Koushik Sen

Address:	Electrical Engineering and Computer Sciences Department	**Home:**	(510) 338-0426
	University of California, Berkeley	**Office:**	(510) 642-2420
	735 Soda Hall		
	Berkeley, CA 94720-1776, USA		
Email:	ksen@cs.berkeley.edu		
Web:	http://www.cs.berkeley.edu/~ksen/		

Research Interest

Software Engineering, *Programming Languages*, and *Formal Methods*:

- Design of algorithms and tools for automated scalable testing, monitoring, verification, analysis, and debugging of sequential, parallel, and distributed software systems.

- Develop language constructs that not only help avoid introducing common bugs in programs, but also facilitate effective and systematic testing and monitoring.

Education

- **University of Illinois at Urbana Champaign**   2001 – 2006
  Ph.D. in Computer Science
  Advisor: Professor Gul Agha

- **University of Illinois at Urbana Champaign**   2001 – 2003
  M.S. in Computer Science
  Advisor: Professor Gul Agha

- **Indian Institute of Technology, Kanpur**   1995 – 1999
  B.Tech. in Computer Science
  Project Advisor: Professor Manindra Agrawal

Honors and Awards

- *Invited contribution:* "Technical Perspective: Veritesting tackles Path-explosion Problem", *Communications of the ACM*, 59(6), June 2016.

- *ACM SIGSOFT Distinguished Paper Award, 38th International Conference on Software Engineering* (ICSE'16), for the paper titled "Feedback-Directed Instrumentation for Deployed JavaScript Applications."

- *ACM SIGSOFT Distinguished Paper Award, 10th Joint Meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering* (ESEC/FSE'15), for the paper titled "MultiSE: Multi-Path Symbolic Execution using Value Summaries."

- *Keynote:* "Concolic Testing: A Decade Later", 13th International Workshop on Dynamic Analysis (WODA'15), Pittsburg, PA, October 26, 2015.

- *Okawa Foundation Research Grant*, 2015.

- *Keynote:* "Automated Test Generation Using Concolic Testing", 8th India Software Engineering Conference Bangalore, India, February 19, 2015.

- *Distinguished Alumni Educator Award*, University of Illinois at Urbana Champaign, Champaign, IL, October, 2014.

- *Prof. R. Narasimhan Lecture Award*, at *36th International Conference on Software Engineering* (ICSE'14) and Tata Institute of Fundamental Research, Mumbai, India, for the paper titled "CodeHint: Dynamic and Interactive Synthesis of Code Snippets", June, 2014.

- *Invited contribution:* "Symbolic execution for software testing: Three decades later.", *Communications of the ACM*, 56(2):82–90, February 2013.

- *Second Prize* at the *First International Workshop on Live Programming* held in conjunction with the 35th International Conference on Software Engineering (ICSE'13) for the tool CodeHint (http://www.cs.berkeley.edu/~joel/codehint/).

- *Keynote:* "Concolic Testing and Constraint Satisfaction", 14th International Conference on Theory and Applications of Satisfiability Testing (SAT'11), Ann Arbor, MI, June 2011.

- *Alfred P. Sloan Foundation Fellow*, Computer Science, 2011.

- *IFIP TC2 Manfred Paul Best Paper Award*, *32nd International Conference on Software Engineering* (ICSE'10), for the paper titled "DETERMIN: Inferring Likely Deterministic Specifications of Multithreaded Programs."

- *2009 Haifa Verification Conference Award* for the work on "DART: Directed Automated Random Testing" appeared in ACM SIGPLAN 2005 Conference on Programming Language Design and Implementation (PLDI'05).

- *Invited Contribution:* Jacob Burnim and Koushik Sen. "Asserting and checking determinism for multi-threaded programs." *Communications of the ACM*, 53(6):97–105, June 2010.

- *ACM SIGSOFT Distinguished Paper Award, 7th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering* (ESEC/FSE'09), for the paper titled "Asserting and Checking Determinism for Multithreaded Programs."

- *ACM SIGSOFT Distinguished Paper Award, 31st International Conference on Software Engineering* (ICSE'09), for the paper titled "Effective Static Deadlock Detection."

- *National Science Foundation CAREER Award*, 2008.

- *David J. Kuck Outstanding Ph.D. Thesis Award*, Department of Computer Science, University of Illinois, 2007.

- *ACM SIGSOFT Distinguished Paper Award*, 5th joint meeting of the *European Software Engineering Conference and ACM SIGSOFT Symposium on the Foundations of Software Engineering* (ESEC/FSE'05), for the paper titled "CUTE: A Concolic Unit Testing Engine for C."

- *C. W. Gear Outstanding Graduate Student Award*, Department of Computer Science, University of Illinois, 2005.

- *C.L. & Jane W-S. Liu Award for Exceptional Research Promise*, Department of Computer Science, University of Illinois, 2004.

- *Academic Excellence Award* by Indian Institute of Technology, Kanpur for outstanding academic performance, India, 1996 and 1997.

- *Jawaharlal Nehru SAIL Scholarship* for undergraduate studies, India, 1995.

- *National Talent Search Examination Scholarship* by the National Council for Educational Research and Training, Government of India, 1993.

- *First prize in the Nationwide Open Software Competition*, *first prize in the Nationwide On-The-Spot Programming Contest*, and *first prize in the Nation-wide Electronic Circuit Design Contest*, India, 1999.

Employment

- Associate Professor, Electrical Engineering and Computer Sciences Department, University of California Berkeley, CA, USA.   July 2012 – present

- Assistant Professor, Electrical Engineering and Computer Sciences Department, University of California Berkeley, CA, USA.   September 2006 – June 2012

Publications

Refereed Journal Publications

[1] Cristian Cadar and Koushik Sen. Symbolic execution for software testing: Three decades later. *Communications of the ACM*, 56(2):82–90, February 2013.

