and Abstract Interpretation: 6th International Conference, VMCAI 2005, Paris, January 17–19, 2005, Proceedings*, volume 3385 of *Lecture Notes in Computer Science*, pages 413–429, 2005.

30. Stephen F. Siegel and George S. Avrunin. Verification of MPI-based software for scientific computation. In Susanne Graf and Laurent Mounier, editors, *Model Checking Software: 11th International SPIN Workshop, Barcelona, Spain, April 1–3, 2004, Proceedings*, volume 2989 of *Lecture Notes in Computer Science*, pages 286–303. Springer-Verlag, 2004.

31. Stephen F. Siegel and George S. Avrunin. Improving the precision of INCA by preventing spurious cycles. In Mary Jean Harrold, editor, *Proceedings of the ACM SIGSOFT 2000 International Symposium on Software Testing and Analysis, Portland, OR, USA, August 21–24, 2000*, pages 191–200. ACM Press, 2000.

Papers & Extended Abstracts for Invited Talks/Tutorials Published in Peer-Reviewed Conference Proceedings

32. Stephen F. Siegel and Ganesh Gopalakrishnan. Formal analysis of message passing (Invited Talk). In Ranjit Jhala and David Schmidt, editors, *Verification, Model Checking, and Abstract Interpretation: 12th International Conference, VMCAI 2011, Austin, TX, January 23–25, 2011, Proceedings*, volume 6538 of *Lecture Notes in Computer Science*, pages 2–18, January 2011.

33. Stephen F. Siegel. Formal verification for scientific computing: Trends and progress. In Matti Ropo, Jan Westerholm, and Jack Dongarra, editors, *Recent Advances in Parallel Virtual Machine and Message Passing Interface*, volume 5759 of *Lecture Notes in Computer Science*, page 7. Springer Berlin / Heidelberg, 2009.

34. Stephen F. Siegel. Verifying parallel programs with MPI-Spin. In Franck Cappello, Thomas Hérault, and Jack Dongarra, editors, *Recent Advances in Parallel Virtual Machine and Message Passing Interface, 14th European PVM/MPI User's Group Meeting, Paris, France, September 30 - October 3, 2007, Proceedings*, volume 4757 of *Lecture Notes in Computer Science*, pages 13–14. Tutorial. Springer, 2007.

Other Published Invited Papers

35. Stephen F. Siegel. Verification of MPI-based computations. In Henri E. Bal, Lubos Brim, and Martin Leucker, editors, *Distributed Verification and Grid Computing*, number 08332 in Dagstuhl Seminar Proceedings, Dagstuhl, Germany, 1–3, 2008. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, Germany.

Significant Technical Reports

36. Stephen F. Siegel, Andrew R. Siegel, and Cristian Rabiti. UNIC Code: Algorithmic specification of the Method of Long Characteristics. Technical Memo ANL/MCS-TM-301, Mathematics and Computer Science Division, Argonne National Laboratory, June, 2008.

37. Stephen F. Siegel and George S. Avrunin. Modeling MPI programs for verification. Technical Report UM-CS-2004-75, Department of Computer Science, University of Massachusetts Amherst, 2004.

38. Stephen F. Siegel. The INCA Query Language. Technical Report UM-CS-2002-18, Department of Computer Science, University of Massachusetts Amherst, 2002.

39. George S. Avrunin, James C. Corbett, Matthew B. Dwyer, Corina S. Păsăreanu, and Stephen F. Siegel. Comparing finite-state verification techniques for concurrent software. Technical Report UM-CS-1999-69, Department of Computer Science, University of Massachusetts Amherst, 1999.

5 Software Systems Developed

- Functional Equivalence Verification Suite (FEVS), `http://vsl.cis.udel.edu/fevs`

  - FEVS is a suite of 37 programs (all in C, many using MPI) to test the precision of verification tools that target numerical/scientific software. The programs are arranged in 11 groups, each containing one simple version believed to be correct, the *specification*. Each group also contains several implementations which can be considerably more complex, some of which contain known errors.

  - *Developed at University of Delaware.*

- Toolkit for Accurate Scientific Software (TASS), `http://vsl.cis.udel.edu/tass`

  - TASS is a state-of-the-art symbolic execution and model checking platform for numerically-intensive C/MPI programs. Working directly from source code, it can be used to verify or refute a number of safety properties of such programs. It can also show that two programs are functionally equivalent, within specified bounds on the input. TASS is now being used to investigate new specification and verification techniques (such as collective assertions and invariants) in a number of projects in the Verified Software Lab.

