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VIJAY GANESH
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EDUCATION _____

Degree	Institution	Graduation Date
PhD, Computer Science	Stanford University, CA, USA	Sep 2007
MS, Electrical Engineering	Stanford University, CA, USA	Jun 2000
B-Tech, Electronics and Communication	College of Engineering, Trivandrum Kerala, India	Nov 1994

FULL-TIME ACADEMIC APPOINTMENTS_____

Research Position	Institution	Dates
Full Professor	School of Computer Science, Georgia Tech, Atlanta, USA	Sep 2023 – present
Co-Director	Waterloo Artificial Intelligence Institute, University of Waterloo, Canada	Mar 2021 – Apr 2023
Associate Professor (tenure) Assistant Professor	ECE and CS (cross-appointed) University of Waterloo, Canada	Jul 2018 – Sep 2023 Sep 2012 – Jun 2018
Research Scientist	Massachusetts Institute of Technology, Cambridge, MA, USA	Oct 2007 – Sep 2012

VISITING/AFFILIATE ACADEMIC APPOINTMENTS _____

Research Position	Institution	Dates
Fellow	Balsillie School of International Affairs, Waterloo, Canada	Oct 2022 – present
Visiting Professor	Computer Science, Indian Institute of Technology, Bombay, India	Jan 2020 – present
Visiting Scientist (organizer: SAT program)	Simons Institute for Theory of Computing, Berkeley, CA, USA	Mar 2023 – May 2023 Jan 2021 – May 2021
Visiting Professor	Computer Science, University of Toronto, Ontario, Canada	Sep 2019 – Feb 2020 Jan 2016 – Mar 2016
Visiting Professor	Chebyshev Labs, St. Petersburg State University, St. Petersburg, Russia	Apr 2016 – Jun 2016

RESEARCH INTERESTS _____

Boolean SAT and SMT solvers, machine learning (ML) for solvers, Neurosymbolic AI
AI for math (LLMs + LEAN), AI for science, AI for software engineering
Proof complexity, mathematical logic
Quantum foundations

The primary focus of my research is the theory and practice of automated reasoning algorithms (specifically, SAT/SMT solvers and provers), as well as their applications in AI, software engineering, security, formal methods, mathematics, and physics. In this context, I have received more than 30 awards, medals, and distinctions at top-tier ACM and IEEE venues, including an ACM ISSTA Impact Paper Award 2019 (best paper in 10 years), an ACM Test of Time Award at CCS 2016 (best paper in 10 years), a citation for 10-year most-influential papers at the ACM/IEEE sponsored DATE conference in 2008 (best paper in 10 years), and more than 10 other best paper awards or invited papers. A few of these awards and distinctions are listed below. The rest can be found on my website.

1. Waterloo Engineering Research Excellence Award (EREA) 2022. Associate Professor Category. **(Highest research award for professors at Waterloo's Faculty of Engineering)**

2. **ACM ISSTA IMPACT Paper Award 2019 (Best Paper in 10 Years @ ISSTA conference)**

3. Won two silver medals at the SAT competition 2017, Melbourne, Australia

4. **ACM CCS Test of Time Award 2016 (Best Paper in 10 Years @ ACM CCS conference)**

5. Outstanding Paper @ ACSAC 2016, Los Angeles, USA

6. Early Researcher Award (ERA) 2016, Ontario, Canada

7. Won two gold medals at the SAT competition 2016, Bordeaux, France

8. IBM Faculty Award 2015, Awarded by IBM TJ Watson Research Center, New York, USA

9. MathCheck paper selected as among Best Papers at CADE 2015, Berlin, Germany

10. Z3str2 String Solver paper selected as among Best Papers at CAV 2015, San Francisco, USA

11. Best Paper Award at the Software Product Lines Conference (SPLC) 2015, Nashville, USA

12. Google Faculty Research Award 2013 (Only 15 winners worldwide in software engineering)

13. Heidelberg Laureate Forum Invitee 2013 (Highly selective conference where young researchers are invited to meet with Fields, Turing, and Abel prize winners. My blog post on the event.)

14. Google Faculty Research Award 2011 (Only 12 winners worldwide in software engineering)

15. ACM SIGSOFT Distinguished Paper Award at ISSTA 2009

16. **Ten-year most influential paper at DATE 2008 (Best Paper in 10 Years @ ACM/IEEE DATE conference)**

RESEARCH FUNDING HISTORY

Funding Program	Project Title	PI	Agency	Funds USD (my %)	Duration
WISA Research for Impact	Data efficient Learning of Aircraft Dynamics for Simulated Flight Testing	Vijay Ganesh	WISA, Waterloo	$37K (100%)	Apr 2023-Apr 2024
NSERC Discovery	Machine Learning and Solvers: The Next Frontier	Vijay Ganesh	NSERC	$182K (100%)	Apr 2020-Apr 2025
MITACS	5 projects	Vijay Ganesh	MITACS	$56K (100%)	May 2016-present
Amazon AWS	Amazon AWS for Automated Reasoning	Vijay Ganesh	Amazon Inc.	$143K (100%)	Jan 2019-Jan 2021
Ripple	Ripple Faculty Fellow: Security of Smart Contracts	Vijay Ganesh	Ripple Inc.	$89K (100%)	Jan 2019-Jan 2023
Amazon	String Solvers for Security	Vijay Ganesh	Amazon Inc.	$139K (100%)	Jan 2018-Jan2020
NSERC Discovery Extension	Next-generation Constraint Solvers for Software Engineering and Security	Vijay Ganesh	NSERC	$19K (100%)	Apr 2018-Mar 2019
NSERC CRD 2017 (Co-PI)	Accelerating multi-objective combinatorial optimizations via GPUs for Cyber-Physical Systems Design	Krzysztof Czarnecki	NSERC	$111K (25%)	Jan 2017 - Dec 2018
Early Researcher Award 2016	Solvers for Security via a Combination of Machine Learning and Deduction	Vijay Ganesh	Ontario	$111K (100%)	Jun 2016 - Jun 2021
IBM Faculty Award 2015	String Solvers for Mobile and Cloud Security	Vijay Ganesh	IBM	$6K (100%)	Dec 2015 - Mar 2017
NSERC Create 2015 (Co-PI)	Product-Line Engineering for Cyber-Physical Systems	Krzysztof Czarnecki	NSERC	$1,226K (8%)	Apr 2015 - Mar 2021
NSERC Discovery 2013	Next-generation Constraint Solvers for Software Engineering and Security	Vijay Ganesh	NSERC	$93K (100%)	Apr 2013 - Mar 2018
Google Faculty Award 2013	From Functional Regressions to Security Testing	Vijay Ganesh	Google	$11K (100%)	Oct 2013 – Oct 2016
Waterloo ECE Starter 2012	University of Waterloo ECE Departmental Seed Funding for Junior Faculty	Vijay Ganesh	ECE, Waterloo	$93K (100%)	Sep 2012 - present
Google Faculty Award 2011	Constraint Solvers for Security Testing	Vijay Ganesh	Google	$45K (100%)	Sep 2011 - Sep 2016
NSF Grant 0905244 2009 (Co-PI)	Exposing and Eliminating Errors at Component Boundaries	Martin Rinard	NSF, USA	$507K (33%)	Oct 2009 - Sep 2012
Total award**				**$2.8M USD (54%)**	

** All funds in US dollars (c2023). My share is approx. $1.53 million USD or 54% of the total funding.

As stated above, the primary focus of my research is the theory and practice of SAT/SMT solvers, and their applications to problems in software engineering, security, AI, mathematics, and physics. Below I describe some of my most significant practical and theoretical research contributions in this context.

Important Practical Results

1. **Machine Learning for Logic: ML-based Solvers and Provers (2014–present)**

SAT and SMT solvers are mathematical reasoning algorithms aimed at solving the **satisfiability problem** for Boolean logic and first-order theories respectively. The Boolean satisfiability (or SAT) problem is rightly considered one of the most important problems in computer science and mathematics. Even though the SAT problem has been shown to be NP-complete, and is considered to be intractable in the worst-case, modern conflict-driven clause-learning (CDCL) SAT solvers are capable of solving real-world formulas with tens of millions of variables and clauses in them. As a consequence, they have found wide applicability in diverse areas such as software engineering, security, AI, mathematics, and physics.

One of the most important questions in SAT research is the following: **"why are solvers so efficient, despite the fact that the SAT problem is NP-complete?"**

In my attempt to answer the above question, my collaborators and I made a set of crucial discoveries:

First, it has been known that solvers can be best understood as algorithms that implement proof systems (e.g., resolution). However, until recently, solver implementations used ad-hoc methods to implement these proof systems. By contrast, we showed that solver design can be dramatically improved in terms of efficiency, extensibility, and quality if solver optimization heuristics (aimed at optimally sequencing and selecting proof rules) are implemented using both online and offline machine learning techniques. The underlying reason for this is that solvers produce copious amount of data as they perform their analysis and proof search, and this data can be leveraged using ML techniques to dynamically optimize the solver's performance.

This idea that SAT solvers are combinations of proof rules (logic) and ML optimization heuristics is one of my key contributions and underpins the design of our award-winning SAT solver, MapleSAT. A version of this solver won two gold medals and two silver medals at the annual SAT competition in 2016 and 2017 respectively and has deeply impacted the field of solver design. Other researchers have adopted and adapted ideas from our work in the context of their solver research.

Second, theorists and practitioners have long held the view that SAT solvers work well for real-world instances because of their inherent structure that can be described parametrically and used to prove upper/lower parameterized complexity-theoretic bounds. While many parameters have been proposed, they all fail in some way or the other to appropriately describe this phenomenon of solver efficiency. After extensive empirical work, my collaborators and I have identified a set of parameters, namely, **hierarchical community structure and mergeability**, that can be shown to empirically explain why solvers are so efficient for real-world instances.

While the definitions of these parameters can get technical, the crucial insight is that these parameters not only capture the structure of real-world instances, but also help explain how solvers are so effective at solving large real-world instances. Specifically, when one considers a certain regime of values for these parameters (corresponding to real-world industrial instances), we see that proof size of such formulas scale polynomially with the size of such formulas. Further, we see that the proof search for such formulas tends to be highly localized to certain parts of the formula structure and thus remains effective. By contrast, the proof search for formulas that have been shown to be hard for SAT solvers (e.g., randomly generated expanders) has been shown to be not automatable (unless some widely held complexity-theoretic assumptions are violated).

2. String solvers for software engineering and security (2009–present)

The problem of designing efficient string solving algorithms is recognized as one of the most difficult by SMT solver experts. These solvers are a particularly important class of tools in the context of security analysis of string-intensive programs, such as Web applications.

Since 2009, I have co-designed a series of string solving algorithms that are efficient for many security applications, culminating in the co-design and implementation of the Z3str3 and its successor Z3str4 string solver. **My decade-long work on the theory and practice of string solvers led to an ACM IMPACT Paper Award at ISSTA 2019.**

3. STP Solver for scalable symbolic analysis (2005–2012)

One of my most impactful practical result is the design and implementation of the STP bit-vector and array solver that **played an important role in the development of scalable symbolic execution, widely considered a breakthrough in software engineering and security**. The STP solver's success is primarily due to several abstraction-refinement style algorithms that I designed for deciding bit-vector and array formulas. These algorithms have stood the test of time and continue to be used and extended to novel settings. STP has been used to find thousands of bugs in many critical pieces of software including Debian Linux and is currently used by many companies to build in-house security analysis or test generation tools. This work led to an **ACM Test of Time Award at the CCS 2016 conference**.

Important Theoretical Results

1. Parameterized proof complexity of SAT and SMT solvers (2016-present)

As stated above, one of the most important problems in solver research is "why are SAT solvers efficient, even though the SAT problem is NP-complete?". This question can be generalized to many other classes of solvers as well, such as ILP or SMT, that are aimed at solving NP-complete, PSPACE-complete, NEXPTIME-complete, or harder problems.

