

# Curriculum Vitae

George S. Avrunin

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## Degrees

BS (Mathematics), 1972, University of Michigan  
MA (Mathematics), 1974, University of Michigan  
PhD (Mathematics), 1976, University of Michigan

## Experience

University of Massachusetts.  
Assistant Professor, 1976–1982.  
Associate Professor, 1982–1991.  
Professor, since 1991.  
Associate Department Head, 2002–2008 (Acting Head, Fall 2005).  
Department Head, since 2008.  
Adjunct Professor of Computer Science, since 1992.

University of Virginia.  
Visiting Assistant Professor, 1980.

## Memberships

American Mathematical Society  
Association for Computing Machinery  
Association for Women in Mathematics  
IEEE Computer Society  
Mathematical Association of America

## Selected Honors and Professional Service

ACM Distinguished Scientist, 2006

Associate Editor, ACM Transactions on Software Engineering and Methodology, since 2005.

National Science Foundation Awards Panels (1998, 1999, 2003, 2007, 2008)

ACM International Symposium on Software Testing and Analysis: General Chair 2004; member of Steering Committee since 2002 (chair 2004–2006); Program Committee 1998, 2000, 2002, 2006, 2009

ACM SIGSOFT Symposium on the Foundations of Software Engineering: Program Committee 2006

ACM SPIN Workshop on Software Model Checking: Program Committee 2001, 2005

Computer Aided Verification: Program Committee 2003

ACM & IEEE International Conference on Software Engineering: Program Committee 1999, 2002, 2003, 2005, 2006

ACM & IEEE International Conference on Automated Software Engineering: Program Committee 2008

IEEE International Conference on Distributed Computing Systems: Program Committee 1999

IEEE International Conference on Engineering Complex Computer Systems: Program Committee 1997

IEEE Real-Time Systems Symposium: Program Committee 1994

### Grants

Co-principal investigators: J. E. Humphreys and G. S. Avrunin. “Modular Representations and Cohomology Rings of Groups”, National Science Foundation grant MCS-830248. June 1, 1983 to November 30, 1985. \$65,300.

Co-principal investigators: J. C. Wileden and G. S. Avrunin. “Analysis Support for Development of Concurrent Software Systems”, National Science Foundation grant CCR-8806970. July 15, 1988 to December 31, 1990. \$223,738.

Co-principal investigators: J. C. Wileden and G. S. Avrunin. “Improving and Extending Constrained Expression Analysis Techniques”, Office of Naval Research grant N00014-89-J-1064. October 1, 1988 to September 30, 1991. \$282,886.

Principal investigator: G. S. Avrunin. “Constrained Expression Analysis of Concurrent Systems”, National Science Foundation Grant CCR-9106645. September 15, 1991 to August 28, 1994. \$136,231.

Co-principal investigators: G. S. Avrunin and J. C. Wileden. “Constrained Expression Analysis of Real-Time Systems”, Office of Naval Research Grant N00014-89-J-1064 (modification of previous award). October 1, 1991 to January 31, 1994. \$228,537.

Principal investigator: G. S. Avrunin. “Automated Analysis of Concurrent Systems”, National Science Foundation Grant CCR-9407182. September 1, 1994 to August 31, 1997. \$206,461.

Principal investigator: G. S. Avrunin. “Experimental Study of Static Analysis Techniques for Concurrent Software”, National Science Foundation Grant CCR-9708184. September 1, 1997 to August 31, 2001. \$1,434,337.

Principal investigator: G. S. Avrunin. “Software Model Checking for Embedded Systems”, Army Research Office Agreement DAAD190110564. May 1, 2001 to October 31, 2006. \$1,257,450.

Co-principal investigators: L. A. Clarke, G. S. Avrunin, E. A. Henneman, L. J. Osterweil. “Improving the Safety and Efficiency of Medical Processes”, National Science Foundation Grant CCF-0427071. October 1, 2004 to September 30, 2008. \$1,448,468.