  - *Developed at University of Delaware.*

- MPI-SPIN, `http://vsl.cis.udel.edu/mpi-spin`

  - The predecessor to TASS, MPI-Spin is a significant extension to the model checker Spin. It adds support for a large subset of MPI, and was the main platform used for the research reported in many of our publications.

  - *Development started at University of Massachusetts and continued at University of Delaware; approximately 50% at Delaware.*

- Memory Aware Data Redistribution Engine (MADRE), `http://vsl.cis.udel.edu/madre`

  - MADRE is a C/MPI library for re-distributing blocks of data in a memory-constrained distributed environment. This problem arises frequently in many kinds of scientific applications, such as particle-based algorithms. A number of different heuristics and algorithms have been proposed (by ourselves and other researchers) to solve this problem, and MADRE has been used to investigate and compare these.

  - *Development started at University of Massachusetts and continued at University of Delaware; approximately 25% at Delaware.*

6 Talks

Invited Talks

- *Scopes & Processes: a general concurrency model for parallel program analysis and model checking*, Colloquium, School of Computing, University of Utah, September 7, 2012

- *Formal Specification and Verification of MPI Programs Using TASS*, Argonne National Laboratory, Mathematics and Computer Science Division, April 31, 2011

- *Formal Specification and Verification of MPI Programs Using TASS*, Massachusetts Institute of Technology, Computer Science and Artificial Intelligence Laboratory, April 15, 2011

- *Formal Verification for Scientific Computing: Trends and Progress*, EuroPVM/MPI 2009. (Video), September 10, 2009.

- *Towards Verifiable Scientific Computing*, University of Nebraska Lincoln colloquium, July 10, 2008

- *Towards Verifiable Scientific Computing*, University of Utah colloquium, Salt Lake City, UT, November 16, 2007

- *Finite-state verification for scientific computing*, in the series *Computing the future: lectures in computational science, engineering, and mathematics*, Center for Computation and Technology, Louisiana State University, Baton Rouge, LA, April 18, 2005.

- *Recent progress in the finite-state verification of MPI programs*, Argonne National Laboratory, November 18, 2004.

- *Applying finite-state verification to scientific software using MPI*, Smith College, December 3, 2003.

- *Applying finite-state verification to scientific software using MPI*, Argonne National Laboratory, January 13, 2003.

Other selected talks

- *Generalizing Formal Methods from Sequential to Message-Passing Parallel Programs: The Case of Symbolic Execution*, $(EC)^2$: Exploiting Concurrency Efficiently and Correctly, July 14, 2011

- *The Toolkit for Accurate Scientific Software*, the Third International Workshop on Numerical Software Verification, July 15, 2010

- *Using MPI-Spin to model check MPI programs with nonblocking communication*, EuroPVM/MPI, Late and Breaking Results, http://www.pvmmpi06.org, Bonn, Germany, September 20, 2006

- *The Hochschild cohomology ring of a finite group*, Algebra Seminar, Northwestern University, June 1997

- *Cohomology is* really *representation theory*, AMS Special Session on Representation Theory of Finite Groups, Detroit, Michigan, May 1997

- *The Hochschild cohomology ring of a finite group*, Group cohomology seminar, University of Georgia, Athens, May 1997

- *On the cohomology of split extensions of elementary abelian 2-groups*, AMS Special Session on Classifying Spaces and Cohomology of Finite Groups, Columbia, Missouri, November 1996

- *On the cohomology of split extensions of elementary abelian 2-groups*, The Fields Institute, Toronto, April 1996

- *The cohomology of the Burt group*, Algebra seminar, Northwestern University, May 1995

- *The cohomology of the Morava stabilizer group* $\mathbb{S}_2$ *at the prime* 3, AMS Special Session on Classifying Spaces and Cohomology of Finite Groups, Orlando, Florida, March 1995

- *Generalized Benson-Carlson duality*, AMS Special Session on Cohomology and Representations of Finite Groups, San Francisco, California, January 1995

- *Generalized Benson-Carlson duality*, Canadian Mathematical Society Annual Seminar, Representations of groups: finite, algebraic, Lie, and quantum, Banf, Canada, June 1994