The fact that there exist efficient algorithms that can solve many classes of real-world instances of problems that are theoretically deemed to be hard suggests a gap between theory and practice. Traditional complexity-theoretic analysis of problems tends to focus on the worst-case and is unsuitable for bridging this gap. Fortunately, theorists have developed many other lines of research, such as parameterized complexity and smoothed analysis, that are powerful tools at explaining why certain algorithms work well in practice and can be applied in the solver setting as well.

By leveraging tools from (parameterized) proof complexity, my collaborators and I have proved a series of results towards explaining the power of SAT and SMT solvers. While this work is still in progress, the initial results that we have obtained have already proven to be very useful. In particular, we showed that SMT solvers are polynomially-equivalent to Res(T) and Res*(T) proof systems, and SAT solvers are polynomially-equivalent to the merge resolution proof system. These theoretical results leverage the merge parameter that we discovered to empirically explain why solvers are efficient, thus linking theory and practice.

The ultimate goal of this line of research is to establish parameteric upper bounds on the runtime of solvers such that for a suitable regime of parameter values (that correspond to real-world instances) the runtime of CDCL SAT solvers is polynomial in the size of the input and possibly exponential in the parameter (accounting for both proof size and proof search/automatability). Another goal of this line of research is to theoretically explain why certain solver heuristics work well (e.g., 1UIP clause learning scheme, VSIDS branching heuristics, restarts etc.) in terms of parameters that are found to characterize industrial instances. Further, we are also working towards establishing lower bounds on these heuristics, thus explaining under what conditions they fail to perform well.

2. MathCheck SAT+CAS combination for verification of math conjectures (2014-present)

In many areas of mathematics, computers are increasingly being used to prove, formalize, and check theorems. For certain kinds of conjectures (especially ones involving combinatorial structures and arguments), establishing their veracity can be reduced to the problem of checking the satisfiability of a suitably constructed Boolean formula. Given that SAT solvers are efficient general-purpose search methods, such reductions can be very effective. However, SAT solvers do suffer from an important weakness, namely, that they often lack domain-specific knowledge about many areas of mathematics. Such knowledge or advice can be very useful in pruning the search spaces associated with combinatorial math problems. By contrast, computer algebra systems (CAS) are storehouses of mathematical knowledge but lack the efficient general-purpose search capabilities of solvers.

This state-of-affairs suggests that by combining the general search capability of SAT solvers with domain-specific knowledge-based advice provided by CAS, in a corrective feedback loop, one can effectively solve a variety of combinatorial mathematical problems that cannot be solved by either approach alone (or possibly by any other method). Indeed, my collaborators and I came to this exact realization that if we appropriately combine the search capabilities of SAT solvers with domain-specific advice from a CAS, in a paradigm we call SAT+CAS, one can solve a large number of math problems. We published our first paper on the SAT+CAS paradigm at the CADE 2015 conference. This paper was selected as among the best papers at the conference, and we were invited to publish an extended version of the paper in the FMSD journal. Since then, we have published over a dozen papers, solving a variety of mathematical problems using MathCheck, a SAT+CAS tool that we designed and built.

Another direction we are exploring using the SAT+CAS paradigm is that of solving "concrete" complexity-theoretic questions. In complexity, there are a large number of questions of the following form: does there exist a circuit of concrete size k that can solve a given problem. For example, what is the minimum number of multiplication operations one needs to multiply two 3x3 integer matrices. It is known that the minimum number of multiplications needed to solve the "3x3 matrix multiplication problem" must be greater than 19 (that required a very clever proof), but less than or equal to 23. It is not yet known whether the answer is 20, 21, or 22. These kinds of problems are in essence combinatorial search problems that can be solved using the general-purpose search capability of SAT, aided with domain-specific advice from a CAS.

3. Theories over strings (2009–present)

I have done extensive work in the context of decidability and complexity-theoretic questions for theories over strings. In 2020, my collaborators and I established the PSPACE-completeness of a quantifier-free theory of simple regular expressions, arithmetic over string length, and concatenation, among many other complexity and (un)-decidability results for fragments of theories over strings. Also, in 2017, I proved that the quantifier-free theory of string equations, length function, and string-integer conversion is undecidable. In 2012, I proved that the theory of string equations with a single quantifier-alternation is undecidable.

INDUSTRIAL EXPERIENCE

Oct 2017 – Jun 2019, Founding Advisor, **Quantstamp and Blockchain Development Labs (BDL)**, Toronto, Ontario, Canada: Advisor on security analysis methods

May 1999 - Aug 1999, Research Intern, SRI International, Menlo Park, CA, USA: Designed and implemented a slicing tool for the Java programming language

Feb 1996 - Sep 1997, Software Engineer, Texas Instruments (India) Ltd, Bangalore, India: Designed and implemented instruction set simulators for TI's C54x DSP chips

Nov 1994 - Dec 1995, Software Engineer, Larsen & Toubro (India) Ltd, Mumbai, India: Designed and implemented software for industrial programmable logic controllers

PUBLICATION METRICS

Below find a list of top-tier **ACM, IEEE, or AAAI** computer science venues where my most important papers have been published. All these venues are ranked highly (i.e., A* or A) by the well-regarded conference ranking website CORE. In addition, I have also published papers at top-tier journals such as Communications of the ACM **(CACM)**, Journal of Automated Reasoning (**JAR**), IEEE Transactions on Information Theory (**IEEE Trans. Inf. Theory**), Journal of Symbolic Computation (**JSC**), Annals of Mathematics and Artificial Intelligence (**AMAI**), and American Physical Society's Physical Review Research (**PRR**). I have over 100 publications at the following and other venues.

Topic	Venue ID	Full Name of Venue	CORE	Number of Papers
Artificial Intelligence	AAAI	Association for Advancement of Artificial Intelligence	**A***	13
Formal Methods	CAV	International Conference on Computer Aided Verification	**A***	10
Artificial Intelligence	IJCAI	International Joint Conference on Artificial Intelligence	**A***	6
Software Engineering	ICSE	International Conference on Software Engineering	**A***	4
Computer Security	CCS	International Conference on Computer and Communications Security	**A***	2
Software Engineering	FSE	Foundations of Software Engineering	**A***	1
Artificial Intelligence	NeurIPS	International Conference on Neural Information Processing Systems	**A***	1
Artificial Intelligence	ICML	International Conference on Machine Learning	**A***	1
Programming Languages	POPL	Symposium on Principles of Programming Languages	**A***	1
Automated Reasoning	SAT	Theory and Application of Satisfiability Testing	**A**	12
Automated Reasoning	CP	Principles and Practice of Constraint Programming	**A**	4
Software Engineering	ISSTA	International Symposium on Software Testing and Analysis	**A**	2

PUBLICATIONS

The names of the authors listed below are presented in order of their contributions, with the highest contributor first. The names of my students are marked with a '*' and those of my postdoctoral fellows with a '**'. You can also find my publications on DBLP, as well as on Google Scholar.

BOOK CHAPTERS

B1. **Vijay Ganesh** and Moshe Vardi. 2020. On the Unreasonable Effectiveness of SAT Solvers. In Tim Roughgarden (Ed.), **Beyond the Worst-case Analysis of Algorithms. Cambridge University Press (CUP).** pp. 547-567.

T1.   **Vijay Ganesh**. PhD Thesis Title: Decision Procedures for Bit-vectors, Arrays, and Integers. Stanford University, Stanford, CA, USA. September 2007. Advisor: David L. Dill.

PEER-REVIEWED CONFERENCE PUBLICATIONS

C1.   Prithwish Jana*, Piyush Jha*, Haoyang Ju, Gautham Kishore, Aryan Mahajan, and **Vijay Ganesh**. CoTran: An LLM-Based Code Translator Using Reinforcement Learning with Feedback from Compiler and Symbolic Execution. In the Proceedings of the 27th European Conference on Artificial Intelligence (**ECAI 2024**). Santiago De Compostela, Spain, Oct 19-24, 2024. 4011-4018.

C2.   Behkish Nassirzadeh*, Albert Heinle, Stefanos Leonardos, Anwar Hasan, and **Vijay Ganesh**. CountChain: A Decentralized Oracle Network for Counting Systems. IEEE International Conference on Blockchain (**Blockchain 2024**). Copenhagen, Denmark, Aug 19-22, 2024. 324-331.

C3.   Zhengyang Lu, Stefan Siemer, Piyush Jha, Joel Day, Florin Manea, and Vijay Ganesh. Layered and Staged Monte Carlo Tree Search for SMT Strategy Synthesis. In the Proceedings of the 33rd International Joint Conference on Artificial Intelligence (**IJCAI 2024**). Jeju Island, South Korea, Aug 3-9, 2024. 1907-1915.

C4.   Zhengyu Li*, Curtis Bright, and **Vijay Ganesh**. A SAT Solver + Computer Algebra Attack on the Minimum Kochen-Specker Problem. In the Proceedings of the 33rd International Joint Conference on Artificial Intelligence (**IJCAI 2024**). Jeju Island, South Korea, Aug 3-9, 2024. 1898-1906.

C5.   Behkish Nassirzadeh*, Stefanos Leonardos, Anwar Hasan, Vijay Ganesh. AdChain: Decentralized Header Bidding. In the Proceedings of the 5th International Conference on Mathematical Research for the Blockchain Economy (**MARBLE 2024**). Malaga, Spain, 9-11 July, 2024.

C6.   Piyush Jha*, Joseph Scott*, Jaya Sriram Ganeshna, Mudit Singh, and **Vijay Ganesh**. BertRLFuzzer: A BERT and Reinforcement Learning based Fuzzer. In the Proceedings of the 38th AAAI Conference on Artificial Intelligence (**AAAI 2024**). Vancouver, Canada, Feb 20-27, 2024. Pages 23521-23522.

C7.   Conor Duggan*, Zhengyu Li*, Curtis Bright, and **Vijay Ganesh**. A SAT + Computer Algebra System Verification of the Ramsey Problem R(3,8). In the Proceedings of the 38th AAAI Conference on Artificial Intelligence (**AAAI 2024**). Vancouver, Canada, Feb 20-27, 2024. Pages 23480-23481.

C8.   Zhengyu Li*, Curtis Bright, and **Vijay Ganesh**. A SAT Solver and Computer Algebra Attack on the Minimum Kochen-Specker Problem. In the Proceedings of the 38th AAAI Conference on Artificial Intelligence (**AAAI 2024**). Vancouver, Canada, Feb 20-27, 2024. Pages 23559-23560.

C9.   Zifan Wang, Saranya Vijayakumar, Kaiji Lu, **Vijay Ganesh**, Somesh Jha, and Matt Fredrikson. Grounding Neural Inference with Satisfiability Modulo Theories. In the Proceedings of the International Conference on Neural Information Processing (**NeurIPS 2023**). New Orleans, USA, Dec 10-15, 2023. NeurIPS 2023 Spotlight.

C10.   Marc Vinyals, Chunxiao Li*, Noah Fleming, Antonina Kolokolova, and **Vijay Ganesh**. Limits of CDCL Learning via Merge Resolution. In the Proceedings of the 26th International Conference on Theory and Applications of Satisfiability Testing (**SAT 2023**). Alghero, Italy, July 4-8, 2023.

C11.   Albert Oliveras, Chunxiao Li*, Darryl Wu*, Jonathan Chung*, and **Vijay Ganesh**. Learning Shorter Redundant Clauses in SDCL Using MaxSAT. In the Proceedings of the 26th International Conference on Theory and Applications of Satisfiability Testing (**SAT 2023**). Alghero, Italy, July 4-8, 2023.

C12. Fuat Can Beylunioglu, Mehrdad Pirnia, P. Robert Duimering, and **Vijay Ganesh**. Robust Training for AC-OPF. In the Proceedings of the 37th AAAI Conference on Artificial Intelligence (**AAAI 2023**). Washington D.C., USA, Feb 7-14, 2023.

