

Swarat Chaudhuri

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Curriculum vitae (current as of March 2016)

Research interests

My research lies at the interface of formal methods and programming systems. The two thrusts of my work are: (a) algorithms, based on automated deduction, state space search, and probabilistic inference, for formal reasoning about programs; and (b) practical approaches to computer-aided program design and verification that utilize these algorithms. The applications that motivate my work come from an eclectic mix of areas, including system software, end-user programming, robotics, multiagent systems, and approximate computation.

Education

- 2001-2007 **Doctor of Philosophy**, *University of Pennsylvania*.
Dissertation *Logics and Algorithms for Software Model Checking* (Advisor: Professor Rajeev Alur)
1997-2001 **Bachelor of Technology**, *Indian Institute of Technology, Kharagpur, India*.

Employment

- July 2015 onwards **Associate Professor with Tenure**, *Rice University*.
July 2011-June 2015 **Assistant Professor**, *Rice University*.
January 2008-May 2011 **Assistant Professor**, *Pennsylvania State University*.
Fall 2007 **Postdoctoral scientist**, *NEC Laboratories America*.
Summers of 2002, 2005, 2006 **Summer intern**, respectively at *Lucent Bell Laboratories*, *Grammatech Corporation*, and *IBM T.J. Watson Research Center*.

Awards

- 2011 **Distinguished Paper Award**, *ESEC/FSE 2011*, for the paper "Proving programs robust" (the paper was also selected as a *CACM* research highlight).
2010 **National Science Foundation CAREER Award**, For "Robustness Analysis of Uncertain Programs: Algorithms, Theory, and Tools".
2007 **ACM SIGPLAN Outstanding Doctoral Dissertation Award**, Presented annually by the Association for Computing Machinery (ACM) to the author of the outstanding doctoral dissertation in the area of Programming Languages.

- 2007 **Morris and Dorothy Rubinoff Award**, *Presented by the University of Pennsylvania to a dissertation that has resulted in or could lead to innovative applications of computer technology.*

Publications

[All published papers are available at <http://www.cs.rice.edu/~swarat/pubs>. In the author listings, names of students, visiting students, and postdoctoral researchers whom I mentored and funded appear in bold type.]

Publications in journals and refereed conferences

- [RSS16] **Neil T. Dantam**, Zachary Kingston, Swarat Chaudhuri, and Lydia E. Kavraki. Incremental Task and Motion Planning: A Constraint-Based Approach. *Robotics: Science and Systems (RSS)*, 2016.
- [ICAPS16] **Yue Wang, Neil T. Dantam**, Swarat Chaudhuri, and Lydia E. Kavraki. Task and Motion Policy Synthesis as Liveness Games. *International Conference on Automated Planning and Scheduling (ICAPS)*, 2016.
- [PLDI16] Navid Yaghmazadeh, Christian Klinger, Isil Dillig, and Swarat Chaudhuri. Synthesizing transformations on hierarchically structured data. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2016.
- [VMCAI16] Kengo Kido, Swarat Chaudhuri and Ichiro Hasuo. Abstract interpretation with infinitesimals — towards scalability in nonstandard static analysis. *International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*, 2016.
- [VSTTE15] Tewodros A. Beyene, Swarat Chaudhuri, Corneliu Popeea, and Andrey Rybalchenko. Recursive Games for Compositional Program Synthesis. *Verified Software: Theories, Tools, and Experiments (VSTTE)*, 2015.
- [CDC15] Zhenqi Huang, Yu Wang, Sayan Mitra, Geir Dullerud and Swarat Chaudhuri. Controller synthesis with inductive proofs for piecewise linear systems: an SMT-based algorithm. *54th IEEE Conference on Decision and Control (CDC)*, 2015.
- [WWW15] **Yanxin Lu**, Joe Warren, Christopher Jermaine, Swarat Chaudhuri, and Scott Rixner. Grading the Graders: Motivating Peer Graders in a MOOC. *24th International World Wide Web Conference (WWW)*, 2015.
- [PLDI15] **John Feser**, Swarat Chaudhuri, and Isil Dillig. Synthesizing data structure transformations from input-output examples. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2015.
- [ICDM14] Anna Drummond, **Yanxin Lu**, Swarat Chaudhuri, Chris Jermaine, Scott Rixner, and Joe Warren. Learning to grade student programs in a massive open online course. *IEEE International Conference on Data Mining (ICDM)*, 2014.
- [CAV14] Thomas Dillig, Isil Dillig, and Swarat Chaudhuri. Optimal guard synthesis for memory safety. *International Conference on Computer-Aided Verification (CAV)*, 2014.
- [PLDI14] Rishi Surendran, Raghavan Raman, Swarat Chaudhuri, John Mellor-Crummey, and Vivek Sarkar. Test Driven Repair of Data Races in Structured Parallel Programs. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2014.
- [ICRA14] **Srinivas Nedunuri, Sailesh Prabhu**, Mark Moll, Swarat Chaudhuri, and Lydia Kavraki. SMT-Based Synthesis of Integrated Task and Motion Plans for Mobile Manipulation. *IEEE International Conference on Robotics and Automation (ICRA)*, 2014.