Co-principal investigators: S. F. Siegel, G. S. Avrunin. “Collaborative Research: Finite-State Verification for High-Performance Computing”, National Science Foundation Grant CCF-0541035. April 15, 2006 to March 31, 2009. \$546,000.

Co-principal investigators: L. A. Clarke, G. S. Avrunin, E. A. Henneman, L. J. Osterweil. “Collaborative Research: Process-Centered, Analysis-Driven System Development Applied to Human-Intensive Medical Processes”, National Science Foundation Grant CCF-0820198, July 1, 2008 to June 30, 2011. \$500,000.

## Publications

### Books and Chapters in Books

Clyde H. Coombs and George S. Avrunin. *The Structure of Conflict*. Lawrence Erlbaum Associates, Hillsdale, NJ, 1988. 264 pages.

George S. Avrunin and Jack C. Wileden. Improvements in automated analysis of concurrent and real-time software. In André M. van Tilborg and Gary M. Koob, editors, *Foundations of Real-Time Computing: Formal Specifications and Methods*, chapter 8, pages 195–215. Kluwer Academic Publishers, 1991.

Shangzhu Wang, George S. Avrunin, and Lori A. Clarke. Plug-and-Play Architectural Design and Verification. In R. de Lemos, F. Di Giandomenico, C. Gacek, H. Muccini, and M. Vieira, editors, *Architecting Dependable Systems V*, number 5135 in LNCS, pages 273–297. Springer, 2008.

### Papers in Refereed Journals

Clyde H. Coombs and George S. Avrunin. Single-peaked functions and the theory of preference. *Psych. Rev.*, 84:216–230, 1977.

Reprinted in: E. D. Lantermann and H. Feger, editors, *Similarity and Choice*, Hans Huber Publishers, Bern (1980), pp. 182–207.

- Clyde H. Coombs and George S. Avrunin. A theorem on single-peaked preference functions in one dimension. *J. Math. Psych.*, 16:261–266, 1977.
- George S. Avrunin. A vanishing theorem for second degree cohomology. *J. Algebra*, 53:382–388, 1978.
- George S. Avrunin. 2-cohomology of some unitary groups. *Ill. J. Math.*, 24:317–332, 1980.
- George S. Avrunin. The image of the restriction map on 2-cohomology. *Arch. Math. (Basel)*, 34:502–508, 1980.
- George S. Avrunin. Annihilators of cohomology modules. *J. Algebra*, 69:150–154, 1981.
- George S. Avrunin. Generic cohomology for twisted groups. *Trans. Amer. Math. Soc.*, 268:247–253, 1981.
- George S. Avrunin and Leonard L. Scott. A Quillen stratification theorem for modules. *Bull. Amer. Math. Soc. (N.S.)*, 6:75–78, 1982.
- George S. Avrunin and Leonard L. Scott. Quillen stratification for modules. *Invent. Math.*, 66:277–286, 1982.
- George S. Avrunin and Jack C. Wileden. Describing and analyzing distributed software system designs. *ACM Trans. Prog. Lang. Syst.*, 7(3):380–403, July 1985.
- George S. Avrunin, Laura K. Dillon, Jack C. Wileden, and William E. Riddle. Constrained expressions: Adding analysis capabilities to design methods for concurrent software systems. *IEEE Trans. Softw. Eng.*, SE-12(2):278–292, 1986.
- Reprinted in: S. M. Shatz and J.-P. Wang, editors, *Tutorial: Distributed-Software Engineering*, IEEE Computer Society Press, Washington, DC (1989), pp. 258–271.
- Laura K. Dillon, George S. Avrunin, and Jack C. Wileden. Constrained expressions: Toward broad applicability of analysis methods for distributed software systems. *ACM Trans. Prog. Lang. Syst.*, 10(3):374–402, July 1988.
- George S. Avrunin, Ugo A. Buy, James C. Corbett, Laura K. Dillon, and Jack C. Wileden. Automated analysis of concurrent systems with the constrained expression toolset. *IEEE Trans. Softw. Eng.*, 17(11):1204–1222, November 1991.
- George S. Avrunin and Jon F. Carlson. Nilpotency degree of cohomology rings in characteristic two. *Proc. Amer. Math. Soc.*, 118(2):239–343, 1993.