C13. Behkish Nassirzadeh*, Huaiying Sun, Sebastian Banescu, and **Vijay Ganesh**. Gas Gauge: A Security Analysis Tool for Smart Contract Out-of-Gas Vulnerabilities. In the Proceedings of the 3rd International Conference on Mathematical Research for Blockchain Economy (**MARBLE 2022**), Vilamoura, Portugal, July 12-14, 2022.

C14. Dhananjay Ashok, Vineel Nagisetty*, Christopher Srinivasa, and **Vijay Ganesh**. A Solver + Gradient Descent Training Algorithm for Deep Neural Networks. In the Proceedings of the 31st International Joint Conference on Artificial Intelligence (**IJCAI 2022**). Vienna, Austria, July 23–29, 2022.

C15. Joseph Scott*, Trishal Sudula, Hammad Rehman, Federico Mora, and **Vijay Ganesh**. BanditFuzz: Fuzzing SMT Solvers with Multi-agent Reinforcement Learning. In the Proceedings of the 24th International Symposium on Formal Methods (**FM 2021**), Virtual Conference (Beijing, China), Nov 20-26, 2021. Pages 103-121.

C16. Z3str4: A Multi-armed String Solver. Federico Mora, Murphy Berzish*, Mitja Kulczynski, Dirk Nowotka, and **Vijay Ganesh**. Proceedings of the 24th International Symposium on Formal Methods (**FM 2021**), Virtual Conference (Beijing, China), Nov 20-26, 2021. Pages 389-406.

C17. Murphy Berzish*, Joel Day, **Vijay Ganesh**, Mitja Kulczynski, Florin Manea, Federico Mora, and Dirk Nowotka. String Theories involving Regular Membership Predicates: From Practice to Theory and Back. In the Proceedings of the 13th International Conferences on Combinatorics on Words (**WORDS 2021**), Virtual Conference (Rouen, France), Sep 13-17, 2021. Pages 50-64.

C18. Murphy Berzish*, Mitja Kulczynski, Federico Mora, Florin Manea, Joel Day, Dirk Nowotka, and **Vijay Ganesh.** An SMT Solver for Regular Expressions and Linear Arithmetic over String Length. In the Proceedings of the 33rd International Conference on Computer Aided Verification (**CAV 2021**), Virtual Conference (Los Angeles, USA), Jul 20-23, 2021. Pages 289-312.

C19. Chunxiao Li*, Jonathan Chung, Soham Mukherjee, Marc Vinyals, Noah Fleming, Antonina Kolokolova, Alice Mu, and **Vijay Ganesh**. On The Hierarchical Community Structure of Practical Boolean Formulas. In the Proceedings of the 24th International Conference on Theory and Applications of Satisfiability Testing (**SAT 2021**). Virtual Conference (Barcelona, Spain), Jul 5-9, 2021. Pages 359-376.

C20. Joseph Scott*, Aina Niemetz, Mathias Preiner, Saeed Nejati*, and **Vijay Ganesh**. MachSMT: A Machine Learning-based Algorithm Selector for SMT Solvers. Proceedings of the 27th International Conference on Tools & Algorithms for the Construction & Analysis of Systems (**TACAS 2021**), Virtual Conference (Luxembourg), Mar 27 – Apr 1, 2021. Pages 303-325.

C21. Laura Graves*, Vineel Nagisetty*, and **Vijay Ganesh**. Amnesiac Machine Learning. Proceedings of the 35th AAAI Conference on Artificial Intelligence (**AAAI 2021**). Virtual Conference (Vancouver, Canada), Feb 2-9, 2021. Pages 11516-11524.

C22. Dhananjay Ashok, Joseph Scott*, Maysum Panju, Sebastian Wetzel, and **Vijay Ganesh**. Logic-Guided Genetic Algorithms. Accepted at the 35th AAAI Conference on Artificial Intelligence (**AAAI 2021**). Virtual Conference (Vancouver, Canada), Feb 2-9, 2021. Pages 15753-15754.

C23. Curtis Bright*, Kevin K. H. Cheung, Brett Stevens, Ilias S. Kotsireas, and **Vijay Ganesh**. A SAT-based Resolution of Lam's Problem. Accepted at the 35th AAAI Conference on Artificial Intelligence (**AAAI**

2021). Virtual Conference (Vancouver, Canada), Feb 2-9, 2021. Pages 3669-3676.

C24.   Saeed Nejati*, Ludovic Le Frioux, and **Vijay Ganesh**. A Machine Learning-based Splitting Heuristic for Divide-and-Conquer Solvers. In the Proceedings of the 26th International Conference on the Principles and Practices of Constraint Programming (**CP 2020**). Virtual Conference (Louvain-la-Neuve, Belgium), Sep 7-11, 2020. Pages 899-916.

C25.   Haonan Duan, Saeed Nejati*, George Trimponias, Pascal Poupart, and **Vijay Ganesh**. Online Bayesian Moment Matching based SAT Solver Heuristics. Proceedings of the International Conference on Machine Learning (**ICML 2020**). Virtual Conference (Vienna, Austria), Jul 12-18, 2020. Pages 2710-2719.

C26.   Curtis Bright*, Kevin K. H. Cheung, Brett Stevens, Ilias S. Kotsireas, and **Vijay Ganesh**. Unsatisfiability Proofs for Weight 16 Codewords in Lam's Problem. In the Proceedings of the 29th International Joint Conference on Artificial Intelligence (**IJCAI 2020**). Virtual Conference (originally at Yokohama, Japan in July 2020), Jan 7 – Jan 15, 2021. Pages 1460-1466.

C27.   Joseph Scott*, Federico Mora, and **Vijay Ganesh**. BanditFuzz: A Reinforcement-Learning based Performance Fuzzer for SMT Solvers. 12th Working Conference on Verified Software: Theories, Tools, and Experiments (**VSTTE 2020**). Virtual Conference (originally at LA, USA), July 20-21, 2020. Pages 68-86.

C28.   Vincent Vallade, Ludovic Le Frioux, Souheib Baarir, Julien Sopena, **Vijay Ganesh**, and Fabrice Kordon. Community and LBD-based Clause Sharing Policy for Parallel SAT Solving. In the Proceedings of the 23rd International Conference on Theory and Applications of Satisfiability Testing (**SAT 2020**). Virtual Conference (originally at Alghero, Italy), Jul 3 – Jul 10, 2020. Pages 11-27.

C29.   Chunxiao Li*, Noah Fleming, Marc Vinyals, Toniann Pitassi, and **Vijay Ganesh**. Towards a Complexity-theoretic Understanding of Restarts in SAT Solvers. In the Proceedings of the 23rd International Conference on Theory and Applications of Satisfiability Testing (**SAT 2020**). Virtual Conference (originally at Alghero, Italy), Jul 3 – Jul 10, 2020. Pages 233-249.

C30.   Joseph Scott*, Maysum Panju, and **Vijay Ganesh**. Logic Guided Machine Learning. In the Proceedings of the 34th AAAI Conference on Artificial Intelligence (**AAAI 2020**), New York City, USA, Feb 7 – Feb 12, 2020. Pages 13909-13910.

C31.   Curtis Bright*, Ilias Kotsireas, and V**ijay Ganesh**. SAT Solvers and Computer Algebra Systems: A Powerful Combination for Mathematics. In the Proceedings of the 29th Annual International Conference on Computer Science and Software Engineering (**CASCON 2019**), Toronto, Canada, Nov 4, 2019. Pages 323-328.

C32.   Saeed Nejati* and **Vijay Ganesh**. CDCL(Crypto) SAT Solvers for Cryptanalysis. In the Proceedings of the 29th Annual International Conference on Computer Science and Software Engineering (**CASCON 2019**), Toronto, Canada, Nov 4, 2019. Pages 311-316.

C33.   William Zhang*, Sebastian Banescu, Steven Stewart, Leonardo Passos, and **Vijay Ganesh**. M-Pro: Combining Static and Symbolic Analysis for Scalable Testing of Smart Contracts. In the Proceedings of the 30th International Symposium on Software Reliability Engineering (**ISSRE 2019**), Berlin, Germany, Oct 28 – 31, 2019. Pages 456-462.

C34.   Reza Babaee*, **Vijay Ganesh**, and Sean Edwards. Accelerated Learning of Predictive Runtime Monitors for Rare Failure. In the Proceedings of the 19th International Conference on Runtime Verification (**RV 2019**), Porto, Portugal, October 8-11, 2019. Pages 111-128.

C35. Curtis Bright*, Jeurgen Gerhard, Ilias Kotsireas, and **Vijay Ganesh**. Effective Problem-Solving using SAT Solvers. In the Proceedings of the Annual Maple Conference (**Maple 2019**), Waterloo, Ontario, Canada, Oct 15 – Oct 17, 2019. Pages 205-219.

C36. Hari Govind*, Yakir Vizel, **Vijay Ganesh**, and Arie Gurfinkel. Interpolating Strong Induction. In the Proceedings of the 31st International Conference on Computer Aided Verification (**CAV 2019**), New York City, New York, USA, July 15-18, 2019. Pages 367-385.

C37. Adam Kiezun, Philip J. Guo, Pieter Hooimeijer, Michael D. Ernst, and **Vijay Ganesh**. Theory and Practice of String Solvers. In the Proceedings of the 28th ACM SIGSOFT International Symposium on Software Testing and Analysis (**ISSTA 2019**), Beijing, China, July 15-19, 2019. Pages 6-7. ACM IMPACT Paper Award at ISSTA 2019

C38. Curtis Bright*, Dragomir Djokovic, Ilias Kotsireas, and **Vijay Ganesh**. A SAT+CAS Approach to Finding Good Matrices: Examples and Counterexamples. The 33rd AAAI Conference on Artificial Intelligence (**AAAI 2019**), Honolulu, Hawaii, USA, Jan 27 – Feb 1, 2019. Pages 1435-1442.

C39. Joel Day, Paul He*, Florin Manea, Dirk Nowotka, and **Vijay Ganesh.** The Satisfiability of Word Equations: Decidable and Undecidable Theories. In the Proceedings of the 12th International Conference on Reachability Problems (**RP 2018**), Marseille, France, September 24 – September 26, 2018. Pages 15-29.

C40. Saeed Nejati*, Jan Horacek, Catherine Gebotys, and **Vijay Ganesh**. Algebraic Fault Attacks on SHA Hash Functions using Programmatic SAT Solvers. In the Proceedings of the 24th International Conference on the Principles and Practices of Constraint Programming (**CP 2018**), Lille, France, August 26-31, 2018. Pages 737-754.

C41. Edward Zulkoski*, Ruben Martins, Christoph M. Wintersteiger, Robert Robere, Jia Hui Liang*, Krzysztof Czarnecki and **Vijay Ganesh**. The Effect of Structural Measures and Merges on SAT Solver Performance. In the Proceedings of the 24th International Conference on the Principles and Practices of Constraint Programming (**CP 2018**), Lille, France, August 26-31, 2018. Pages 436-452.

C42. Edward Zulkoski*, Ruben Martins, Christoph M. Wintersteiger, Jia Hui Liang*, Krzysztof Czarnecki and **Vijay Ganesh**. Learning Sensitive Backdoors with Restarts. In the Proceedings of the 24th International Conference on the Principles and Practices of Constraint Programming (**CP 2018**), Lille, France, August 26-31, 2018. Pages 453-469.

C43. Curtis Bright*, Albert Heinle, Ilias Kotsireas, and **Vijay Ganesh**. Enumeration of Complex Golay Pairs via Programmatic SAT. Proceedings of 43rd International Symposium of Symbolic and Algebraic Computation (**ISSAC 2018**), New York City, New York, USA, July 16-19, 2018. Pages 111-118.

C44. Jia Hui Liang*, Hari Govind*, Pascal Poupart, Krzysztof Czarnecki, and **Vijay Ganesh**. An Empirical Study of Branching Heuristics through the Lens of Global Learning Rate. In the Proceedings of the 27th International Joint Conference on Artificial Intelligence (**IJCAI 2018**), Stockholm, Sweden, July 13-19, 2018. Pages 5319-5323. IJCAI 'Sister Conference Best Paper Track' Invited Paper 2018

C45. Robert Robere, Antonina Kolkolova, and **Vijay Ganesh**. The Proof Complexity of SMT Solvers. In the Proceedings of the 30th International Conference on Computer Aided Verification (**CAV 2018**), Oxford, United Kingdom, July 14-17, 2018. Pages 275-293.