[2] Jacob Burnim and Koushik Sen. Asserting and checking determinism for multithreaded programs. *Communications of the ACM*, 53(6):97–105, June 2010.

[3] Krste Asanovic, Rastislav Bodík, James Demmel, Tony Keaveny, Kurt Keutzer, John Kubiatowicz, Nelson Morgan, David A. Patterson, Koushik Sen, John Wawrzynek, David Wessel, and Katherine A. Yelick. A view of the parallel computing landscape. *Communications of ACM*, 52(10):56–67, 2009.

[4] Grigore Roşu and Koushik Sen. An instrumentation technique for online analysis of multithreaded programs. *Special Issue of Concurrency and Computation: Practice and Experience (CC:PE)*, 19(3):311–325, 2007.

[5] Koushik Sen, Grigore Roşu, and Gul Agha. Online efficient predictive safety analysis of multithreaded programs. *International Journal on Software Technology and Tools Transfer (STTT)*, 8(3):248–260, 2006.

[6] Cyrille Artho, Howard Barringer, Allen Goldberg, Klaus Havelund, Sarfraz Khurshid, Mike Lowry, Corina Pasareanu, Grigore Roşu, Koushik Sen, Willem Visser, and Rich Washington. Combining test case generation and runtime verification. *Theoretical Computer Science*, 336(2–3):209–234, May 2005.

Refereed Conference Publications

[1] Esben Andreasen, Colin S. Gordon, Satish Chandra, Manu Sridharan, Frank Tip, and Koushik Sen. Trace Typing: An Approach for Evaluating Retrofitted Type Systems. In *European Conference on Object-Oriented Programming (ECOOP'16)*. July 2016.

[2] Xuehai Qian, Koushik Sen, Paul Hargrove, and Costin Iancu. SReplay: Deterministic Group Replay for One-Sided Communication. In *30th International Conference on Supercomputing (ICS'16)* ACM, June 2016.

[3] Magnus Madsen, Frank Tip, Esben Andreasen, Koushik Sen, and Anders Mller. Feedback-Directed Instrumentation for Deployed JavaScript Applications. In *38th International Conference on Software Engineering (ICSE'16)*, IEEE, May 2016. **ACM SIGSOFT Distinguished Paper Award.**

[4] Cindy Rubio-Gonzalez, Cuong Nguyen, Benjamin Mehne, Koushik Sen, James Demmel, William Kahan, Costin Iancu, Wim Lavrijsen, David H. Bailey, and David Hough. Floating-Point Precision Tuning Using Blame Analysis. In *38th International Conference on Software Engineering (ICSE'16)*, IEEE, May 2016.

[5] Xuehai Qian and Koushik Sen and Paul Hargrove and Costin Iancu. OPR: Deterministic Group Replay for One-Sided Communication. In *21st ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP'16)*, ACM, March 2016. *Short Paper.*

[6] Wontae Choi, Satish Chandra, George Necula, and Koushik Sen. A type system for javascript with fixed object layout. In *22nd International Static Analysis Symposium (SAS'15)*. LNCS, September 2015.

[7] Liang Gong, Michael Pradel, and Koushik Sen. Jitprof: Pinpointing jit-unfriendly javascript code. In *10th Joint Meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE'15)*. ACM, September, 2015.

[8] Koushik Sen, George Necula, Liang Gong, and Wontae Choi. Multise: Multi-path symbolic execution using value summaries. In *10th Joint Meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE'15)*. ACM, September, 2015. **ACM SIGSOFT Distinguished Paper Award.**

[9] Simon Jensen, Manu Sridharan, Koushik Sen, and Satish Chandra. Meminsight: Platform-independent memory debugging for javascript. In *10th Joint Meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE'15)*. ACM, September, 2015.

[10] Liang Gong, Michael Pradel, Manu Sridharan, and Koushik Sen. Dlint: Dynamically checking bad coding practices in javascript. In *International Symposium on Software Testing and Analysis (ISSTA'15)*. ACM, July 2015.

[11] Michael Pradel and Koushik Sen. The good, the bad, and the ugly: An empirical study of implicit type conversions in javascript. In *European Conference on Object-Oriented Programming (ECOOP'15)*, July 2015.

[12] Michael Pradel, Parker Schuh, and Koushik Sen. Typedevil: Dynamic type inconsistency analysis for javascript. In *37th International Conference on Software Engineering (ICSE'15)*. IEEE, May 2015.

[13] Haruto Tanno, Xiaojing Zhang, Hoshino Takashi, and Koushik Sen. Tesma and catg: Automated test generation tools for models of enterprise applications. In *37th International Conference on Software Engineering Demonstration Track (ICSE'15)*. IEEE, May 2015.

[14] Cuong Nguyen, Hiroaki Yoshida, Mukul Prasad, Indradeep Ghosh, and Koushik Sen. Generating succinct test cases using dont care analysis. In *IEEE International Conference on Software Testing, Verification and Validation (ICST'15)*, pages 1–10. IEEE, April 2015.

[15] Milind Chabbi, Wim Lavrijsen, Wibe de Jong, Koushik Sen, John Mellor-Crummey, and Costin Iancu. Barrier elision for production parallel programs. In *20th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPOPP'15)*, pages 109–119. ACM, February 2015.

[16] Michael Pradel, Parker Schuh, George Necula, and Koushik Sen. Eventbreak: Analyzing the responsiveness of user interfaces through performance-guided test generation. In *Annual Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA'14)*, pages 33–47. ACM, October 2014.