- *Poincaré duality and cohomology of finite groups*, Workshop on Group Representation Theory, Technion, Israel Institute of Technology, Haifa, Israel, June 1994

- *Twisting cochains and group cohomology*, Colloquium, University of Georgia, Fall 1992

- *Twisting cochains and the spectral sequence of a split extension of finite groups*, Algebra seminar, University of Virginia, Fall 1992

- *Characteristic classes and cohomology of groups*, Algebra seminar, Northwestern University, Winter 1992

7 Service

External

- Program Committee, NSV-2011

- Program Committee, EuroPVM/MPI 2009, 2010, 2012

- Program Committee (Tutorials), SC09

- Program Committee (Technical track, Systems), SC10

- Organizing committee, *Exploiting Concurrency Efficiently and Correctly* $((EC)^2)$, CAV Workshop, 2008, 2009, 2010, 2011 (chair), 2012. $(EC)^2$ *had the highest attendance of the 11 CAV workshops in 2009.*

- External reviewer for the following journals and conferences (selected):

    - *International Symposium on Software Testing and Analysis* (ISSTA 2011)
    - *Supercomputing* (SC09)
    - *ACM SIGPLAN Symposium on Principles and Practice of Parallel Computing* (PPoPP 2008)
    - *Transactions on Software Engineering*, IEEE, 2008
    - *17th International Conference on Computer Aided Verification* (CAV 2008)
    - *Concurrency and Computation: Practice and Experience*, 2007
    - *Parallel Computing*, 2007
    - *ACM Transactions on Software Engineering and Methodology* (TOSEM), 2007
    - *13th European PVM/MPI Users' Group Meetings* (EuroPVM/MPI 2006)
    - *Communications in Algebra*, 2006

- Proposal evaluation panel member, National Science Foundation, 2006, 2009, 2011

- Panelist, Department of Energy, Advanced Scientific Computing Research Exascale Tools Workshop, Panel on Correctness and Debugging, October 13–14, 2011

- Ph.D. committee, external member, Sarvani Vakkalanka, University of Utah (advisor: Ganesh Gopalakrishnan)

- Publicity Chair, International Symposium on Software Testing and Analysis, Boston, Massachusetts, July 11–14, 2004

- Co-chair (with John Maginnis), Special Session on Cohomology of Finite Groups, 1998 Spring Central Sectional Meeting (#932) of the American Mathematical Society, March 27–28, 1998

Departmental

- Computing Infrastructure Committee, 2011–2012

- Graduate Program Committee, 2010–2012

- HPC Programming Team coach, 2010

- served on the Search Committee for a tenure-track hire in software engineering, 2009–2010

- participated in the CISC 475 assessment process, 2007, 2008, 2009

- served on the Undergraduate Committee, 2007–2009

- served on the Graduate Recruitment Committee, 2006–2007

- serving on the Master of Science in Software Engineering committee: helped develop curriculum of new program and prepare documents for university approval

- assisted with the UD booth presence at SC07 and SC09 (the International Conference for High Performance Computing, Networking, Storage and Analysis, also known as "Supercomputing") with funding, posters, a student, and maintaining a booth presence

- organized and coached two UD teams which competed in the HPC Programming Contest at SC09. One team tied for first place, the other came in third.

- co-organized the Computer and Information Sciences Distinguished Lecture Series, 2007–2008

- co-organizer of SIG-SYS

8 Teaching and Mentoring

University of Delaware

- Graduate student advisees and research assistants

  - Timothy Zirkel: Ph.D. student and RA, 2008–present. Passed Ph.D. preliminary exams, January 2011. Passed Ph.D. Thesis Proposal Defense (qualifying exam), May 2011; topic: *Formally Verifying the Accuracy of Numerical Approximations in Scientific Software*
  - Timothy McClory: independent study, M.S. student, and RA, 2011–2012
  - Yi Wei: M.S. student and RA, 2007–2010. Earned M.S., 2010
  - Michael Karpeles: RA, 2011
  - Benjamin Perry: RA, 2010
  - Jiaqiang Xu: M.S. student and RA, 2007–2008. Earned M.S., 2009
  - Pujan Kafle: M.S. student and RA, 2006–2008. Earned M.S., 2008
  - Samuel Moelius: RA, 2007–2008