C46. Dmitry Blotsky*, Federico Mora, Murphy Berzish*, Yunhui Zheng, Ifaz Kabir, and **Vijay Ganesh**. StringFuzz: A Fuzzer for String Solvers. In the Proceedings of the 30th International Conference on Computer Aided Verification (**CAV 2018**), Oxford, United Kingdom, July 14-17, 2018. Pages 45-51.

C47. Jia Hui Liang*, Chanseok Oh, Minu Mathews, Ciza Thomas, Chunxiao Li, and **Vijay Ganesh**. A Machine Learning based Restart Policy for CDCL SAT Solvers. In the Proceedings of the 21st International Conference on Theory and Applications of Satisfiability Testing (**SAT 2018**), Oxford, United Kingdom, July 9-12, 2018. Pages 94-110.

C48. Curtis Bright*, Ilias Kotsireas, and **Vijay Ganesh**. A SAT+CAS Method for Enumerating Williamson Matrices of Even Orders. In the Proceedings of the 32nd AAAI Conference on Artificial Intelligence (**AAAI 2018**), New Orleans, Louisiana, USA, February 2-7, 2018. Pages 6573-6580.

C49. Jia Hui Liang*, Hari Govind*, Pascal Poupart, Krzysztof Czarnecki, and **Vijay Ganesh**. An Empirical Study of Branching Heuristics through the Lens of Global Learning Rate. In the Proceedings of the 20th International Conference on Theory and Application of Satisfiability Testing (**SAT 2017**), Melbourne, Australia, Aug 28 – Sep 1, 2017. Pages 119-135.
Among Top Three Best Papers @ SAT 2017

C50. Saeed Nejati*, Zack Newsham*, Joe Scott*, Jia Hui Liang*, Catherine Gebotys, Pascal Poupart, and **Vijay Ganesh.** A Propagation Rate based Splitting Heuristic for Divide-and-Conquer Solvers. In the Proceedings of the 20th International Conference on Theory and Application of Satisfiability Testing (**SAT 2017**), Melbourne, Australia, Aug 28 – Sep 1, 2017. Pages 251-260.

C51. Murphy Berzish*, Yunhui Zheng, and **Vijay Ganesh**. Z3str3: A String Solver with Theory-Aware Branching. In the Proceedings of the 17th Formal Methods in Computer Aided Design Conference (**FMCAD 2017**), Vienna, Austria, Oct 2-6, 2017. Pages 55-59.

C52. Saeed Nejati*, Jia Hui Liang*, **Vijay Ganesh**, Catherine Gebotys, and Krzysztof Czarnecki. Adaptive Restart and CEGAR-based Solver for Inverting Cryptographic Hash Functions. In the Proceedings of the 9th Working Conference on Verified Software: Theories, Tools, and Experiments (**VSTTE 2017**), Heidelberg, Germany, July 22-23, 2017. Pages 120 - 131.

C53. Sanu Subramanian*, Murphy Berzish*, **Vijay Ganesh,** Omer Tripp. A Solver for a Theory of Bit-vectors and Strings. In the Proceedings of 39th International Conference on Software Engineering (**ICSE 2017**), Companion Vol., Buenos Aires, Argentina, May 20-28, 2017. Pages 124 - 126.

C54. Martin Ochoa, Sebastian Banescu, Cynthia Disenfeld, Gilles Barthe, and **Vijay Ganesh.** Reasoning about Probabilistic Defense Mechanisms against Remote Attacks. In the Proceedings of 2nd IEEE European Symposium on Security and Privacy (**EuroSP 2017**), Paris, France, Apr 26-28, 2017. Pages 499 − 513.

C55. Sebastian Banescu, Zack Newsham*, **Vijay Ganesh**, Christian Collberg, and Alexander Pretchner. Code Obfuscation Against Symbolic Execution Attacks. In the Proceedings of the 32nd Annual Computer Security Applications Conference (**ACSAC 2016**), Los Angeles, USA, Dec 5-9, 2016. Pages 189-200. Outstanding Paper Award @ ACSAC 2016

C56. Murphy Berzish*, Asif Khan, Atulan Zaman, **Vijay Ganesh**, and Derek Rayside. Manifold: An SMT-Based Declarative Language for Electronic and Microfluidic Design Synthesis. Proceedings of the 26th International Conference on Computer Science and Software Engineering Conference (**CASCON 2016**), Toronto, Canada, Oct 31-Nov 2, 2016. Pages 188-193.

C57. Riyad Parvez*, **Vijay Ganesh**, Glenn Wurster, Joe Kirwin, and Paul Ward. Combining Static Analysis and Targeted Symbolic Execution for Scalable Bug-finding in Application Binaries. Proceedings of the 26th International Conference on Computer Science and Software Engineering Conference (**CASCON 2016**), Toronto, Canada, Oct 31-Nov 2, 2016. Pages 116-127.

C58.   Curtis Bright*, **Vijay Ganesh**, Albert Heinle, Ilias Kotsireas, Saeed Nejati*, and Krzysztof Czarnecki. MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. In the Proceedings of the 18th International Conference on Computer Algebra in Scientific Computing (**CASC 2016**), Bucharest, Romania, Sep 19-23, 2016. Pages 117-133. Symbolic Computation + Constraint Solving Track Invited Paper 2016

C59.   Ed Zulkoski*, **Vijay Ganesh**, and Krzysztof Czarnecki. MathCheck: A Math Assistant based on a Combination of Computer Algebra Systems and SAT Solvers. In the Proceedings of the 25th International Joint Conference on Artificial Intelligence (**IJCAI 2016**), New York, USA, July 9-15, 2016. Pages 4228-4223. IJCAI 'Sister Conference Best Paper Track' Invited Paper 2016

C60.   Steven Stewart, Derek Rayside, **Vijay Ganesh**, and Krzysztof Czarnecki. Accelerating the General Simplex Procedure for Linear Real Arithmetic via GPUs. In the Proceedings of the 8th Working Conference on Verified Software: Theories, Tools, and Experiments (**VSTTE 2016**), Toronto, Canada, July 17-18, 2016. Pages 129-138.

C61.   Jia Hui Liang*, **Vijay Ganesh**, Pascal Poupart, and Krzysztof Czarnecki. Learning Rate Based Branching Heuristic for SAT Solvers. In the Proceedings of the 19th International Conference on Theory and Applications of Satisfiability Testing (**SAT 2016**), July 5, 2016. Pages 123-140.

C62.   Jia Hui Liang*, **Vijay Ganesh**, Pascal Poupart, and Krzysztof Czarnecki. Exponential Recency Weighted Average Branching Heuristic for SAT Solvers. Proceedings of the 30th AAAI Conference on Artificial Intelligence (**AAAI 2016**), Tuscon, Arizona, USA, Feb 12, 2016. Pages 3434-3440.

C63.   Jia Hui Liang*, **Vijay Ganesh**, Ed Zulkoski*, Atulan Zaman, and Krzysztof Czarnecki. Understanding VSIDS Branching Heuristic in Conflict-Driven Clause-Learning SAT Solvers. In Proceedings of the 11th International Haifa Verification Conference (**HVC 2015**), Haifa, Israel, Nov 17-19, 2015. Pages 225-241

C64.   Zack Newsham*, William Lindsay*, Jian Hui Liang*, **Vijay Ganesh**, Sebastian Fischmeister, and Krzysztof Czarnecki. SATGraf: Visualising the Evolution of SAT Formula Structure in Solvers. In the Proceedings of the 18th International Conference on Satisfiability Testing (**SAT 2015**), Austin, USA, Sep 24-27, 2015. Pages 62-70.

C65.   Ed Zulkoski*, **Vijay Ganesh**, and Krzysztof Czarnecki. MathCheck: A Math Assistant via a Combination of Computer Algebra Systems and SAT Solvers. In Proceedings of the 25th International Conference on Automated Deduction (**CADE 2015**), Berlin, Germany, Aug 1-7, 2015. pages 607-622. Paper selected for Journal of Automated Reasoning Special Issue on Best Papers at CADE'15

C66.   Yunhui Zheng, **Vijay Ganesh**, Sanu Subramanian*, Omer Tripp, Julian Dolby and Xiangyu Zhang. Effective Search-space Pruning for Solvers of String Equations, Regular Expressions and Length Constraints. In Proceedings of the 27th International Conference on Computer-aided Verification (**CAV 2015**), San Francisco, July 20-24, 2015. Pages 235-254. Paper selected for Formal Methods for System Design Special Issue on Best Papers at CAV'15

C67.   Jia Hui Liang*, **Vijay Ganesh**, Venkatesh Raman, and Krzysztof Czarnecki. Why SAT-based Analysis of Large Real-world Feature Models is Easy. In Proceedings of 19th International Software Product Line Conference (**SPLC 2015**), Nashville, Tennessee, USA, July 20-24, 2015. Pages 91-100. Best paper award at SPLC 2015

C68.   Zack Newsham*, **Vijay Ganesh**, Gilles Audemard, Sebastian Fischmeister and Laurent Simon. The Impact of Community Structure on SAT Solver Performance. In the Proceedings of the 17th International Conference on Theory and Application of Satisfiability Testing (**SAT 2014**), Vienna, Austria, July 14-17, 2014. Pages 252-268. Best student paper award @ SAT 2014

C69.   Yunhui Zheng, Xiangyu Zhang and **Vijay Ganesh**. Z3-str: A Z3-based String Solver for Web Application Analysis. In Proceedings of 9th Joint Meeting on Foundations of Software Engineering (**FSE 2013**), St. Petersburg, Russia, August 18-26, 2013. Pages 114-124. Acceptance Rate 20%

C70.   **Vijay Ganesh**, Mia Minnes, Armando Solar-Lezama and Martin C. Rinard. Word Equations with Length Constraints: What's Decidable? In the Proceedings of the 8th Haifa Verification Conference (**HVC 2012**), Haifa, Israel, Nov 2012. Pages 209-226.

C71.   Fan Long, **Vijay Ganesh**, Michael Carbin, Stelios Sidroglou and Martin C. Rinard. Automatic Input Rectification. In the Proceedings of 34th International Conference on Software Engineering (**ICSE 2012**), Zurich, Switzerland, Jun 2012. Pages 80-90. Acceptance rate 21%.

C72.   **Vijay Ganesh**, Adam Kiezun, Shay Artzi, Philip Guo, Pieter Hooimiejer and Michael Ernst. HAMPI: A String Solver for Testing, Analysis and Vulnerability Detection. In Proceedings of 23rd International Conference on Computer-aided Verification (**CAV 2011**), Snowbird, Utah, USA, July 14 – 20, 2011. Pages 1-19. Invited Tutorial Paper at CAV 2011

C73.   Karthick Jayaraman, **Vijay Ganesh**, Mahesh Tripunitara, Steve Chapin and Martin C. Rinard. Automatic Error Finding for Access-control Policies. In the Proceedings of the 13th ACM Conference on Computer and Communications Security (**CCS 2011**), Chicago, Illinois, USA, November 2011. Pages 163-174. Acceptance Rate 15%.

C74.   Adam Kiezun, **Vijay Ganesh**, Philip J. Guo, Pieter Hoomijier, and Michael D. Ernst. HAMPI: A Solver for String Constraints. In Proceedings of the 18th ACM International Symposium of Testing and Analysis (**ISSTA 2009**), Chicago, USA, July 2009. Pages 105-116. Acceptance Rate 29%. ACM Distinguished (SIGSOFT) Paper Award at ISSTA 2009

C75.   **Vijay Ganesh**, Tim Leek, and Martin C. Rinard. Taint-based Directed Whitebox Fuzzing. In the Proceedings of the 31st International Conference on Software Engineering (**ICSE 2009**), Vancouver, Canada, May 2009. Pages 474-484. Acceptance rate 12%.