- George S. Avrunin, James C. Corbett, Laura K. Dillon, and Jack C. Wileden. Automated derivation of time bounds in uniprocessor concurrent systems. *IEEE Trans. Softw. Eng.*, 20(9):708–719, September 1994.
- James C. Corbett and George S. Avrunin. Using integer programming to verify general safety and liveness properties. *Formal Methods in System Design*, 6:97–123, January 1995.
- George S. Avrunin, James C. Corbett, and Laura K. Dillon. Analyzing partially-implemented real-time systems. *IEEE Trans. Softw. Eng.*, 24(8):602–614, August 1998.
- George S. Avrunin, James C. Corbett, and Matthew B. Dwyer. Benchmarking finite-state verifiers. *Software Tools for Technology Transfer*, 2(4):317–320, 2000.
- Stephen F. Siegel and George S. Avrunin. Improving the precision of INCA by eliminating solutions with spurious cycles. *IEEE Trans. Softw. Eng.*, 28(2):115–128, 2002.
- Elizabeth A. Henneman, Rachel Cobleigh, Kimberly Frederick, Ethan Katz-Bassett, George S. Avrunin, Lori A. Clarke, Leon J. Osterweil, Chester Andrzejewski, Jr., Karen Merrigan, and Phillip L. Henneman. Increasing patient safety and efficiency in transfusion therapy using formal process definitions. *Transfusion Medicine Reviews*, 21(1):49–57, January 2007.
- Jamieson M. Cobleigh, George S. Avrunin, and Lori A. Clarke. Breaking up is hard to do: An evaluation of automated assume-guarantee reasoning. *ACM Trans. Softw. Eng. Method.*, 17(2): Article 7, 1–52, 2008.
- Stephen F. Siegel, Anastasia Mironova, George S. Avrunin, and Lori A. Clarke. Combining symbolic execution with model checking to verify parallel numerical programs. *ACM Trans. Softw. Eng. Method.*, 17(2): Article 10, 1–34, 2008.
- Elizabeth A. Henneman, Rachel Cobleigh, George S. Avrunin, Lori A. Clarke, Leon J. Osterweil, and Philip L. Henneman. Designing property specifications to improve the safety of the blood transfusion process. *Transfusion Medicine Reviews*, 22(4):291–299, October 2008.

#### Papers in Highly Refereed Conferences

- Jack C. Wileden and George S. Avrunin. Toward automating analysis support for developers of distributed software. In *Proceedings of the Eighth International Conference on Distributed Computing Systems*, pages 350–357. IEEE Computer Society Press, June 1988.
- George S. Avrunin, Laura K. Dillon, and Jack C. Wileden. Experiments with automated constrained expression analysis of concurrent software systems. In Richard A. Kemmerer, editor, *Proceedings of the ACM SIGSOFT '89 Third Symposium on Software Testing, Analysis and Verification*, pages 124–130, December 1989.