[17] Joel Galenson, Philip Reames, Rastislav Bodik, Bjoern Hartmann, and Koushik Sen. Codehint: Dynamic and interactive synthesis of code snippets. In *36th International Conference on Software Engineering (ICSE'14)*, pages 653–663. IEEE, May 2014. **Prof. R. Narasimhan Lecture Award.**

[18] Cindy Rubio-Gonzalez, Cuong Nguyen, Hong Diep Nguyen, James Demmel, William Kahan, Koushik Sen, David H. Bailey, Costin Iancu, and David Hough. Precimonius: Tuning assistant for floating-point precision. In *International Conference for High Performance Computing, Networking, Storage and Analysis (SC'13)*. ACM, November 2013.

[19] Wontae Choi, George Necula, and Koushik Sen. Guided gui testing of android applications with minimal restart and approximate learning. In *Annual Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA'13)*, pages 623–640. ACM, October 2013.

[20] Koushik Sen, Swaroop Kalasapur, Tasneem Brutch, and Simon Gibbs. Jalangi: A selective record-replay and dynamic analysis framework for JavaScript. In *9th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE'13)*. ACM, August 2013.

[21] Jacob Burnim, Tayfun Elmas, George Necula, and Koushik Sen. Concurrit: A domain specific language for reproducing concurrency bugs. In *ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI'13)*, pages 153–164. ACM, June 2013.

[22] Chang-Seo Park, Koushik Sen, and Costin Iancu. Scaling data race detection for partitioned global address space programs. In *27th International Conference on Supercomputing (ICS'13)*, pages 47–58. ACM, June 2013.

[23] Chang-Seo Park, Koushik Sen, and Costin Iancu. Scaling data race detection for partitioned global address space programs (short paper). In *18th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP'13)*, pages 305–306. ACM, February 2013.

[24] Jacob Burnim, Tayfun Elmas, George C. Necula, and Koushik Sen. Ndetermin: Inferring nondeterministic sequential specifications for parallelism correctness (short paper). In *17th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPOPP'12)*, pages 329–330. ACM, February 2012.

[25] Chang-Seo Park and Koushik Sen. Concurrent breakpoints (short paper). In *17th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPOPP'12)*, pages 331–332. ACM, February 2012.

[26] Chang-Seo Park, Koushik Sen, Paul Hargrove, and Costin Iancu. Efficient data race detection for distributed memory parallel programs. In *International Conference for High Performance Computing, Networking, Storage and Analysis (SC'11)*, page 51. ACM, November 2011.

[27] Pallavi Joshi, Haryadi S. Gunawi, and Koushik Sen. Prefail: A programmable failure-injection framework. In *Annual Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA'11)*, pages 171–188. ACM, October 2011.

[28] Jacob Burnim, Koushik Sen, and Christos Stergiou. Testing concurrent programs on relaxed memory models. In *International Symposium on Software Testing and Analysis (ISSTA'11)*. ACM, July 2011.

[29] Jacob Burnim, Tayfun Elmas, George Necula, and Koushik Sen. Ndseq: Runtime checking for nondeterministic sequential specifications of parallel correctness. In *ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI'11)*, pages 401–414. ACM, June 2011.

[30] Cristian Cadar, Patrice Godefroid, Sarfraz Khurshid, Corina Pasareanu, Koushik Sen, Nikolai Tillmann, and Willem Visser. Symbolic execution for software testing in practice – preliminary assessment. In *Impact Project Focus Area in 33rd International Conference on Software Engineering (ICSE'11)*, pages 1066–1071. IEEE, May 2011.

[31] Haryadi S. Gunawi, Thanh Do, Pallavi Joshi, Peter Alvaro, Joseph M. Hellerstein, Andrea C. Arpaci-Dusseau, Remzi H. Arpaci-Dusseau, Koushik Sen, and Dhruba Borthakur. Fate and destini: A framework for cloud recovery testing. In *8th USENIX Symposium on Networked Systems Design and Implementation (NSDI'11)*, March 2011.

[32] Jacob Burnim, George Necula, and Koushik Sen. Specifying and checking semantic atomicity for multithreaded programs. In *16th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS'11)*, pages 79–90. ACM, March 2011.

[33] Jacob Burnim, Koushik Sen, and Christos Stergiou. Sound and complete monitoring of sequential consistency for relaxed memory models. In *International Conference on Tools and Algorithms for the Construction ana Analysis of Systems (TACAS'11)*, pages 11–25, March 2011.

[34] Ajay Chander, Dinakar Dhurjati, Koushik Sen, and Dachaun Yu. Optimal test input sequence generation for finite state models and pushdown systems. In *IEEE International Conference on Software Testing, Verification and Validation (ICST'11)*, pages 140–149. IEEE, March 2011.

[35] Pallavi Joshi, Mayur Naik, Koushik Sen, and David Gay. An effective dynamic analysis for detecting generalized deadlocks. In *ACM SIGSOFT Eighteenth Symposium on the Foundations of Software Engineering (FSE'10)*. ACM, 2010.

[36] Nicholas Jalbert and Koushik Sen. A trace simplification technique for effective debugging of concurrent programs. In *ACM SIGSOFT Eighteenth Symposium on the Foundations of Software Engineering (FSE'10)*. ACM, 2010.

[37] Jacob Burnim and Koushik Sen. Determin: Inferring likely deterministic specifications of multithreaded programs. In *32nd International Conference on Software Engineering (ICSE'10)*. IEEE, 2010. **IFIP TC2 Manfred Paul Award for Excellence in Software: Theory and Practice.**

[38] Jacob Burnim and Koushik Sen. Asserting and checking determinism for multithreaded programs. In *7th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE'09)*, pages 3–12. ACM, 2009. **ACM SIGSOFT Distinguished Paper Award. Invited to CACM Research Highlights.**

[39] Pallavi Joshi, Mayur Naik, Chang-Seo Park, and Koushik Sen. An extensible active testing framework for concurrent programs. In *21st International Conference on Computer Aided Verification (CAV'09)*, volume 5643 of *Lecture Notes in Computer Science*, pages 675–681. Springer, 2009.