C76.   Karthick Jayaraman, **Vijay Ganesh**, David Harvison, Vijay Ganesh and Adam Kiezun. jFuzz: A Concolic Whitebox Fuzzer for Java. In the Proceedings of NASA Formal Methods Symposium (**NFM 2009**), Mountain View, CA, USA, April 2009. Pages 121-125.

C77.   **Vijay Ganesh** and David L. Dill. A Decision Procedure for Bit-vectors and Arrays. In the Proceedings of the 19th International Conference on Computer Aided Verification (**CAV 2007**), Berlin, Germany, July 2007. Pages 519-531. Acceptance Rate 25%

C78.   Cristian Cadar, **Vijay Ganesh**, Peter Pawlowski, David L. Dill, and Dawson Engler. EXE: Automatically Generating Inputs of Death. In the Proceedings of the 13th ACM Conference on Computer and Communications Security (**CCS 2006**) Alexandria, Virginia, USA, November 2006. Pages 322-335. Acceptance Rate 15%. ACM Test of Time Award at CCS 2016

C79.   Sergey Berezin, **Vijay Ganesh**, and David Dill. An Online Proof-Producing Decision Procedure for Mixed-Integer Linear Arithmetic. In the Proceedings of the 9th International Conference on Tools & Algorithms for the Construction & Analysis of Systems (**TACAS 2003**), Warsaw, Poland, Apr 2003. Pages 521-536.

C80.   **Vijay Ganesh**, Sergey Berezin, and David L. Dill. Deciding Presburger Arithmetic by Model Checking and Comparisons with Other Methods. 4th International Conference on Formal Methods for Computer Aided Design (**FMCAD 2002**), Portland, USA, November 2002. Pages 171-186.

C81. Ashok Halambi, Peter Grun, **Vijay Ganesh**, Asheesh Khare, Nikil Dutt, and Alex Nicolau. EXPRESSION: A Language for Architecture Exploration through Compiler/Simulator Retargetability. Proceedings of International Conference on Design Automation and Test in Europe (**DATE 1999**), Munich, Germany, Mar 1999. Pages 485-490. Ten-year Most Influential Paper at DATE 2008

PEER-REVIEWED JOURNAL PUBLICATIONS

J1. Joel Day, **Vijay Ganesh**, Nathan Grewal, Matthew Konefal, and Florin Manea. A Closer Look at the Expressive Power of Logics Based on Word Equations. Theory of Computing Systems. (**TCS 2024**) 68(3) June 2024. Pages 322-379.

J2. Joel Day, Nathan Grewal*, Florin Manea, and **Vijay Ganesh**. On the Expressive Power of String Constraints. Proceedings of the ACM Journal on Programming Languages (**POPL 2023**). Volume 7, January 2023. Pages 278-308.

J3. Murphy Berzish*, Joel Day, **Vijay Ganesh**, Mitja Kulczynski, Florin Manea, Federico Mora, and Dirk Nowotka. Towards More Efficient Methods for Solving Regular-Expression heavy String Constraints. Theoretical Computer Science (**TCS 2023**). Volume 943, January 2023. Pages 50-72. Invited Paper

J4. Joseph Scott*, Aina Niemetz, Mathias Preiner, Saeed Nejati, and **Vijay Ganesh**. MachSMT: A Machine Learning based Algorithm Selector for SMT Solvers. ACM International Journal on Software Tools and Technology (**STTT 2023**). Volume 25, Issue 2, April 2023. Pages 219-239. Invited Journal Paper in STTT Journal 2023

J5. Curtis Bright*, Ilias Kotsireas, and **Vijay Ganesh**. When Satisfiability Meets Symbolic Computation. Communication of the ACM (**CACM 2022**). Volume 65, Number 7, July 2022. Pages 64-72.

J6. **Vijay Ganesh**, Sanjit Seshia, and Somesh Jha. Machine Learning and Logic: A New Frontier in Artificial Intelligence. Springer Journal of Formal Methods in System Design (**FMSD**). Volume 60, Number 3, June 2022. Pages 426-451. Special Issue in Memory of Formal Methods Pioneer and Turing Award Winner Edmund Clarke Jr.

J7. Curtis Bright*, Ilias Kotsireas, Albert Heinle, and **Vijay Ganesh**. Complex Golay Pairs up to Length 28: A Search via Computer Algebra and Programmatic SAT. Journal of Symbolic Computation (**JSC 2021**). Volume 102, January 2021. Pages 153-172.
In Special Issue of JSC 2021

J8. Curtis Bright*, Ilias Kotsireas, and **Vijay Ganesh**. Applying Computer Algebra Systems and SAT Solvers to the Williamson Conjecture. Journal of Symbolic Computation (**JSC 2020**). Volume 100, Dec 2020. Pages 187-209.
In Special Issue of JSC 2020

J9. Sebastian Wetzel, Roger Melko, Joseph Scott*, Maysum Panju, and **Vijay Ganesh**. Discovering Symmetry Invariants and Conserved Quantities by Interpreting Siamese Neural Networks. Physical Review Research (PRR), Volume 2, Issue 3, Sep 2020. American Physical Society. Pages 03349-1 – 10.

J10.   Curtis Bright*, Kevin K. H. Cheung, Brett Stevens, Dominique Roy, Ilias Kotsireas, and **Vijay Ganesh**. A Non-existence Certificate for Projective Planes of Order Ten with Weight 15 Codewords. Springer Journal for Applicable Algebra for Engineering, Communications, and Computing (**AAECC 2020**). Volume 31, Issue 3-4, Mar-Apr 2020. Pages 195-213.

J11.   Curtis Bright*, Ilias Kotsireas, and **Vijay Ganesh**. New Infinite Families of Perfect Quaternion and Williamson Sequences. IEEE Transactions on Information Theory (**IEEE Trans. Inf. Theory 2019**). Volume 66, Issue 12, Dec 2020. Pages 7739-7751.

J12.   Curtis Bright*, Ilias Kotsireas, and **Vijay Ganesh**. The SAT+CAS Paradigm and the Williamson Conjecture (extended abstract). ACM Communications in Computer Algebra (**ACM CCA 2019**), Volume 52, Issue 3, September 2019. Pages 82-84.

J13.   Curtis Bright*, Dragomir Djokovic, Ilias Kotsireas, and **Vijay Ganesh**. The SAT+CAS method for Combinatorial Search with Applications to Best Matrices. Annals of Mathematics and Artificial Intelligence (**AMAI 2019**). Volume 87, Dec 2019. Pages 321-342.

J14.   Jianmei Guo, Jia Hui Liang*, Kai Shi, Dingyu Yang, Jingsong Zhang, **Vijay Ganesh**, Krzysztof Czarnecki, and Huiqun Yu. SMTIBEA: A Hybrid Multi-Objective Optimization Algorithm for Configuring Large Constrained Software Product Lines. International Journal of Software and System Modeling (**SOSM 2019**). Volume 18, Issue 2, August 2019. Pages 1447-1466.

J15.   Yunhui Zheng, **Vijay Ganesh**, Sanu Subramanian*, Omer Tripp, Julian Dolby, and Xiangyu Zhang. Z3str2: An Efficient Solver for Strings, Regular Expressions, and Length Function. Formal Methods in System Design Journal (**FMSD 2017**), Volume 50, Issue number 2-3, June 2017. Pages 249-288.
        Invited Paper in the Formal Methods in System Design Journal 2017

J16.   Ed Zulkoski*, Curtis Bright*, Albert Heinle, Ilias Kotsireas, Krzysztof Czarnecki, and **Vijay Ganes**h. Combining SAT Solvers with Computer Algebra Systems to Verify Combinatorial Conjectures. Journal of Automated Reasoning (**JAR 2017**), Volume 58, Issue 3, March 2017. Pages 313-339. Published by Springer Nature.
        Invited Paper in Special Issue of Journal of Automated Reasoning 2017

J17.   Karthick Jayaraman, Mahesh Tripunitara, **Vijay Ganesh**, Steve Chapin, and Martin C. Rinard. Mohawk: Abstraction-refinement and Bound Estimation for Verifying Access-control Policies. ACM Transactions on Information and System Security (**TISSEC 2013**), Volume 15, Issue number 4, April 2013. Pages 18:1 – 18:28.

J18.   **Vijay Ganesh**, Adam Kiezun, Shay Artzi, Phillip Guo, Pieter Hooimiejer, and Michael D. Ernst. HAMPI: A Solver for Word Equations over Strings, Regular Expressions and Context-free Grammars. ACM Transactions on Software Engineering and Methodology (**TOSEM 2012**), Volume 21, Issue number 4, Nov 2012. Pages 25:1 – 25:28.
        Invited Paper in TOSEM Journal 2012

J19.   Cristian Cadar, **Vijay Ganesh**, Peter Pawlowski, David L. Dill, and Dawson Engler. EXE: Automatically Generating Inputs of Death. ACM Transactions on Information and System Security (**TISSEC 2008**), Volume 12, Issue number 2, December 2008. Pages 10:1-10:38.

PEER-REVIEWED WORKSHOP PUBLICATIONS

W1. Zhengyang Lu, Stefan Siemer, Piyush Jha, Joel Day, Florin Manea, and Vijay Ganesh. Layered and Staged Monte Carlo Tree Search for SMT Strategy Synthesis. In the Proceedings of the 22nd International Workshop on Satisfiability Modulo Theories (**SMT 2024**), Montreal, Canada, July 22-23, 2024.

W2. Zhengyu Li*, Curtis Bright, and **Vijay Ganesh**. An SC-Square Approach to the Minimum Kochen-Specker Problem. In the Proceedings of the 7th International Workshop on Satisfiability Checking and Symbolic Computation (**SC^2 @FLOC 2022**), Haifa, Israel, Aug 12, 2022.

W3. Joseph Scott*, Guanting Pan*, Elias B. Khalil, and **Vijay Ganesh**. Goose: A Meta-Solver for Deep Neural Network Verification. In the Proceedings of the 20th International Workshop on Satisfiability Modulo Theories (**SMT @FLOC 2022**), Haifa, Israel, Aug 11-12, 2022.

W4. Vincent Vallade, Saeed Nejati, Julien Sopena, Souheib Baarir, and **Vijay Ganesh**. Diversifying a Parallel SAT Solver with Bayesian Moment Matching. In Proceedings of the Symposium on Dependable Software Engineering: Theories, Tools, Applications. Beijing, China. Oct 27-29, 2022.

W5. Vineel Nagisetty*, Laura Graves*, and **Vijay Ganesh**. xAI-GAN: Enhancing Generative Adversarial Networks via Explainable AI Systems. In Proceedings of **AAAI-xAI 2021**. Virtual Conference (Vancouver, Canada), Feb 2-9, 2021.

W6. Joseph Scott*, Aina Niemitz, Mathias Preiner, and **Vijay Ganesh**. MachSMT: A Machine Learning-based Algorithm Selector for SMT Solvers. In the Proceedings of the 18th International Workshop on Workshop on Satisfiability Modulo Theories (**SMT 2020**). Virtual Workshop (Paris), July 5-6, 2020.

W7. Joseph Scott*, Federico Mora, and **Vijay Ganesh**. BanditFuzz: A Reinforcement Learning based Performance Fuzzer for SMT Solver. In the Proceedings of the 18th International Workshop on Satisfiability Modulo Theories (**SMT 2020**). Virtual Workshop (Paris, France), July 5-6, 2020.

W8. Curtis Bright*, Kevin K. H. Cheung, Brett Stevens, Ilias S. Kotsireas, and **Vijay Ganesh**. Non-existence Certificates for Ovals in a Projective Plane of Order Ten. In the Proceedings of the 31st International Workshop on Combinatorial Algorithms (**IWOCA 2020**). Virtual Workshop (Bordeaux, France), Jun 8-10, 2020.