- George S. Avrunin, Ugo A. Buy, and James C. Corbett. Integer programming in the analysis of concurrent systems. In Kim Guldstand Larsen and Arne Skou, editors, *Computer Aided Verification, 3rd International Workshop Proceedings*, volume 575 of *Lecture Notes in Computer Science*, pages 92–102, Aalborg, Denmark, July 1991. Springer-Verlag.
- George S. Avrunin, Ugo A. Buy, James C. Corbett, Laura K. Dillon, and Jack C. Wileden. Experiments with an improved constrained expression toolset. In *Proceedings of the Symposium on Testing, Analysis, and Verification (TAV<sub>4</sub>)*, pages 178–187. ACM SIGSOFT, October 1991.
- James C. Corbett and George S. Avrunin. A practical method for bounding the time between events in concurrent real-time systems. In Thomas Ostrand and Elaine Weyuker, editors, *Proceedings of the 1993 International Symposium on Software Testing and Analysis (ISSTA)*, pages 110–116, Cambridge, MA, June 1993. ACM Press.
- James C. Corbett and George S. Avrunin. Towards scalable compositional analysis. In David Wile, editor, *Proceedings of the Second ACM SIGSOFT Symposium on Foundations of Software Engineering*, pages 53–61, New Orleans, December 1994. ACM Press.
- George S. Avrunin. Symbolic model checking using algebraic geometry. In Rajeev Alur and Thomas A. Henzinger, editors, *Computer Aided Verification, 8th International Conference*, volume 1102 of *Lecture Notes in Computer Science*, pages 26–37, New Brunswick, NJ, July/August 1996. Springer-Verlag.
- George S. Avrunin, James C. Corbett, and Laura K. Dillon. Analyzing partially-implemented real-time systems. In *Proceedings of the 19th International Conference on Software Engineering*, pages 228–238, Boston, May 1997.
- Gleb Naumovic, George S. Avrunin, Lori A. Clarke, and Leon J. Osterweil. Applying static analysis to software architectures. In Mehdi Jazayeri and Helmut Schauer, editors, *Software Engineering—ESEC/FSE '97*, volume 1301 of *Lecture Notes in Computer Science*, pages 77–93, Zurich, September 1997. Springer Verlag.
- Gleb Naumovich and George S. Avrunin. A conservative data flow algorithm for detecting all pairs of statements that may happen in parallel. In *Proceedings of 6th International Symposium on the Foundations of Software Engineering*, pages 24–34, November 1998.
- Gleb Naumovich, George S. Avrunin, and Lori A. Clarke. Data flow analysis for checking properties of concurrent Java programs. In *Proceedings of the Twenty-First International Conference on Software Engineering*, pages 399–410, Los Angeles, May 1999.
- Matthew B. Dwyer, George S. Avrunin, and James C. Corbett. Patterns in property specifications for finite-state verification. In *Proceedings of the Twenty-First International Conference on Software Engineering*, pages 411–420, Los Angeles, May 1999.