- [POPL14-a] Swarat Chaudhuri, **Martin Clochard**, and Armando Solar-Lezama. Bridging Boolean and quantitative synthesis using smoothed proof search. In *41st ACM Symposium on Principles of Programming Languages (POPL)*, 2014.
- [POPL14-b] Tewodros Beyene, Swarat Chaudhuri, Corneliu Popeea, and Andrey Rybalchenko. A constraint-based approach to solving games on infinite graphs. In *41st ACM Symposium on Principles of Programming Languages (POPL)*, 2014.
- [POPL14-c] Swarat Chaudhuri, Azadeh Farzan, and Zachary Kincaid. Consistency analysis of decision-making programs. In *41st ACM Symposium on Principles of Programming Languages (POPL)*, 2014.
- [ACCSAC13] Sirinda Palahan, Domagoj Babic, Swarat Chaudhuri, and Daniel Kifer. Extraction of statistically significant malware behaviors. *Annual Computer Security Applications Conference (ACCSAC)*, 2013.
- [OOPSLA13] Jisheng Zhao, **Roberto Lubliner**, Zoran Budimlic, Swarat Chaudhuri, and Vivek Sarkar. Isolation for nested task-parallelism. *International Conference on Object Oriented Programming, Systems, Languages and Applications (OOPSLA)*, 2013.
- [ATVA13] Roopsha Samanta, Jyotirmoy Deshmukh, and Swarat Chaudhuri. Robustness analysis of string transducers. In *Automated Technology for Verification and Analysis (ATVA)*, 2013.
- [LICS13] Swarat Chaudhuri, Sriram Sankaranarayanan and Moshe Vardi. Regular real analysis. *ACM/IEEE Symposium on Logic in Computer Science (LICS)*, 2013.
- [VMCAI13] Roopsha Samanta, Jyotirmoy Deshmukh, and Swarat Chaudhuri. Robustness analysis of networked systems. In *International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*, 2013.
- [CACM12] Swarat Chaudhuri, Sumit Gulwani, and **Roberto Lubliner**. Continuity and robustness of programs. *Research highlights, Communication of the ACM (CACM)*, August 2012.
- [CAV12] Swarat Chaudhuri and Armando Solar-Lezama. Euler: A System for numerical optimization of programs. In *International Conference on Computer-Aided Verification (CAV)*, 2012.
- [TOPLAS11] Rajeev Alur, Swarat Chaudhuri, and P. Madhusudan. Software model-checking with languages of nested trees. *ACM Transactions on Programming Languages and Systems (TOPLAS)*, Volume 33 Issue 5, November 2011.
- [FSE11] Swarat Chaudhuri, Sumit Gulwani, **Roberto Lubliner**, and **Sara Navidpour**. Proving programs robust. *Joint European Software Engineering Conference and ACM Symposium on the Foundations of Software Engineering (ESEC/FSE)*, 2011.
- [OOPSLA11] **Roberto Lubliner**, Jisheng Zhao, Zoran Budimlic, Swarat Chaudhuri, and Vivek Sarkar. Delegated isolation. *International Conference on Object Oriented Programming, Systems, Languages and Applications (OOPSLA)*, 2011.
- [USENIX-SEC11] William Enck, Damien Ocateau, Swarat Chaudhuri, and Patrick McDaniel. A path to Android application security. *The 20th USENIX Security Symposium*, 2011.
- [CAV11] Swarat Chaudhuri and Armando Solar-Lezama. Smoothing a program soundly and robustly. In *International Conference on Computer-Aided Verification (CAV)*, 2011.
- [PLDI11] Saurabh Srivastava, Sumit Gulwani, Swarat Chaudhuri, and Jeff Foster. Path-based inductive synthesis for program inversion. *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2011.