[40] Pallavi Joshi, Chang-Seo Park, Koushik Sen, and Mayur Naik. A randomized dynamic program analysis technique for detecting real deadlocks. In *ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI'09)*, pages 110–120. ACM, 2009.

[41] Mayur Naik, Chang-Seo Park, Koushik Sen, and David Gay. Effective static deadlock detection. In *31st International Conference on Software Engineering (ICSE'09)*, pages 386–396. IEEE, 2009. **ACM SIGSOFT Distinguished Paper Award.**

[42] Jacob Burnim, Sudeep Juvekar, and Koushik Sen. Wise: Automated test generation for worst-case complexity. In *31st International Conference on Software Engineering (ICSE'09)*, pages 463–473. IEEE, 2009.

[43] Jacob Burnim, Nicholas Jalbert, Christos Stergiou, and Koushik Sen. Looper: Lightweight detection of infinite loops at runtime. In *24th IEEE/ACM nternational Conference on Automated Software Engineering (ASE'09)*. IEEE, 2009.

[44] Shaunak Chatterjee, Sudeep Juvekar, and Koushik Sen. Sniff: A search engine for java using free-form queries. In *Fundamental Approaches to Software Engineering (FASE'09)*, volume 5503, pages 385–400, 2009.

[45] Chang-Seo Park and Koushik Sen. Randomized active atomicity violation detection in concurrent programs. In *16th International Symposium on Foundations of Software Engineering (FSE'08)*, pages 135–145. ACM, 2008.

[46] Koushik Sen. Race directed random testing of concurrent programs. In *ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI'08)*, pages 11–21. ACM, 2008.

[47] Jacob Burnim and Koushik Sen. Heuristics for scalable dynamic test generation. In *23rd IEEE/ACM nternational Conference on Automated Software Engineering (ASE'08)*, pages 443–446. IEEE, 2008.

[48] Pallavi Joshi and Koushik Sen. Predictive typestate checking of multithreaded java programs. In *23rd IEEE/ACM nternational Conference on Automated Software Engineering (ASE'08)*, pages 288–296. IEEE, 2008.

[49] Yamini Kannan and Koushik Sen. Universal symbolic execution and its application to likely data structure invariant generation. In *International Symposium on Software Testing and Analysis (ISSTA'08)*, pages 283–294. ACM, 2008.

[50] Murali Krishna Ramanathan, Koushik Sen, Ananth Grama, and Suresh Jagannathan. Protocol inference using static path profiles. In *15th International Static Analysis Symposium (SAS'08)*, volume 5079 of *Lecture Notes in Computer Science*, pages 78–92. Springer, 2008.

[51] Krishnendu Chatterjee, Koushik Sen, and Thomas Henzinger. Model-checking omega-regular properties of interval markov chains. In *11th International Conference on Foundations of Software Science and Computation Structures (FoSSaCS'08)*, volume 4962 of *Lecture Notes in Computer Science*, pages 302–317. Springer, 2008.

[52] Koushik Sen. Concolic testing. In *22nd IEEE/ACM nternational Conference on Automated Software Engineering (ASE'07)*, pages 571–572. IEEE, 2007.

[53] Koushik Sen. Effective random testing of concurrent programs. In *22nd IEEE/ACM nternational Conference on Automated Software Engineering (ASE'07)*, pages 323–332. IEEE, 2007.

[54] Pallavi Joshi, Koushik Sen, and Mark Shlimovich. Predictive testing: Amplifying the effectiveness of software testing (poster paper). In *6th joint meeting of the European Software Engineering Conference and ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE'07)*, pages 561–564. ACM, 2007.

[55] Michael Emmi, Rupak Majumdar, and Koushik Sen. Dynamic test input generation for database applications. In *International Symposium on Software Testing and Analysis (ISSTA'07)*, pages 151–162. ACM, 2007.

[56] Rupak Majumdar and Koushik Sen. Hybrid concolic testing. In *29th International Conference on Software Engineering (ICSE'07)*, pages 416–426. IEEE, 2007.

[57] Koushik Sen and Gul Agha. A race-detection and flipping algorithm for automated testing of multi-threaded programs. In *Haifa verification conference 2006 (HVC'06)*, volume 4383 of *Lecture Notes in Computer Science*, pages 166–182. Springer, 2006.

[58] Koushik Sen and Mahesh Viswanathan. Model checking multithreaded programs with asynchronous atomic methods. In *18th International Conference on Computer Aided Verification (CAV'06)*, volume 4144 of *Lecture Notes in Computer Science*, pages 300–314. Springer, 2006.

[59] Koushik Sen and Gul Agha. Cute and jcute : Concolic unit testing and explicit path model-checking tools. In *18th International Conference on Computer Aided Verification (CAV'06)*, volume 4144 of *Lecture Notes in Computer Science*, pages 419–423. Springer, 2006.

[60] Koushik Sen, Mahesh Viswanathan, and Gul Agha. Model-checking Markov chains in the presence of uncertainties. In *12th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'06)*, volume 3920 of *Lecture Notes in Computer Science*, pages 394–410. Springer, 2006.

[61] Koushik Sen and Gul Agha. Automated systematic testing of open distributed programs. In *International Conference on Fundamental Approaches to Software Engineering (FASE'06) (ETAPS'06 conference)*, volume 3922 of *Lecture Notes in Computer Science*, pages 339–356. Springer, 2006.

[62] Koushik Sen, Darko Marinov, and Gul Agha. CUTE: A concolic unit testing engine for C. In *5th joint meeting of the European Software Engineering Conference and ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE'05)*, pages 263–272. ACM, 2005. **ACM SIGSOFT Distinguished Paper Award.**

[63] Patrice Godefroid, Nils Klarlund, and Koushik Sen. DART: Directed automated random testing. In *ACM SIGPLAN 2005 Conference on Programming Language Design and Implementation (PLDI'05)*, pages 213–223, 2005.