- Gleb Naumovich, George S. Avrunin, and Lori A. Clarke. An efficient algorithm for computing MHP information for concurrent Java programs. In O. Nierstrasz and M. Lemoine, editors, *Software Engineering—ESEC/FSE '99. 7th European Software Engineering Conference held jointly with the 7th ACM SIGSOFT Symposium on the Foundations of Software Engineering*, number 1687 in LNCS, pages 338–354, Toulouse, September 1999.
- 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 International Symposium on Software Testing and Analysis*, pages 191–200, Portland, OR, August 2000. ACM Press.
- Rachel L. Smith, George S. Avrunin, Lori A. Clarke, and Leon J. Osterweil. PROPEL: An approach supporting property elucidation. In *Proceedings of the Twenty-Fourth International Conference on Software Engineering*, pages 11–21, Orlando, FL, May 2002.
- Jianbin Tan, George S. Avrunin, and Lori A. Clarke. Heuristic-based model refinement for FLAVERS. In *Proceedings of the Twenty-Sixth International Conference on Software Engineering*, pages 635–644, Edinburgh, May 2004.
- Jianbin Tan, George S. Avrunin, Lori A. Clarke, Shlomo Zilberstein, and Stefan Leue. Heuristic-guided counterexample search in FLAVERS. In Matthew Dwyer, editor, *Proceedings of the 12th ACM SIGSOFT Symposium on the Foundations of Software Engineering*, pages 201–210, Newport Beach, CA, November 2004.
- Stephen F. Siegel and George S. Avrunin. Modeling wildcard-free MPI programs for verification. In *Symposium on Principles and Practice of Parallel Programming (PPoPP '05)*, pages 95–106, Chicago, IL, June 2005.
- Jianbin Tan, George S. Avrunin, and Lori A. Clarke. Managing space for finite-state verification. In *Proceedings of the 28th International Conference on Software Engineering*, pages 152–161, Shanghai, May 2006.
- Shangzhu Wang, George S. Avrunin, and Lori A. Clarke. Architectural building blocks for plug-and-play design. In Ian Gorton, George T. Heneman, Ivica Crnkovic, Heinz W. Schmidt, Judith A. Stafford, Clemens A. Szyperski, and Kurt Wallnau, editors, *Proceedings of the 9th International SIGSOFT Symposium on Component-Based Software Engineering (CBSE 2006)*, number 4063 in LNCS, pages 98–113, Västerås, Sweden, June 2006.
- Stephen F. Siegel, Anastasia Mironova, George S. Avrunin, and Lori A. Clarke. Using model checking with symbolic execution to verify parallel numerical programs. In Mauro Pezzé, editor, *Proceedings of the ACM SIGSOFT International Symposium on Software Testing and Analysis*, pages 157–168, Portland, ME, July 2006.
- Jamieson M. Cobleigh, George S. Avrunin, and Lori A. Clarke. Breaking up is hard to do: An investigation of decomposition for assume-guarantee

reasoning. In Mauro Pezzé, editor, *Proceedings of the ACM SIGSOFT International Symposium on Software Testing and Analysis*, pages 97–108, Portland, ME, July 2006.

Rachel L. Cobleigh, George S. Avrunin, and Lori A. Clarke. User guidance for creating precise and accessible property specifications. In *Proceedings of the 14th ACM SIGSOFT Symposium on the Foundations of Software Engineering*, pages 208–218, Portland, OR, November 2006.

Bin Chen, George S. Avrunin, Elizabeth A. Henneman, Lori A. Clarke, Leon J. Osterweil, and Philip L. Henneman. Analyzing medical processes. In *ICSE '08: Proceedings of the 30th International Conference on Software Engineering*, pages 623–632, Leipzig, May 2008.

Lori A. Clarke, George A. Avrunin, and Leon J. Osterweil. Using software engineering technology to improve the quality of medical processes (Keynote Address). In *ICSE Companion '08: Companion of the 30th International Conference on Software Engineering*, pages 889–898, Leipzig, May 2008.

#### Papers in Other Conferences and Workshops

George S. Avrunin and Jack C. Wileden. Algebraic techniques for the analysis of concurrent systems. In *Proceedings of the Sixteenth Hawaii International Conference on Systems Sciences*, pages 51–57, 1983.

George Avrunin and Jan Demers. Exploring symmetry with first graders. <http://mathforum.org/mathed/mime/avrunin.html>, 1997. (Invited report for the Math Forum's Mathematicians in Mathematics Education page).

Matthew B. Dwyer, George S. Avrunin, and James C. Corbett. Property specification patterns for finite-state verification. In Mark Ardis, editor, *Proceedings of FMSP '98, the Second Workshop on Formal Methods in Software Practice*, pages 7–15, Clearwater Beach, FL, March 1998.

Rachel L. Smith, George S. Avrunin, and Lori A. Clarke. From natural language requirements to rigorous property specifications. In *Workshop on Software Engineering for Embedded Systems (SEES 2003): From Requirements to Implementation*, pages 40–46, Chicago, IL, September 2003.

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*, number 2989 in LNCS, pages 286–303, Barcelona, April 2004. Springer-Verlag.

George S. Avrunin, Stephen F. Siegel, and Andrew R. Siegel. Finite-state verification for high-performance computing. In Phillip Johnson, editor, *Proceedings of the Second International Workshop on Software Engineering for High Performance Computing System Applications*, pages 68–73, St. Louis, MO, May 2005.