- [CAV10] Pavol Černý, Arjun Radhakrishna, Damien Zufferey, Swarat Chaudhuri, and Rajeev Alur. Model checking of linearizability of concurrent list implementations. In *International Conference on Computer-Aided Verification (CAV)*, 2010.
- [PLDI10] Swarat Chaudhuri and Armando Solar-Lezama. Smooth interpretation. In *ACM Conference on Programming Language Design and Implementation (PLDI)*, 2010.
- [POPL10] Swarat Chaudhuri, Sumit Gulwani, and **Roberto Lubliner**. Continuity analysis of programs. In *37th ACM Symposium on Principles of Programming Languages (POPL)*, 2010.
- [VMCAI10] Rajeev Alur and Swarat Chaudhuri. Temporal reasoning for procedural programs. In *International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*, 2010.
- [OOPSLA09] **Roberto Lubliner**, Swarat Chaudhuri, and Pavol Černý. Parallel programming with object assemblies. In *International Conference on Object Oriented Programming, Systems, Languages and Applications (OOPSLA)*, 2009.
- [FSE09] Chao Wang, Swarat Chaudhuri, Aarti Gupta, and Yang Yu. Symbolic Pruning of Concurrent Program Executions. In *7th Joint European Software Engineering Conference and ACM Symposium on the Foundations of Software Engineering (ESEC/FSE)*, 2009.
- [ISSTA08] Sriram Sankaranarayanan, Swarat Chaudhuri, Franjo Ivancic, and Aarti Gupta. Dynamically inferring data preconditions over predicates by tree learning. In *International Symposium on Software Testing and Analysis (ISSTA)*, 2008.
- [POPL08] Swarat Chaudhuri. Subcubic algorithms for recursive state machines. In *35th ACM Symposium on Principles of Programming Languages (POPL)*, 2008.
- [TACAS07] Rajeev Alur, Pavol Černý, and Swarat Chaudhuri. Model checking on trees with path equivalences. In *13th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2007.
- [FSTTCS06] Rajeev Alur and Swarat Chaudhuri. Branching pushdown tree automata. In *26th Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, 2006.
- [CAV06] Rajeev Alur, Swarat Chaudhuri, and P. Madhusudan. Languages of nested trees. In *18th International Conference on Computer-Aided Verification (CAV)*, 2006.
- [POPL06] Rajeev Alur, Swarat Chaudhuri, and P. Madhusudan. A fixpoint calculus for local and global program flows. In *33rd Annual ACM Symposium on Principles of Programming Languages (POPL)*, 2006.
- [TACAS05] Rajeev Alur, Swarat Chaudhuri, Kousha Etessami, and P. Madhusudan. On-the-fly reachability and cycle detection for recursive state machines. In *11th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2005.
- [CONCUR03] Rajeev Alur, Swarat Chaudhuri, Kousha Etessami, Sudipto Guha, and Mihalis Yannakakis. Compression of partially ordered strings. In *14th International Conference on Concurrency Theory (CONCUR)*, 2003.

Publications in workshops with proceedings

- [SPIN07] Swarat Chaudhuri and Rajeev Alur. Instrumenting C programs with nested word monitors. In *Model Checking Software: 14th International SPIN Workshop*, 2007.

Teaching

[Student evaluations of recent courses are available on request.]

- Spring 2014, Fall 2014, Fall 2015 *COMP 382: Reasoning about Algorithms.* Required undergraduate course on theoretical computer science.
- Fall 2012, Fall 2013, Spring 2015 *COMP 507: Computer-Aided Program Design.* Introductory graduate course on program verification and synthesis.
- Spring 2012, Spring 2013 *COMP 482: Design and Analysis of Algorithms.* Senior undergraduate course on algorithms.
- Spring 2013 *COMP 607: Automata, Logic, and Infinite Games.* Graduate seminar.
- Spring 2012 *COMP 607: Program Synthesis.* Graduate seminar.
- Fall 2011 *COMP 411: Principles of Programming Languages.* Senior undergraduate and entry-level graduate course on programming languages.
- Spring 2011 *CSE 598: Exploiting Concurrency Efficiently and Correctly.* Graduate-level course on concurrent and parallel programming.
- Fall 2010, Fall 2009, Fall 2008 *CMPSC 461: Programming Language Concepts.* Senior undergraduate and entry-level graduate course on programming languages.
- Fall 2010 *CSE 597-C: Program Analysis Seminar.* Graduate-level seminar on program analysis and synthesis.
- Spring 2010 *CSE 520: The Science of Computer Programming.* Graduate-level course on program verification and abstract interpretation.
- Spring 2009 *CSE 598: Program Analysis.* Advanced graduate-level course on program analysis and abstract interpretation.
- Spring 2008 *CSE 598: Computer-Aided Verification.* Advanced graduate-level course on model checking.