[64] Koushik Sen, Mahesh Viswanathan, and Gul Agha. On statistical model checking of stochastic systems. In *17th International Conference on Computer Aided Verification (CAV'05)*, volume 3576 of *Lecture Notes in Computer Science*, pages 266–280. Springer, 2005.

[65] Koushik Sen, Mahesh Viswanathan, and Gul Agha. VESTA: A statistical model checker and analyzer for probabilistic systems. In *2nd International Conference on Quantitative Evaluation of Systems (QEST'05)*, pages 251–252. IEEE, 2005.

[66] Abhay Vardhan, Koushik Sen, Mahesh Viswanathan, and Gul Agha. Using language inference to verify omega-regular properties. In *11th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'05)*, volume 3440 of *Lecture Notes in Computer Science*, pages 45–60. Springer, 2005.

[67] Koushik Sen, Grigore Roşu, and Gul Agha. Detecting errors in multithreaded programs by generalized predictive analysis of executions. In *7th IFIP International Conference on Formal Methods for Open Object-Based Distributed Systems (FMOODS'05)*, volume 3535 of *Lecture Notes in Computer Science*, pages 211–226. Springer, 2005.

[68] Abhay Vardhan, Koushik Sen, Mahesh Viswanathan, and Gul Agha. Actively learning to verify safety for fifo automata. In *24th Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS'04)*, volume 3328 of *Lecture Notes in Computer Science*, pages 494–505. Springer, 2004.

[69] Abhay Vardhan, Koushik Sen, Mahesh Viswanathan, and Gul Agha. Learning to verify safety properties. In *6th International Conference on Formal Engineering Methods (ICFEM'04)*, volume 3308 of *Lecture Notes in Computer Science*, pages 274–289. Springer, 2004.

[70] Koushik Sen, Mahesh Viswanathan, and Gul Agha. Learning continuous time markov chains from sample executions. In *1st International Conference on Quantitative Evaluation of Systems (QEST'04)*, pages 146–155. IEEE, 2004.

[71] Prasad Naldurg, Koushik Sen, and Prasanna Thati. A temporal logic based approach to intrusion detection. In *24th IFIP WG 6.1 International Conference on Formal Techniques for Networked and Distributed Systems (FORTE'04)*, volume 3235 of *Lecture Notes in Computer Science*, pages 359–376. Springer, 2004.

[72] Koushik Sen, Mahesh Viswanathan, and Gul Agha. Statistical model checking of black-box probabilistic systems. In *16th International Conference on Computer Aided Verification (CAV'04)*, volume 3114 of *Lecture Notes in Computer Science*, pages 202–215. Springer, 2004.

[73] Koushik Sen, Abhay Vardhan, Gul Agha, , and Grigore Roşu. Efficient decentralized monitoring of safety in distributed systems. In *26th International Conference on Software Engineering (ICSE'04)*, pages 418–427. IEEE, 2004.

[74] Koushik Sen, Grigore Roşu, and Gul Agha. Online efficient predictive safety analysis of multithreaded programs. In *10th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS'04)*, volume 2988 of *Lecture Notes in Computer Science*, pages 123–138, 2004.

[75] Howard Barringer, Allen Goldberg, Klaus Havelund, and Koushik Sen. Rule-based runtime verification. In *5th International Conference on Verification, Model Checking and Abstract Interpretation (VMCAI'04)*, volume 2937 of *Lecture Notes in Computer Science*, pages 44–57. Springer, 2004.

[76] Koushik Sen, Grigore Roşu, and Gul Agha. Runtime Safety Analysis of Multithreaded Programs. In *9th European Software Engineering Conference and 11th ACM SIGSOFT International Symposium on the Foundations of Software Engineering (ESEC/FSE'03)*, pages 337–346. ACM, 2003.

[77] Koushik Sen, Grigore Roşu, and Gul Agha. Generating optimal linear temporal logic monitors by coinduction. In *8th Asian Computing Science Conference (ASIAN'03)*, volume 2896 of *Lecture Notes in Computer Science*, pages 260–75. Springer, 2003.

[78] Nirman Kumar, Koushik Sen, José Meseguer, and Gul Agha. A rewriting based model for probabilistic distributed object systems. In *6th IFIP International Conference on Formal Methods for Open Object-based Distributed Systems (FMOODS'03)*, volume 2884 of *Lecture Notes in Computer Science*, pages 32–46. Springer, 2003.

Refereed Workshop Proceedings

[1] Koushik Sen, Haruto Tanno, Xiaojing Zhang, and Takashi Hoshino. GUIDESE: Annotations for Guiding Concolic Testing. In *10th IEEE/ACM International Workshop on Automation of Software Test*, May 2015.

[2] Jacob Burnim, Tayfun Elmas, George Necula, and Koushik Sen. Concurrit: Testing concurrent programs with programmable state-space exploration. In *4th USENIX Workshop on Hot Topics in Parallelism (HotPar'12)*, June 2012.

[3] Nicholas Jalbert, Cristiano Pereira, Gilles Pokam, and Koushik Sen. Radbench: A concurrency bug benchmark suite. In *3rd USENIX Workshop on Hot Topics in Parallelism (HotPar'11)*, 2011.

[4] Pallavi Joshi, Haryadi S. Gunawi, and Koushik Sen. Prefail: Programmable and efficient failure testing framework. In *Poster Sessions and Work-in-Progress Reports in 9th USENIX Conference on File and Storage Technologies (FAST/WIP'11)*, 2011.

[5] Haryadi S. Gunawi, Thanh Do, Pallavi Joshi, Joseph M. Hellerstein, Andrea C. Arpaci-Dusseau, Remzi H. Arpaci-Dusseau, and Koushik Sen. Towards automatically checking thousands of failures with micro-specifications. In *6th USENIX Workshop on Hot Topics in System Dependability (HotDep'10)*, 2010.