W9. Gereon Kramer, Erika Abraham, and **Vijay Ganesh**. Proof Complexity of MCSAT Solvers. In the Proceedings of the 4th International Workshop on Satisfiability Checking and Symbolic Computation (**SC^2 2019**), Bern, Switzerland, 10th July 2019.

W10. Ed Zulkoski*, Robert Robere, Jia Hui Liang*, Ruben Martins, Christoph Wintersteiger, Krzysztof Czarnecki, and V**ijay Ganesh**. Relating Complexity-theoretic Parameters with SAT Solver Performance. Pragmatics of CR Workshop (**PoCR 2017**), Melbourne, Australia, Aug 28-Sep 1, 2017.

W11. **Vijay Ganesh**, Sebastian Benascu, and Martin Ochoa. The Meaning of Attack-resistant Systems. In Proceedings of International Workshop on Programming Languages and Analysis for Security (**PLAS @ ECOOP 2015**), Prague, Czech Republic, July 6, 2015. Pages 49-55.

W12. Nikolaj Bjorner, **Vijay Ganesh**, Raphael Michel, and Margus Veanes. An SMT-LIB Format for Sequences and Regular Expressions. In the Proceedings of the International Workshop on Satisfiability Modulo Theories (**SMT 2012**), Manchester, UK, June 30, 2012. Pages 77-87.

W13. Raphael Michel, **Vijay Ganesh**, Arnaud Hubaux, and Patrick Heymans. An SMT-based Approach to Automated Configuration. In the Proceedings of the International Workshop on Satisfiability Modulo Theories (**SMT 2012**), Manchester, UK, June 30, 2012. Pages 109-119.

W14. **Vijay Ganesh**, Michael Carbin and Martin C. Rinard. Cryptographic Path Hardening: Hiding Vulnerabilities in Software using Cryptography. Off-the-beaten-track. Co-located with Principles of Programming Languages Conference, Philadelphia, USA, Jan 2012.

W15. Saddek Bensalem, **Vijay Ganesh**, et al. An Overview of SAL. In Proceedings of NASA Langley Formal Methods Workshop (**LFM 2000**), Williamsburg, Virginia, USA, June 2000.

EDITED VOLUMES

E1. Arie Gurfinkel and **Vijay Ganesh**: Computer Aided Verification - 36th International Conference, **CAV 2024**, Montreal, QC, Canada, July 24-27, 2024, Proceedings, Part I. Lecture Notes in Computer Science 14681, Springer 2024, ISBN 978-3-031-65626-2.

E2. Arie Gurfinkel and **Vijay Ganesh**: Computer Aided Verification - 36th International Conference, **CAV 2024**, Montreal, QC, Canada, July 24-27, 2024, Proceedings, Part II. Lecture Notes in Computer Science 14682, Springer 2024, ISBN 978-3-031-65629-3.

E3. Arie Gurfinkel and **Vijay Ganesh**: Computer Aided Verification - 36th International Conference, **CAV 2024**, Montreal, QC, Canada, July 24-27, 2024, Proceedings, Part III. Lecture Notes in Computer Science 14683, Springer 2024, ISBN 978-3-031-65632-3.

E4. Zhe Hou and **Vijay Ganesh**. Automated Technology for Verification and Analysis, 19th **ATVA 2021**, Gold Coast Australia, Oct 18-22, 2021. Lecture Notes in Computer Science 12971, Springer 2021.

E5. Cristian Cadar, **Vijay Ganesh**, Raimondas Sasnauskas, and Koushik Sen. Symbolic Execution and Constraint Solving. Dagstuhl Seminar 14442, Volume 4, Issue 10, **Dagstuhl Reports 2015**.

E6. Armin Biere, **Vijay Ganes**h, Martin Grohe, Jakob Nordström, and Ryan Williams. The Theory and Practice of SAT Solving. Dagstuhl Seminar 15171, Volume 5, Issue 4, **Dagstuhl Reports 2015**.

E7. **Vijay Ganesh** and Nicky Williams. Constraints in Software Testing, Verification, and Analysis (**CSTVA 2014**), ACM 2014. ISBN 978-1-4503-2847-0.

INVITED TALKS _____

Institution/Venue (significant venues highlighted in boldface)	Date	Talk Title
1. University of Illinois, Urbana-Champaign, Illinois, USA (Virtual talk)	Nov 2024	At the Intersection of Reasoning and Learning: From Solvers to LLMs

2.	Lawrence Berkeley National Laboratory, Berkeley, USA	Apr 2024	Scientific Discovery via Logic and Machine Learning
3.	Massachusetts Institute of Technology Cambridge, USA (Virtual talk)	Mar 2024	Scientific Discovery via Logic and Machine Learning
4.	R2SR Workshop, University of Colorado, Boulder	Nov 2023	Automated Scientific Discovery via Solvers and Machine Learning
5.	Shonan Village, Shonan, Japan	Oct 2023	A SAT Solver + Computer Algebra Attack on the Minimum Kochen-Specker Problem
6.	**Invited Tutorial @ Constraint Programming (CP 2023), Toronto, USA**	**Aug 2023**	**Machine Learning for Solvers: At the intersection of reasoning and learning**
7.	SAT Reunion program @ Simons Institute, Berkeley, USA	May 2023	A SAT Solver + Computer Algebra Attack on the Minimum Kochen-Specker Problem
8.	Sorbonne University, Paris, France	Dec 2022	Logic Guided Machine Learning and Genetic Algorithms: A New Approach to Automated Scientific Discovery
9.	Memorial University of Newfoundland, Canada	Nov 2022	On the Unreasonable Effectiveness of SAT Solvers: Logic + Machine Learning
10.	Dagstuhl, Saarland, Germany	Oct 2022	A SAT Solver + Computer Algebra Attack on the Minimum Kochen-Specker Problem
11.	AI for Science and Engineering, Waterloo, Canada	Jan 2022	Logic Guided Machine Learning and Genetic Algorithms: A New Approach to Automated Scientific Discovery
12.	Goethe, HPI Potsdam, Hamburg, Frankfurt Institute for Advanced Studies (ADYN group)	Dec 2021	On the Unreasonable Effectiveness of SAT Solvers: Logic + Machine Learning
13.	McGill University, Montreal, Canada	Nov 2021	On the Unreasonable Effectiveness of SAT Solvers: Logic + Machine Learning
14.	Harvard University, Department of Applied Mathematics, Massachusetts, USA	Nov 2021	When Computer Algebra meets Satisfiability: A New Approach to Combinatorial Mathematics
15.	**Keynote @ FroCos 2021, Birmingham, UK**	**Sep 2021**	**On the Unreasonable Effectiveness of SAT Solvers: Logic + Machine Learning**
16.	Rice University, Texas, USA	Aug 2021	When Computer Algebra meets Satisfiability: A New Approach to Combinatorial Mathematics
17.	SC^2 Workshop, College Station, Texas, USA	Aug 2021	Machine learning and Logic Solvers: The Next Frontier
18.	Bowie State University, Maryland, USA	Apr 2021	On the Unreasonable Effectiveness of SAT Solvers: Logic + Machine Learning

19. University of Gottingen, Germany	Mar 2021	On the Unreasonable Effectiveness of SAT Solvers: Logic + Machine Learning
20. Waterloo Crypto Seminar, University of Waterloo, Ontario, Canada	Mar 2021	On the Unreasonable Effectiveness of SAT Solvers: Logic + Machine Learning
21. Waterloo ECE Society, University of Waterloo, Ontario, Canada	Mar 2021	At the Confluence of Logic and Machine Learning
22. Simons Semester on SAT, Berkeley, CA, USA	Feb 2021	Perspectives on Practice and Theory of SAT Solving
23. Waterloo Computational Mathematics Colloquium, University of Waterloo	Oct 2020	Machine Learning and Logic Solvers: The Next Frontier
24. International Congress on Mathematical Software, Braunschweig, Germany	Jul 2020	Machine Learning and Logic Solvers: The Next Frontier
25. Vector Institute, Toronto, Canada	Feb 2020	Machine learning and Logic Solvers: The Next Frontier
26. Indian Institute of Technology, Bombay, India	Dec 2019	Machine Learning and Logic Solvers: The Next Frontier
27. Sorbonne University (previously, UPMC), Paris, France	Sep 2019	Machine Learning for SAT Solvers
28. Hasso Plattner Institute, Potsdam, Germany	Aug 2019	Machine Learning for SAT Solvers
29. Keynote @ International Symposium on Software Testing and Analysis (ISSTA), Beijing, China	**July 2019**	**ACM IMPACT Paper Award: Theory and Practice of String Solvers**
30. Indian SAT/SMT Winter School, IIIT, Hyderabad, India	Dec 2018	SAT and SMT Solvers: A Foundational Perspective (3 lectures)
31. Waterloo AI Institute, Canada	Oct 2018	Machine Learning for SAT Solvers
32. Marktoberdorf Summer School on Dependable and Secure Software Systems, Marktoberdorf, Germany	Sep 2018	SAT and SMT Solvers: A Foundational Perspective (4 lectures)
33. Theory and Practice of Satisfiability Solving, BIRS, Oaxaca, Mexico	Aug 2018	Machine Learning for SAT Solvers
34. Plenary Talk @ The 24th Conference on Applications of Computer Algebra (ACA 2018), Santiago De Compostela, Spain	**Jun 2018**	**Plenary Talk: SAT Solvers and Computer Algebra Systems: A Powerful Combination for Mathematics**
35. University of Kiel, Germany	Apr 2018	Mergeability and the Unreasonable Effectiveness of SAT Solvers

36. East China University of Science & Technology, Shanghai, China	Apr 2018	On the Unreasonable Effectiveness of SAT Solvers
37. Academia Sinica, Taipei, Taiwan	Apr 2018	On the Unreasonable Effectiveness of SAT Solvers
38. National University of Singapore	Apr 2018	On the Unreasonable Effectiveness of SAT Solvers
39. Microsoft Research, Bangalore, India	Jan 2018	On the Unreasonable Effectiveness of SAT Solvers
40. Indian Institute of Science, Bangalore, India	Dec 2017	On the Unreasonable Effectiveness of SAT Solvers
41. CSTVA 2017 Workshop, Melbourne, Australia	Aug 2017	On the Unreasonable Effectiveness of SAT Solvers
42. David Dill @ 60 Workshop, Heidelberg, Germany	Jul 2017	On the Unreasonable Effectiveness of SAT Solvers
43. University of Luxembourg	Jul 2017	On the Unreasonable Effectiveness of SAT Solvers
44. Hasso Plattner Institute, Potsdam, Germany	Jul 2017	On the Unreasonable Effectiveness of SAT Solvers
45. Rice University, Houston, USA	Jun 2017	On the Unreasonable Effectiveness of SAT Solvers
46. University of Wisconsin, Madison, USA	Jun 2017	On the Unreasonable Effectiveness of SAT Solvers
47. University of Washington, Seattle, USA	Jun 2017	On the Unreasonable Effectiveness of SAT Solvers
48. Microsoft Research, Redmond, USA	Jun 2017	On the Unreasonable Effectiveness of SAT Solvers
49. Achim Kempf Research Group, Waterloo, Canada	Jun 2017	On the Unreasonable Effectiveness of SAT Solvers
50. IQC, Waterloo, Canada	Jun 2017	On the Unreasonable Effectiveness of SAT Solvers
51. Inria/Loria, Nancy, France	Apr 2017	On the Unreasonable Effectiveness of SAT Solvers
52. Max Planck Institute (MPI), Saarbrucken, Germany	Apr 2017	On the Unreasonable Effectiveness of SAT Solvers
53. Moscow State University, Moscow, Russia	Apr 2017	On the Unreasonable Effectiveness of SAT Solvers
54. College of Engineering, Trivandrum, India	Sep 2016	Towards a Deeper Empirical Understanding of CDCL SAT Solvers
55. Institute for Mathematical Sciences, NUS, Singapore	Sep 2016	Towards a Deeper Understanding of Branching Heuristics in SAT Solvers