- Lori A. Clarke, Yao Chen, George S. Avrunin, Bin Chen, Rachel Cobleigh, Kim Frederick, Elizabeth A. Henneman, and Leon J. Osterweil. Process programming to support medical safety. In Mingshu Li, Barry Boehm, and Leon J. Osterweil, editors, *Unifying the Software Process Spectrum: International Software Process Workshop, SPW 2005*, number 3840 in LNCS, pages 347–359, Beijing, May 2005.
- George S. Avrunin, Lori A. Clarke, Elizabeth A. Henneman, and Leon J. Osterweil. Complex medical processes as context for embedded systems. In *Proceedings of the Workshop on Innovative Techniques for the Certification of Embedded Systems*, San Jose, CA, April 2006. Proceedings published in *ACM SIGBED Review* 3(4), 2006.
- Bin Chen, George S. Avrunin, Lori A. Clarke, and Leon J. Osterweil. Automatic fault-tree derivation from Little-JIL process definitions. In Qing Wang, Dietmar Pfahl, David M. Raffo, and Paul Werinck, editors, *Proceedings of SPW/ProSim 2006*, number 3966 in LNCS, pages 150–158, Shanghai, May 2006.
- Shangzhu Wang, George S. Avrunin, and Lori A. Clarke. Verification support for plug-and-play architectural design. Extended abstract in *Proceedings of the Workshop on the Role of Software Architecture in Testing and Analysis*, Portland, ME, July 2006, 2006.
- Leon J. Osterweil, George S. Avrunin, Bin Chen, Lori A. Clarke, Rachel L. Cobleigh, Elizabeth A. Henneman, and Philip L. Henneman. Engineering medical processes to improve their safety: An experience report. In J. Ralyte, S. Brinkemper, and B. Henderson-Seelers, editors, *Situational Method Engineering: Fundamentals and Experiences*, pages 267–282, Geneva, September 2007. Springer.
- Stefan Christov, Bin Chen, George S. Avrunin, Lori A. Clarke, Leon J. Osterweil, David Brown, Lucinca Cassells, and Wilson Merten. Rigorously defining and analyzing medical processes: An experience report. In *Workshop on Model-Based Trustworthy Health Information Systems*, September 2007.
- Stephen F. Siegel and George S. Avrunin. Verification of halting properties for MPI programs using nonblocking operations. In Franck Capello, Thomas Herault, and Jack Dongarra, editors, *Recent Advances in Parallel Virtual Machine and Message Passing Interface: 14th European PVM/MPI Users' Group Meeting*, volume 4757 of *Lecture Notes in Computer Science*, pages 326–334, Paris, September/October 2007. Springer-Verlag.

#### Unpublished Technical Reports

- George S. Avrunin. Sharpening bounds on the time between events in maximally parallel systems. Technical Report 92-69, Department of Computer Science, University of Massachusetts at Amherst, 1992.

- Victor Yodaiken and George S. Avrunin. Real-time state machines and circuit verification with modal functions. Technical Report 93-04, Department of Computer Science, University of Massachusetts at Amherst, 1993.
- A. T. Chamillard, Lori A. Clarke, and George S. Avrunin. An empirical comparison of static concurrency analysis techniques. Technical Report 96-84, Department of Computer Science, University of Massachusetts, 1996. Revised May 1997.
- 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-1999-069 (revised February 2000), Department of Computer Science, University of Massachusetts.
- Stephen F. Siegel and George S. Avrunin. Analysis of MPI programs. Technical Report UM-CS-2003-036, Department of Computer Science, University of Massachusetts, 2003.
- Richard M. Chang, George S. Avrunin, and Lori A. Clarke. Property inference from program executions. Technical Report UM-CS-2006-26, Department of Computer Science, University of Massachusetts, 2006.