[6] Jacob Burnim, George Necula, , and Koushik Sen. Separating functional and parallel correctness using nondeterministic sequential specifications. In *2nd USENIX Workshop on Hot Topics in Parallelism (HotPar'10)*, 2010.

[7] Gul Agha, José Meseguer, and Koushik Sen. PMaude: Rewrite-based specification language for probabilistic object systems. *Electronic Notes in Theoretical Computer Science*, 153(2):213–239, 2006.

[8] Koushik Sen, Abhay Vardhan, Gul Agha, , and Grigore Roşu. Decentralized runtime analysis of multithreaded applications. In *NSF Next Generation Software Program Workshop (NSFNGS'06) (Satellite Workshop of IPDPS'06)*. IEEE Digital Library, 2006.

[9] Gul Agha, Carl Gunter, Michael Greenwald, Sanjeev Khanna, José Meseguer, Koushik Sen, and Prasanna Thati. Formal modeling and analysis of DoS using probabilistic rewrite theories. In *International Workshop on Foundations of Computer Security (FCS'05) (Affiliated with LICS'05)*, 2005.

[10] Gul Agha, José Meseguer, and Koushik Sen. PMaude: Rewrite-based specification language for probabilistic object systems. In *3rd International Workshop on Quantitative Aspects of Programming Languages (QAPL'05)*, 2005.

[11] Koushik Sen, Abhay Vardhan, Gul Agha, , and Grigore Roşu. On specifying and monitoring epistemic properties of distributed systems. In *2nd International Workshop on Dynamic Analysis (WODA'04), Satellite workshop of ICSE 2004*, pages 32–35. British Institution of Electrical Engineers (IEE), 2004.

[12] Grigore Roşu and Koushik Sen. An instrumentation technique for online analysis of multithreaded programs. In *International Workshop on Parallel and Distributed Systems: Testing and Debugging (PAD-TAD'04) (Satellite workshop of IPDPS'04)*. IEEE digital library, 2004.

[13] Howard Barringer, Allen Goldberg, Klaus Havelund, and Koushik Sen. Program monitoring with ltl in eagle. In *International Workshop on Parallel and Distributed Systems: Testing and Debugging (PAD-TAD'04) (Satellite workshop of IPDPS'04)*. IEEE digital library, 2004.

[14] Koushik Sen and Grigore Roşu. Generating Optimal Monitors for Extended Regular Expressions. In *3rd International Workshop on Runtime Verification (RV'03)*, volume 89(2) of *Electronic Notes in Theoretical Computer Science*. Elsevier Science, 2003.

[15] Prasanna Thati, Koushik Sen, and Narciso Marti Oliet. An executable specification of asynchronous picalculus and may-testing in maude 2.0. In *International Workshop on Rewriting Logic and its Applications (WRLA'02)*, volume 71 of *Electronic Notes in Theoretical Computer Science*. Elsevier Science, 2002.

Invited Papers

[1] Koushik Sen Technical Perspective: Veritesting tackles Path-explosion Problem *Communications of the ACM*, 59(6), June 2016.

[2] Koushik Sen. Concolic testing and constraint satisfaction. In *14th International Conference on Theory and Applications of Satisfiability Testing (SAT'11)*, 2011. Keynote Talk.

[3] Koushik Sen DART: Directed Automated Random Testing. *Haifa Verification Conference (HVC'09)*, pages 4. 2009. Invited Talk.

[4] Koushik Sen and Gul Agha. *Process Coordination and Ubiquitous Computing*, chapter Thin Middleware for Ubiquitous Computing, pages 201–213. CRC Press, September 2002.

Technical Reports

[1] Krste Asanovic, Ras Bodik, James Demmel, Tony Keaveny, Kurt Keutzer, John D. Kubiatowicz, Edward A. Lee, Nelson Morgan, George Necula, David A. Patterson, Koushik Sen, John Wawrzynek, David Wessel, and Katherine A. Yelick. The parallel computing laboratory at u.c. berkeley: A research agenda based on the berkeley view. Technical Report UCB/EECS-2008-23, EECS Department, University of California, Berkeley, Mar 2008.

Software

1. Jalangi: A selective record-replay, dynamic analysis, and concolic testing framework for JavaScript.
   `https://github.com/Samsung/jalangi2`

2. CATG: A concolic test generation tool for Java bytecode.
   `https://github.com/ksen007/janala2`

3. SwiftHand: A Guided GUI Testing Tool for Android Applications.
   `https://github.com/wtchoi/SwiftHand`

4. CodeHint: A tool that synthesizes code from user-provided partial dynamic specifications of the desired behavior.
   `https://github.com/jgalenson/codehint`

5. Precimonius: Tuning Assistant for Floating-Point Precision.
   `https://github.com/nacuong/precimonius`

6. Concurrit: A Domain Specific Language for Testing and Reproducing Concurrency Bugs
   `http://code.google.com/p/concurrit/`

7. UPC-Thrille: Scaling Data Race Detection for Partitioned Global Address Space Programs.
   `http://upc.lbl.gov/thrille.shtml`

8. Thrille: A testing and debugging infra-structure for C/PThread programs
   (`http://github.com/nicholasjalbert/Thrille`)

9. CalFuzzer: Active Random Testing Tool for Multithreaded Java Programs
   (`http://srl.cs.berkeley.edu/~ksen/calfuzzer/`)

10. CREST: Automatic Test Generation Tool for C
    (`http://code.google.com/p/crest/`)

11. CUTE: A Concolic Unit Testing Engine for C and Java
    (`http://osl.cs.uiuc.edu/~ksen/cute/`)

12. DART: Directed Automated Random Testing

Grants

Available on request.