56. Fields Institute, Toronto, Canada	Aug 2016	Towards a Deeper Understanding of Branching Heuristics in SAT Solvers
57. Keynote @ CSTVA, Saarbrucken, Germany	**Jul 2016**	**Towards a Deeper Empirical Understanding of CDCL SAT Solvers**
58. Moscow State University, Moscow, Russia	Apr 2016	Towards a Deeper Empirical Understanding of CDCL SAT Solvers
59. St. Petersburg State, Chebyshev Labs, Russia	Apr 2016	Towards a Deeper Empirical Understanding of CDCL SAT Solvers
60. SRI International, Menlo Park, CA, USA	Jul 2015	Towards a Deeper Empirical Understanding of CDCL SAT Solvers
61. University of California, Berkeley, CA, USA	Jul 2015	Towards a Deeper Empirical Understanding of CDCL SAT Solvers
62. Moscow State University, Russia	Jun 2015	Towards a Deeper Empirical Understanding of CDCL SAT Solvers
63. Dagstuhl, Saarland, Germany	Apr 2015	Towards a Deeper Empirical Understanding of CDCL SAT Solvers
64. Computer Algebra Group, U. of Waterloo, Canada	Mar 2015	An Introduction to SAT/SMT Solvers
65. Dagstuhl, Saarland, Germany	Feb 2015	Impact of Community Structure on SAT Solver Performance
66. Institute of Mathematical Sciences, Chennai, India	Feb 2015	Impact of Community Structure on SAT Solver Performance
67. MapleSoft Inc., Waterloo, Canada	Dec 2014	Solvers for Software Reliability and Security
68. IBM PL Day, TJ Watson Center, NY, USA	Nov 2014	Impact of Community Structure on SAT Solver Performance
69. Dagstuhl, Saarland, Germany	Oct 2014	SAT/SMT Solvers and Applications: Key Ideas and Future Directions
70. Dagstuhl, Saarland, Germany	Aug 2014	Impact of Community Structure on SAT Solver Performance
71. Banff Mathematical Research Station, Canada	Jan 2014	VSIDS Branching Heuristic and Timed Graph Centrality
72. Institute of Mathematical Sciences, Chennai, India	Dec 2013	Undecidability Results for Word Equations, Regular Expressions, and Length Function
73. Aspiring Minds, New Delhi, India	Dec 2013	Solvers for Software Reliability and Security
74. ICCC 2013, College of Engineering, Trivandrum, India	Dec 2013	Solvers for Software Reliability and Security

75.	ADDCT 2013, Lake Placid, NY, USA	Jun 2013	Undecidability Results for Word Equations, Regular Expressions, and Length Function
76.	Google Inc., New York City, New York, USA	Jun 2013	Solvers for Software Reliability and Security
77.	HCSS, Annapolis, Maryland, USA	May 2013	String Solvers for Reliability and Security
78.	Kesterel Institute, Palo Alto, California, USA	May 2013	Solvers for Software Reliability and Security
79.	Purdue University, IN, USA	May 2013	Solvers for Software Reliability and Security
80.	University of Iowa, Iowa City, USA	May 2013	Solvers for Software Reliability and Security
81.	Dagstuhl, Saarland, Germany	Feb 2013	SAT/SMT Solvers for Reliability, Security, and Repair
82.	**Keynote at CSTVA'12, Montreal, Canada**	**Apr 2012**	**Solvers for Software Reliability and Security**
83.	Dagstuhl, Saarland, Germany	Feb 2012	SAT/SMT Solvers for Reliability and Security
84.	**nvited Tutorial @ CAV 2011, Snowbird, Utah, USA**	**Jul 2011**	**HAMPI: A String Solver for Testing, Analysis & Vulnerability Detection**
85.	Dagstuhl, Saarland, Germany	Aug 2011	SAT/SMT Solvers for Software Reliability and Security
86.	Dagstuhl, Saarland, Germany	Jul 2011	SAT/SMT Solvers for Software Reliability and Security
87.	Dagstuhl, Saarland, Germany	Apr 2010	SAT/SMT Solvers for Software Reliability and Security
88.	Massachusetts Institute of Technology Lincoln Labs, USA	Feb 2008	Constraint Solvers for Program Analysis and Bug-finding
89.	Massachusetts Institute of Technology, Cambridge, USA	Nov 2007	Constraint Solvers for Program Analysis and Bug-finding
90.	Coverity Inc. San Francisco, CA, USA	Sep 2007	The STP Bit-vector and Array Solver

TEACHING

COURSES DEVELOPED

Computer-aided Reasoning for Software Engineering (ECE 750-T28): At the University of Waterloo, I developed a graduate course on computer-aided reasoning (SAT/SMT solvers and proof assistants) and their applications in software engineering, security, AI, and mathematics. The course is divided into three modules: In the first module, I cover the basics of mathematical logic, such as proof

systems and their properties (e.g., soundness, completeness), first-order theories, incompleteness, as well as computability and complexity theory. In the second module, I cover modern conflict-driven clause-learning SAT solvers, SMT solvers, their design and architecture, combination of theories, DPLL(T) etc. Finally, in the third module I cover application of SAT/SMT solvers to verification and analysis of software systems, with a special focus on symbolic execution-based testing and analysis. The course also has a project component, and the students are required to build a system based on an existing SAT or SMT solvers (or develop their own solver) as part of their project. The course has been very well received by students and many course projects have been converted into published papers at top-tier conferences.

Discrete Mathematics and Logic (ECE 208): At the University of Waterloo, I helped develop a discrete math and logic undergraduate course (ECE 208) for ECE students who may not have had any background in logic, computability, and complexity theory. The course is quite comprehensive in that it covers Boolean logic, first-order logic, computability, and basic complexity theory. There is also a strong focus on the Boolean satisfiability problem and SAT solver algorithms. This course has been very well received by my students and is one of my favorite undergraduate courses.

COURSES TAUGHT (Georgia Tech)

Term and Year	Course Number/Name	Enrollment
Spring 2025 (Graduate)	CS4510 (Automata and Complexity)	71
Fall 2024 (Graduate)	CS8803 (SAT and SMT Solvers: Theory, Practice, and Applications)	25

COURSES TAUGHT (Waterloo)

Term and Year	Course Number/Name	Enrollment
Fall 2022 (Graduate)	ECE650 (Methods and Tools for Software Engineering)	165
Spring 2022 (Undergraduate)	ECE208 (Discrete Mathematics and Logic)	112
Fall 2021 (Graduate)	ECE650 (Methods and Tools for Software Engineering)	187
Fall 2021 (Graduate)	ECE 750-T28 (Computer-aided Reasoning)	13
Spring 2021 (Graduate)	ECE653 (Software Testing, Quality Assurance, and Maintenance)	64
Spring 2021 (Undergraduate)	ECE208 (Discrete Mathematics and Logic)	132

Fall 2020 (Undergraduate)	ECE208 (Discrete Mathematics and Logic)	184
Spring 2020 (Graduate)	ECE653 (Software Testing, Quality Assurance, and Maintenance)	78
Spring 2019 (Undergraduate)	ECE208 (Discrete Mathematics and Logic)	94
Fall 2018 (Graduate)	ECE 750-T28 (Computer-aided Reasoning)	4
Spring 2018 (Undergraduate)	ECE 351 (Introduction to Compilers)– section 1	70
Spring 2018 (Undergraduate)	ECE 351 (Introduction to Compilers)– section 2	88
Fall 2017 (Graduate)	ECE 750-T28 (Computer-aided Reasoning)	5
Spring 2017 (Undergraduate)	ECE 458 (Introduction to Computer Security)	134
Spring 2017 (Undergraduate)	ECE 351 (Introduction to Compilers)	132
Fall 2016 (Graduate)	ECE 750-T28 (Computer-aided Reasoning)	12
Fall 2015 (Undergraduate)	ECE 250 (Algorithms and Data Structures)	129
Winter 2015 (Graduate)	ECE 750-T28 (Computer-aided Reasoning	7
Winter 2015 (Undergraduate)	ECE 351 (Introduction to Compilers)	69
Spring 2014 (Undergraduate)	ECE 458 (Introduction to Computer Security)	76
Spring 2014 (Undergraduate)	ECE 351 (Introduction to Compilers)	58
Winter 2014 (Undergraduate)	ECE 351 (Introduction to Compilers)	84

Fall 2013 (Graduate)	ECE 750-T28 (Computer-aided Reasoning)	15
Winter 2013 (Undergraduate)	ECE 458 (Introduction to Computer Security)	74
Winter 2013 (Graduate)	Logic Seminar	10

SUPERVISION

From 2011-present, I have (co)-advised and graduated 2 postdoctoral fellows (one was previously my PhD student), 10 PhD and 22 master's students. Of these, 2 are currently tenure-track or tenured professors, 4 others are researchers at companies such as IBM, Amazon, and Quantstamp, and the rest are working as software engineers at leading high-tech companies. I have also co-advised/mentored around two dozen bachelor's students, all of whom are working in leading software companies.

CURRENT STUDENTS AND POSTDOCTORAL FELLOWS (PDFs)

Degree	Name	Advisor	Start	Research topic	End
PhD, GT	Matthew Davis	Vijay Ganesh	08/2024	AI for Code	2028
PhD, GT	Xieting Chu	Vijay Ganesh	08/2024	AI for Science	2029
PhD, GT	Cruise Song	Vijay Ganesh	08/2024	Combination of LEAN and SAT Solvers	2029
PhD, GT	Gregory Constantine	Vijay Ganesh	08/2024	AI for Math	2029
PhD, GT	Brian Li	Vijay Ganesh	08/2023	SAT+CAS for Combinatorial Problems	2028
PhD, GT	Piyush Jha	Vijay Ganesh	08/2023	Combinations of Learning and Reasoning	2028
PhD, GT	Prithwish Jana	Vijay Ganesh	08/2023	Combinations of Learning and Reasoning	2028
PhD, Waterloo	John Lu	Vijay Ganesh	05/2023	Machine Learning for Solvers	2027
PhD, Waterloo	Behkish Nassirzadeh	Vijay Ganesh	05/2019	Security of Blockchain	2025
MS, GT	Salil Kamath	Vijay Ganesh	08/2024	Algorithm Selection	2025
MASc	Darryl Wu	Vijay Ganesh	09/2023	Satisfaction Driven Clause Learning (SDCL) solvers	2025
MASc	Angelo Rajendram	Vijay Ganesh	09/2022	AI for Science	2023

GRADUATED STUDENTS AND POSTDOCTORAL FELLOWS (PDFs)

Degree	Name	Lead Supervisor	Co-supervisor	Grad date	Research topic	First job after graduation
PDF, Waterloo	Curtis Bright	Vijay Ganesh		2019	SAT+CAS for mathematics	Assistant Professor, University of Windsor, Canada
PDF, Waterloo	Souraditya Paul	Vijay Ganesh		2014	Cryptanalysis of hash functions	Associate Professor, IIT, Bhilai, India
PhD	Joe Scott	Vijay Ganesh	Jo Atlee	2024	Meta Solving via Machine Learning for Solvers	Fintech startup
PhD, Waterloo	Chunxiao (Ian) Li	Vijay Ganesh		2023	Reinforcement Learning and Proof Complexity for SAT Solvers	Lecturer, Waterloo
PhD, Waterloo	Murphy Berzish	Vijay Ganesh		2021	String Solvers	Software Engineer, Amazon
PhD, Waterloo	Saeed Nejati	Vijay Ganesh	Cathy Gebotys	2020	SAT-based Cryptanalysis	Applied Scientist, Amazon
PhD, Waterloo	Reza Babaee	Vijay Ganesh	Derek Rayside	2019	ML-based Runtime Verification	Lecturer, University of Waterloo
PhD, Waterloo	Jia Hui Liang	Vijay Ganesh	Krzysztof Czarnecki	2018	Machine Learning for SAT solvers	Senior software engineer at Google
PhD, Waterloo	Ed Zulkoski	Vijay Ganesh	Krzysztof Czarnecki	2018	Complexity-theoretic parameters of SAT formulas	Senior researcher at Quantstamp
PhD and PDF, Waterloo	Curtis Bright	Vijay Ganesh	Krzysztof Czarnecki	2017	SAT+CAS for Mathematics	Assistant Professor, University of Windsor, Canada
PhD, Purdue	Yunhui Zheng*	Xiangyu Zhang Purdue U.	Vijay Ganesh	2014	String solvers for web security analysis	Researcher, IBM TJ Watson Center, NY
PhD, Syracuse	Karthick Jayaraman*	Steve Chapin Syracuse U.	Vijay Ganesh	2010	Security analysis of web applications	Software Engineer, Microsoft, USA
MMath, Waterloo	Conor Duggan	Vijay Ganesh		2024	A verified SAT+CAS solver for Ramsey (3,8)	Software Engineer, Aon Inc., Toronto, Canada
MMath, Waterloo	Tony Pan	Vijay Ganesh		2023	Fuzzers for DNN	Software Engineer, RBC, Toronto, Canada