- Undergraduate students supervised in research projects

- – Alex Stachnik, Independent Study, 2011. Topic: *Construction of compiler-based front-end for TASS*
- – Andrew Chester, Independent Study, 2011. Topic: *Development of new ECE/CIS Account System*
- – Daniel Fix, University of Delaware Research Foundation summer internship, 2010. Topic: *Counterexample trace display for TASS*
- – Robert Deaton, Independent Study, 2009. Topic: *An XML representation for TASS models*
- – John Hankins, Independent Study, 2008. Topic: *A concurrent elevator control system in Java*
- – Brandon Maas, Independent Study, 2008. Topic: *nfoShare (Vgoo) and Bus Bookie Startup Projects*

- Nominated for Excellence in Undergraduate Academic Advising Award, May 2009

- 2006 Fall

  - – CISC 879.011: *Finite-State Verification*

- 2007 Spring

  - – CISC 475: *Object-Oriented Software Engineering*

- 2007 Fall

  - – CISC403/603: *Program Validation*

- 2008 Spring

  - – CISC 475: *Object-Oriented Software Engineering*
  - – CISC 675: *Object-Oriented Software Engineering* (graduate)

- 2008 Fall

  - – CISC 879.011: *Abstract Interpretation*, Fall 2008

- 2009 Spring

  - – CISC 475/675: *Object-Oriented Software Engineering*
  - – CISC 372: *Parallel Programming*

- 2009 Fall

  - – CISC 403/603: *Software Verification*
  - – CISC 879.010: *Advanced Parallel Computing* (co-taught with Martin Swany)

- 2010 Spring

  - – CISC 475/675: *Advanced Software Engineering*
  - – CISC 372: *Parallel Programming* (co-taught with Martin Swany)

- 2010 Fall

  - – CISC 414/614: *Software Verification*

- 2011 Spring

  - – CISC 475/675: *Advanced Software Engineering*
  - – CISC 879.011: *Advanced Topics in Software Verification*

- 2011 Fall

- CISC 108: *Introduction to Computer Science 1*
- CISC 414/614: *Formal Methods in Software Engineering*
- 2012 Spring
  - CISC 475/675: Advanced Software Engineering

Amherst College

- Instructor, CS31: *Concurrency*, Amherst College, Fall 2003

University of Massachusetts Amherst

- Instructor, Math 411: *Introduction to Abstract Algebra I*, Spring 1997
- Instructor, Math 132: *Calculus II with Graphing Calculator*, Spring 1997, Fall 1997, Spring 1998
- Instructor, Math 190: *Basic Math Skills for the Modern World*, Fall 1996
- Instructor, Math 131: *Calculus I with Graphing Calculator*, Fall 1996

Northwestern University

- Instructor, Math D-78: *Group representation theory*, Spring 1995
- Instructor, Math B15-0: *Multiple integration and vector calculus*, Winter 1994–5
- Instructor, Math E-11: *Group cohomology*, Winter 1993–4
- Instructor, Math B14-1: *Calculus*, Northwestern University, Fall 1993

Other

- Instructor, *Beginner and Intermediate Lindy Hop*, 2001–2004, Northampton Center for the Arts, Northampton, Mass.
- College Fellow (teaching assistant), *Functional analysis*, University of Chicago, Winter 1990
- College Fellow, *Representation theory of finite groups*, University of Chicago, Fall 1989
- Teaching Assistant, *Introduction to Computer Programming III*, University of Chicago, Spring 1988
- Computer Lab Assistant, University of Chicago, 1987–8
- Class tutor, *Calculus*, University of Chicago, 1985–6
- Instructor, *Introduction to Computer Programming*, Miami Microcomputer Training Center, 1982–1984

9   Other Awards and Honors

- National Science Foundation Postdoctoral Fellowship, September 1993 – June 1996
- Sloan Foundation Dissertation Fellowship, October 1992 – August 1993
- Office of Naval Research Graduate Fellowship, University of Chicago, June 1989 – May 1992
- Senior Mathematics Award for M.Sc. dissertation, Oxford University, June 1989
- Fulbright Graduate Fellowship, Oxford University, September 1988 – June 1989
- Paul R. Cohen Mathematics Prize, University of Chicago, June 1988
- National Science Foundation Graduate Fellowship (declined), April 1988
- Admitted to Phi Beta Kappa, University of Chicago, June 1987