Keynotes, Invited Talks, and Presentations

- "Concolic Testing: A Decade Later", 13th International Workshop on Dynamic Analysis (WODA'15), Pittsburg, PA, October 26, 2015. **Keynote.**

- "Jalangi: A Dynamic Analysis Framework for JavaScript", Qualcomm Research Silicon Valleys Distinguished Lecture Series, San Jose, CA, July 30, 2015. **Invited Talk**

- "Jalangi: A Dynamic Analysis Framework for JavaScript", 4th Annual Workshop on Tools for JavaScript Analysis (JSTools 2015), Prague, July 6, 2015. **Invited Talk**

- "Jalangi: A Dynamic Analysis Framework for JavaScript", 4th ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis (SOAP 2015), Portland, Oregon, June 14, 2015. **Invited Talk**

- "Automated Test Generation Using Concolic Testing", Advanced Automated Testing Techniques Meetup organized by Twitter Inc., San Francisco, CA, April 14, 2015. **Invited Talk**

- "Automated Software Testing", for a educational program on Advanced Software Testing organized by UC Berkeley for a delegating from LG Electronics, South Korea, Berkeley, CA, March 13, 2015. **Invited Lecture**

- "Automated Test Generation Using Concolic Testing", 8th India Software Engineering Conference Bangalore, India, February 19, 2015. ***Keynote***

- "MultiSE: Multi-Path Symbolic Execution using Value Summaries", University of Illinois Urbana Champaign, October 23, 2014. ***Special Seminar***

- "CORVETTE: Testing, Debugging, and Precision-tuning of Large-scale Parallel and Floating-point Programs", **Prof. R. Narasimhan Lecture Award**, Tata Institute of Fundamental Research, Mumbai, India, June 4, 2014.

- "Automated Test Generation Using Concolic Testing", Tata Institute of Fundamental Research, Mumbai, India, June 3, 2014.

- "Test and Cure your JavaScript Blues", ACM SIGPLAN conference on Systems, Programming, Languages and Applications Industrial Research Talks (SPLASH-I), Indianapolis, IN, October 30, 2013.

- "Active Testing", 6th International Workshop on Exploiting Concurrency Efficiently and Correctly (EC2'13), Saint Petersburg, Russia, July 13, 2013. (Scheduled) ***Invited Talk***

- "Jalangi: A Selective Record-Replay, Dynamic Analysis, and concolic testing Framework for JavaScript", 2nd Annual Workshop on Tools for JavaScript Analysis, Montpellier, France, Second Annual Workshop on Tools for JavaScript Analysis, Montpellier, France, July 1, 2013. ***Invited Talk***

- "Active Testing", 6th International Workshop on Exploiting Concurrency Efficiently and Correctly (EC2'13), Saint Petersburg, Russia, July 13, 2013. ***Invited Talk***

- "Symbolic Execution", Third International Conference on Runtime Verification (RV'12), Istanbul, Turkey, September 25, 2012. ***Invited Tutorial***

- "Concolic Testing and Constraint Satisfaction", 14th International Conference on Theory and Applications of Satisfiability Testing (SAT'11), Ann Arbor, MI, June 2011. ***Keynote***

- "Runtime Checking for Nondeterministic Sequential Specifications of Parallel Correctness", Mysore Park Workshops, Bangalore, India, February 19, 2011. ***Invited Talk***

- "Separating functional and parallel correctness", Workshop on Usable Verification, Microsoft/National Science Foundation, Redmond, WA, November 16, 2010.

- "Asserting and Checking Determinism for Multithreaded Programs", 2nd India Software Engineering Conference, February 25, 2010. ***Invited Talk***

- "Asserting and Checking Determinism for Multithreaded Programs", Workshop on Deterministic Multiprocessing and Parallel Programming, Seattle, WA, December 1, 2009. ***Invited Talk***

- "DART: Directed Automated Random Testing", Haifa Verification Conference, October 22, 2009. ***HVC Award Talk***

- "Testing concurrent programs", Caltech Workshop on Verification and Validation, Pasadena, CA, September, 24, 2009. ***Invited Talk***

- "Active Random Testing of Concurrent Programs", Sun Microsystems, Menlo Park, CA, March 23, 2009. ***Invited Talk***

- "Concolic testing", Docomo Labs, Palo Alto, CA, March 13, 2009. ***Invited Talk***

- "Active Random Testing of Parallel Programs", *Workshop on State-space Exploration for Automated Testing (SSEAT 2008), co-located with ISSTA 08*, Seattle, WA, July 24, 2008. ***Invited Talk***

- "Active Random Testing of Parallel Programs", *Mini-Symposium on Tools for Building Large-scale Scientific Software, 2008 SIAM Annual Meeting*, San Diego, CA, July 10, 2008. ***Invited Talk***

- "Concolic Testing", *22nd IEEE/ACM International Conference on Automated Software Engineering (ASE'07)*, Atlanta, GA, Nov 9, 2007. ***Invited Tutorial***

- "Concolic Testing of Sequential and Concurrent Programs," Agitar Software Inc., Mountain View, CA, January 12, 2007. *Invited Talk*

- "Concolic Testing of Sequential and Concurrent Programs," Stanford University, December 4, 2006. ***Invited Talk***

- "Concolic Testing of Sequential and Concurrent Programs," Fujitsu, Sunnyvale, CA, November 17, 2006. ***Invited Talk***

- "Scalable Automated Methods for Software Reliability,"

  - Princeton University, April 18, 2006.
  - New York University, April 17, 2006.
  - Cornell University, April 13, 2006.
  - Yale University, April 11, 2006.
  - Microsoft Research, Redmond, April 5, 2006.
  - University of Toronto, March 28, 2006.
  - Purdue University, March 22, 2006.
  - IBM T.J. Watson Research Lab, March 20, 2006.
  - University of Pennsylvania, March 13, 2006.
  - Caltech, March 2, 2006.
  - University of California Berkeley, February 27, 2006.
  - University of Washington Seattle, February 22, 2006.
  - University of Michigan Ann Arbor, February 15, 2006.