Research group

[Group website: <http://caper.rice.edu>]

- Ph.D. students
- Yanxin Lu (Fall 2012 onwards)
Research topic: Data-driven program synthesis; constraint-based synthesis of educational games
- Yue Wang (Fall 2013 onwards)
Research topic: Computer-aided robot programming
- Suguman Bansal (Fall 2014 onwards)
Research topic: Computer-aided market design
- Afsaneh Rahbar (Spring 2015 onwards)
Research topic: Data-driven program verification
- Postdoctoral researchers
- Vijayaraghavan Murali (Spring 2015 onwards)
Research topic: Program analysis and synthesis assisted by Big Code

	Neil Dantam (Spring 2015 onwards; co-advised with Lydia Kavradi) <i>Research topic:</i> Computer-aided robot programming
	Hassan Eldib (Summer 2015 onwards) <i>Research topic:</i> Program analysis and synthesis assisted by Big Code
Master students	John Feser (undergraduate researcher from Fall 2013-Spring 2015; Masters student from Summer 2015 onwards) <i>Research topic:</i> Algorithms and engines for program synthesis
Graduated Ph.D. students	Roberto Lubliner. Ph.D. student at Penn State; graduated in August 2012; first employment at Google. <i>Thesis:</i> <i>Concurrent Assemblies: An execution model for irregular parallelism.</i>
Former postdoctoral researchers	Edwin Westbrook. Summer 2011-Summer 2013; currently a researcher at Kestrel Institute. <i>Research topic:</i> Language-based approximate computation. Srinivas Nedunuri. Summer 2012-Fall 2014; now at Cycorp. <i>Research topic:</i> Computer-aided robot programming
Graduated Masters students	Sara Navidpour. ME (Masters without thesis) student at Penn State; graduated Fall 2011. Sailesh Prabhu. MS student at Rice. Graduated Summer 2014. <i>Topic of master's thesis:</i> Automatic synthesis of robot motion plans Ye Fang (Fall 2012-Fall 2014) <i>Topic of master's thesis:</i> Computer-aided mechanism design
Visiting Ph.D. students	Martin Clochard. Masters student at ENS Paris; visited March-August 2012. <i>Research topic:</i> Program synthesis using smoothed search

External funding

- PI *Automating Robot Programming Through Constraint Solving and Motion Planning.* Collaborative NSF Medium grant with Lydia Kavradi. Total amount \$1,000,000. Award period 2015-2019.
- co-PI *Pliny: An End-to-End System for Big Code Analytics.* Award from the DARPA MUSE program. With Vivek Sarkar, Christopher Jermaine, Moshe Vardi, and Keith Cooper (Rice); Isil Dillig and Thomas Dillig (UT Austin); Thomas Reps and Ben Liblit (Wisconsin); and GammaTech, Inc. The award spans three technical areas; I am the lead of Technical Area 4, which focuses on program verification, repair, and synthesis. Total amount \$11 million (approximately). 2014-2018.
- co-PI *Science of Security for Systems.* NSA grant with Sayan Mitra and Geir Dullerud (UIUC). Total amount \$806,502. 2014-2017.
- PI *Computer-Aided Grading, Feedback, and Assignment Creation in Massive Online Programming Courses.* Small NSF grant with Scott Rixner and Joe Warren. Total amount \$300,000. Award period 2013-2015.
- PI *Marrying Program Analysis and Numerical Search.* Collaborative NSF Medium grant with Armando Solar-Lezama and Illya Hicks. Total amount \$1,200,000. Award period 2012-2016.
- PI *Chorus: Dynamic Isolation for Shared-Memory parallelism.* Collaborative NSF Medium grant with Vivek Sarkar. Total amount \$1,200,000. Award period 2010-2014.

Gift \$10,000 gift from Microsoft Research. 2011.