Professional Activities

- (Co)chair:

  - PC Chair of the International Symposium on Software Testing and Analysis (ISSTA'17).
  - Co-chair of Dagstuhl Seminar 14442 on Symbolic Execution and Constraint Solving, October 27-30, 2014.
  - 7th India Software Engineering Conference (ISEC'14), February 19-21, 2014.
  - 2nd International Conference on Runtime Verification (RV'11), September 27-30, 2011.
  - 1st International Workshop on Learning From eXperience (LFX'10), a PLDI'10 workshop, June 6, 2010.

- Program Committee:

  - International Symposium on Software Testing and Analysis (ISSTA'16), July 18–22, 2016.
  - 21st International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS'16), April 2–6, 2016.
  - External Review Committee. Annual Symposium on Principles of Programming Languages (POPL'16), January 20–22, 2016.
  - 15th International Conference on Runtime Verification (RV'15), September 22–25, 2015.
  - 27th International Conference on Computer Aided Verification (CAV'15), July 18–24, 2015.
  - International Symposium on Software Testing and Analysis (ISSTA'15), July 13–17, 2015.
  - External Review Committee of 36th annual ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI'15), June 13–17, 2015.
  - 26th International Conference on Computer Aided Verification (CAV'14), July 18–22, 2014.
  - ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI'14), June 11–18, 2014.
  - External Review Committee of 19th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP'14), February 15–19, 2014.

- 9th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering Tool Demonstrations Track (ESEC/FSE'13), August 18–26, 2013.
- ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA'13), October 26-31, 2013.
- 4th International Workshop on Parallel Software Tools and Tool Infrastructures (PSTI'13), October 2, 2013.
- External Review Committee of 34th annual ACM SIGPLAN conference on Programming Language Design and Implementation (PLDI'13), June 16–22, 2013.
- ACM SIGSOFT 20th International Symposium on the Foundations of Software Engineering (FSE'12), Nov 10–17, 2012.
- External Review Committee of ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA'12), October 19-26, 2012.
- 3rd International Conference on Runtime Verification (RV'12), September 25-28, 2012.
- 4th USENIX Workshop on Hot Topics in Parallelism (HotPar '12), June 7-8, 2012.
- International Conference on Software Testing and Analysis (ISSTA'11), July 17–21, 2011.
- External Review Committee of ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA'11), October 22-27, 2011.
- 18th International SPIN Workshop on Model Checking of Software (SPIN'11), July 14-15, 2011.
- 3rd NASA Formal Methods Symposium (NFM'11), April 18-20, 2011.
- Workshop on Specification and Verification of Component-Based Systems (SAVCBS'10), November 12, 2010.
- International Conference on Runtime Verification (RV'10), November 1–4, 2010.
- ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA'10), October, 2010.
- 1st International Workshop on Parallel Software Tools and Tool Infrastructures (PSTI'10), September 13, 2010.
- International Conference on Software Engineering New Ideas and Emerging Results Track (ICSE NIER'10), May, 2010.
- 2nd NASA Formal Methods Symposium (NFM'10), April, 2010.
- IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS'10), March, 2010.
- 8th Workshop on Specification and Verification of Component-Based Systems (SAVCBS'09), August, 2009.
- International Workshop on Defects in Large Software Systems (DEFECTS'09)
- 1st NASA Formal Methods Symposium (NFM'09), April, 2009.
- 16th International SPIN Workshop on Model Checking of Software (SPIN'09), June, 2009.
- 2nd International Conference on Software Testing, Verification, and Validation (ICST'09), April, 2009.
- 29th International Conference on Distributed Computing Systems (ICDCS'09), June, 2009.
- Fundamental Approaches to Software Engineering (FASE'09), March, 2009.
- 10th International Conference on Distributed Computing and Networking (ICDCN'09), January, 2009.
- 20th International Conference on Computer Aided Verification (CAV'08), July, 2008.
- 23rd IEEE/ACM International Conference on Automated Software Engineering (ASE'08), September, 2008.
- 15th International SPIN Workshop on Model Checking of Software (SPIN'08), August, 2008.
- International Conference on Quantitative Evaluation of Systems (QEST'08), September, 2008.
- 6th ASIAN Symposium on Programming Languages and Systems (APLAS'08), December, 2008.
- Automated Formal Methods (AFM'08), July, 2008.

- 1st International Conference on Software Testing, Verification and Validation (Student Track), (ICST'08), April, 2008.
- 19th International Conference on Computer Aided Verification (CAV'07), July 2007.
- ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA'07), October, 2007.
- 2nd International Workshop on Random Testing (RT'07), November, 2007.

- Proposal Reviewer for NSF and AFOSR.

- Student volunteer for ICSE 2005, St. Luois, MO, USA.

Students

Advising

- Philip Wontae Choi (PhD)

- Rafael Dutra (PhD)

- Liang Gong (PhD)

- Benjamin Mehne (PhD)

- Rohan Padhye (PhD)

Graduated

- Joel Galenson (PhD) (co-advised by Ras Bodik)

- Christos Stergiou (PhD) (co-advised by Edward Lee)

- Pallavi Joshi (PhD)

- Chang-Seo Park (PhD)

- Jacob Burnim (PhD)

- Cuong Nguyen (MS)

- Nicholas Jalbert (MS)

- Sudeep Juvekar (MS)

- Yamini Kannan (MS)

- David Eitan Poll (MS)

- Mark Shlimovich (MS)

Postdocs

- Emmanuelle Saillard

- Xuehai Qian

- Michael Pradel

- Cindy Rubio Gonzalez

- Tayfun Elmas

- Guillaume Revy