PI *CAREER: Robustness Analysis for Uncertain Programs: Theory, Algorithms, and Tools*. NSF CAREER award. Total amount \$426,457. Award period 2010-2015.

Blog

Co-founder *The Programming Languages Enthusiast*. Academic blog that aims to raise awareness of advances and challenges in Programming Languages research. Run jointly with Michael Hicks of University of Maryland.

Committee service

Program co-chair Conference on Computer-Aided Verification (CAV), 2016.

Program co-chair Workshop on Numerical Software Verification (NSV), 2012.

Workshop on Programming Language Technology for Massive Open Online Courses (PLOOC), 2014.

Program chair POPL Off the Beaten Track (OBT), 2015.

Publicity chair ACM Symposium on Principles of Programming Languages (POPL), 2010–12.

Co-organizer Workshop on Exploiting Concurrency Efficiently and Correctly (EC²), 2010 and 2011.

Program committee ACM Conference on Programming Language Design and Implementation (PLDI), 2017.

ACM Conference on Principles of Programming Languages (POPL), 2015.

Computer-Aided Verification (CAV), 2015.

ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), 2014.

ACM Conference on Programming Language Design and Implementation (PLDI), 2013.

Foundations of Software Science and Computation Structures (FoSSaCS), 2013.

ACM Conference on Principles of Programming Languages (POPL), 2012.

Computer-Aided Verification (CAV), 2012.

Workshop on Numerical Software Verification (NSV), 2011.

Symposium on Automated Technology for Verification and Analysis (ATVA), 2011.

Symposium on Games, Automata, Logics and Formal Verification (GandALF), 2011.

	Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI), 2011.
	ACM Conference on Languages, Compilers, and Tools for Embedded Systems (LCTES), 2009.
	15th Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), 2009.
External review committee	ACM Symposium on Programming Language Design and Implementation (PLDI), in 2012, 2014, 2015 and 2016.
	ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA), in 2011 and 2013.
	ACM Symposium on Principles of Programming Languages (POPL), 2013.
Referee	Many venues, including Principles of Programming Languages (POPL), Computer-Aided Verification (CAV), Programming Language Design and Implementation (PLDI), Principles of Parallel Programming (PPoPP), Logic in Computer Science (LICS), Tools and Algorithms for the Construction and Analysis of Systems (TACAS), Concurrency Theory (CONCUR), Static Analysis Symposium (SAS), Computer Science Logic (CSL), Journal of Logic and Algebraic Programming, Symposium on Discrete Algorithms (SODA), Architectural Support for Programming Languages and Operating Systems (ASPLOS), Foundations of Software Technology and Theoretical Computer Science (FSTTCS), ACM Transactions on Programming Languages and Systems (TOPLAS).

Invited talks

Spring 2014	<i>Adventures in Automated Programming.</i> Given at Carnegie Mellon University, University of Illinois, and University of Pennsylvania.
Summer 2013	<i>Bridging the Discrete and the Continuous in Reasoning about Programs.</i> Given at Microsoft Research, Cambridge and Institute for Science and Technology, Austria.
Summer 2012	<i>Computer-Aided Numerical Programming.</i> Given at Ken Kennedy Institute for Information Technology (at Rice University) and Pennsylvania State University.
Fall 2011	<i>Composing Composure: Reasoning about Robustness of Programs.</i> Given at University of Pennsylvania, Princeton University.
Spring 2011	<i>When Programs Make No Jumps: Marrying the Discrete and the Continuous in Program Analysis.</i> Given at Rice University, Northeastern University, University of California at Irvine.
Spring 2010, Summer 2010	<i>Cauchy: Towards an Analytical Calculus of Computation.</i> Given at New York University, Cornell University, University of Toronto, and Microsoft Research.
Fall 2009, Summer 2009	<i>Parallel Programming with Object Assemblies.</i> Given at MIT and Microsoft Research.
Fall 2008, Spring 2009	<i>Programming with Sociable Resources.</i> Given at NEC Laboratories, University of Pennsylvania, and Rice University.
Spring 2007	<i>Context-sensitive software model checking.</i> Given at Pennsylvania State University, University of Texas at Austin, Carnegie Mellon University, NEC Laboratories America, and IBM T. J. Watson Research Center.

Professional memberships

Member of the Association for Computing Machinery (ACM) and the Special Interest Group on Programming Languages (ACM SIGPLAN).

References

On request.

Personal

Date of birth March 27, 1979.

Citizenship Citizen of the United States.