Degree	Student	Advisor	Co-advisor	Year	Thesis	Current Position
MASc, Waterloo	Jonathan Chung	Vijay Ganesh		2023	Extended Resolution SAT Solvers	Software Engineer, Lorica Cybersecurity
MMath, Waterloo	Brian Li	Vijay Ganesh		2023	SAT+CAS for Combinatorial problems	PhD student, Georgia Tech
MASc, Waterloo	John Lu	Vijay Ganesh		2023	Machine learning for string solvers	PhD student, Waterloo
MASc, Waterloo	Alaina Mahalanobis	Vijay Ganesh		2022	NeuroSymbolic AI for Medicine	Medical student, Western University
MEng, Waterloo	Abinaya Venkatesan	Vijay Ganesh		2022		Software Engineer, RBC, Canada
MASc, Waterloo	Vineel Nagisetty	Vijay Ganesh		2021	Combinations of ML and Logic	Researcher, BorealisAI, Canada
MASc, Waterloo	Laura Graves	Vijay Ganesh		2021	Amnesiac Machine Learning	Software Engineer, Blackberry, Canada
MASc, Waterloo	Behkish Nassirzadeh	Vijay Ganesh		2021	Security of Smart Contracts	PhD student at Waterloo
MASc	Hari Govind	Arie Gurfinkel	Vijay Ganesh	2019	Interpolating Strong Induction	PhD student at Waterloo
MASc	Ian Li	Vijay Ganesh		2019	Complexity of SAT solvers	PhD student at Waterloo
MASc, Waterloo	Dmitry Blotsky	Vijay Ganesh		2018	Fuzzers for string solvers	Software Engineer at Amazon
MEng, Waterloo	Mark Wheatley	Vijay Ganesh		2018	Symbolic execution-based testing	Software Engineer at BlackBerry
MASc, Waterloo	Riyad Parvez	Vijay Ganesh	Paul Ward	2016	Combining static and symbolic analysis	
MASc, Waterloo	Sanu Subramanian	Vijay Ganesh		2015	String and bit-vector solvers for security	Security Engineer, Intel, Waterloo
MASc, Waterloo	Zack Newsham	Vijay Ganesh	Sebastian Fischmeister	2015	Community structure of Boolean SAT instances	Tech Lead, Mushroom Cloud, Toronto
MS, EPFL	Philippe Suter	Viktor Kuncak EPFL	Vijay Ganesh	2008	Combination of decision procedures	Researcher, IBM TJ Watson Center, NY

*I was an unofficial PhD advisor to Yunhui Zheng and Karthick Jayaraman.

EDITORIAL POSITIONS AND STEERING COMMITTEE MEMBER

- **Editor-in-Chief**
  - Springer Birkhauser Book Series titled "Progress in Computer Science and Applied Logic" (**PCSAL**). Jan 2018-2023

- **Associate Editor**
  - Maple Transactions, 2021-present

- **Member of Editorial Board**
  - Journal of Satisfiability (**JSAT**). Oct 2018-present

- **Steering Committee Member**
  - Satisfiability Checking and Symbolic Computation (SC^2) Workshop. 2017-present
  - SAT/SMT/AR Summer School. 2018-present
  - CSTVA Workshop. 2017-present

TECHNICAL PROGRAM COMMITTEES, CHAIR AND REFEREE POSITIONS

Year	Position	Venue
2024	Co-Chair Co-Organizer	CAV 2024 Gen AI Summit 2024, Georgia Tech
2024	PC Member	ICLR 2024, AAAI 2024, SAT 2024, PLDI 2024, IJCAI 2024, NeSym 2024
2023	Co-Organizer	Simons Institute reunion workshop on "Satisfiability: Theory, Practice, and Beyond", Simons Institute @ Berkeley, USA
2023	PC Member	NeurIPS 2023, NeSym 2023, OOPSLA 2023
2022	Co-Organizer	1) Waterloo.ai Institute + WIN Joint Workshop on "AI for Science and Engineering" 2) Waterloo.ai Institute renewal workshop 3) Dagstuhl Seminar on Machine Learning and Logic: The Next Frontier 4) Dagstuhl Seminar on Theory and Practice of SAT and Combinatorial Solving
2022	PC Member	AAAI 2022, SAT 2022, ATVA 2022
2021	Co-Organizer	1) Simons Institute Semester on "Satisfiability: Theory, Practice, and Beyond", Simons Institute @ Berkeley, USA 2) Waterloo ML + Logic Online Colloquium 3) Theory and Practice of String Solving Workshop 2021
2021	PC Co-chair	ATVA 2021

2021	Senior PC Member	IJCAI 2021 (Senior PC Member)
2021	PC Member	CAV 2021, PLDI 2021, AAAI 2021, FM 2021, SOCS 2021, AAAI-xAI workshop 2021
2020	PC Member	POPL 2020, AAAI 2020, IJCAI 2020, ICTAI 2020
2020	Co-organizer	Dagstuhl seminar: Theory and Practice of SAT Solving (postponed to 2021 due to the COVID pandemic)
2019	PC Member	IJCAI 2019, ICISS 2019, ICTAI 2019
2019	Co-organizer	1) Dagstuhl Seminar: Bringing CP, SAT, and SMT together: Next Challenges in Constraint Solving 2) Waterloo Machine Learning and Security Workshop 3) Waterloo Blockchain and Security Workshop
2018	PC Member	CAV 2018, IJCAI 2018, CP 2018, FM 2018, FCSD 2018, IJCAR 2018, SAT 2018, PoS 2018
2017	PC Member	PLDI 2017 (ERC), ICSE 2017 (NIER), CP 2017, FroCoS 2017, ASL Special Session on Computer-aided Proofs 2017, SYNASC 2017, SC^2 2017
2017	Co-chair	1) Association of Symbolic Logic Special Session on Computer-aided Proofs 2017 2) Satisfiability Checking and Symbolic Computation (SC^2) Workshop 2017 3) David Dill @ 60 Workshop held at CAV 2017
2016	PC Member	POPL 2016 (ERC), ISAIM 2016, ICDCIT 2016, ICCS 2016, FM 2016, PAAR 2016, VSTTE 2016, SC^2 2016, USE 2016
2016	Main Organizer	Fields Institute Workshop on Theoretical Foundations of SAT Solving, Toronto, Canada. Aug 15-19, 2016
2015	PC Member	AAAI 2015, FM 2015, SMT 2015, VSTTE 2015, USE 2015, ASSESS 2015, CCS-SPSM 2015
2015	Co-chair	SMT Workshop 2015
2015	Co-organizer	Dagstuhl seminar: Theory and Practice of SAT Solving, Apr 19-24, 2015
2014	PC Member	ASSESS 2014, CSTVA 2014
2014	Co-chair	Constraint Solvers for Testing, Verification, and Analysis 2014. Held alongside ICSE 2014
2014	Co-organizer	Dagstuhl seminar: Symbolic Execution and Solving, Oct 27-30, 2014
2013	PC Member	FroCos 2013, CSTVA 2013
2012	PC Member	SMT 2012, IEEE NCA 2012
2011	PC Member	SMT 2011, IEEE NCA 2011

2011	Organizer	International Summer School on SAT/SMT Solvers at MIT, Cambridge, MA, USA. June 12-17, 2011
2004	Organizer	International School on Combination of Decision Procedures @ SRI International and Stanford University, CA, USA. Aug 6-12, 2004

JOURNAL REVIEWER

- Nature Scientific Report
- Nature Communications
- Communication of the ACM (CACM) – ACM
- Journal of Automated Reasoning (JAR) – Springer
- Journal of Computational Algebra (JACA) – European Mathematical Society
- Artificial Intelligence Journal (AI) – Elsevier
- Formal Methods in Systems Design (FMSD) – Springer
- Mathematical Reviews (MR) – American Mathematical Society
- Information Processing Letters (IPL)
- PLOS-One
- International Journal on Graphs and Combinatorics (GCOM)
- International Journal of Artificial Intelligence Tools (IJAIT)
- Journal of Artificial Intelligence Research (JAIR) – AAAI Press
- Journal of Satisfiability (JSAT)
- Algorithms and Complexity in Mathematics, Epistemology, and Science (ACMES)
- ACM Transactions on Software Engineering and Methodology (TOSEM)
- ACM Transactions on Software System and Information Security (TISSEC)
- ACM Transactions on Design Automation of Electronic Systems (TOADES)
- ACM Transactions on Parallel Computing (TOPC)
- Computing Surveys - ACM
- IEEE Transactions on Dependable and Securing Computing (TDSC)
- IEEE Transactions on Software Engineering (TSE)
- IEEE Computer Journal
- IEEE Transactions on Reliability
- IEEE Access
- European Journal of Combinatorics
- Acta Informatica
- AI Communications
- Software Testing, Verification, and Reliability (STVR) – Wiley
- International Journal of Computer Mathematics: Computer Systems Theory (TCOM) – Taylor & Francis

INTERNATIONAL REFEREE POSITIONS

- Knut and Alice Wallenberg Foundation, External Reviewer
- Austrian Science Foundation, External Reviewer
- Canada Foundation for Innovation, Canada, Reviewer
- National Science Foundation (NSF), USA, External Reviewer
- European Research Council (ERC), External Reviewer
- Israel Science Foundation (ISF), External Reviewer
- Royal Swedish Academy of Sciences, External Reviewer
- Icelandic Science Council (IRC), External Reviewer
- Natural Sciences and Engineering Research Council (NSERC), Canada, Reviewer

UNIVERSITY/DEPARTMENTAL COMMITTEES AND INSTITUTES

- Georgia Tech, College of Computing AI Task Force, 2024 – present
- Georgia Tech, Faculty Recruiting Committee, 2023 – present
- Georgia Tech, Tenure and Promotion Committee, 2023 – present

- **University of Waterloo, Waterloo AI Institute Co-Director, 2021 – 2023**
    As a Co-Director of the Waterloo.AI Institute, my role was to help further enhance the reputation of the University of Waterloo as a global leader in **Applied AI research and teaching**. We accomplished this by enabling collaboration between industry and AI researchers at Waterloo, connecting world-leading AI researchers at other institutions with ones at Waterloo, designing and delivering online AI courses, and helping shape governmental policy on AI.
- University of Waterloo, ECE Department, AI Faculty Hiring Committee, 2022-2023
- University of Waterloo, ECE Department, Graduate Studies Committee, 2021 - 2022
- University of Waterloo, Merit Committee, 2020-2021
- University of Waterloo, Engineering Faculty Council, 2020 - 2023
- University of Waterloo, ECE Department Faculty Hiring Committee Member, 2017 – 2020
- University of Waterloo, ECE Department Research Committee, 2017, 2021 - 2022
- University of Waterloo, Engineering Faculty Council, 2013-2014
- University of Waterloo, ECE Department CGS and Vanier Scholarship Committee, 2014
- University of Waterloo, SE/ECE Capstone Design Symposium Referee, 2014 and 2015

PhD/MS DEFENSE COMMITTEE MEMBER*

Name	Degree	University	Supervisor	Year
Sharjeel Khan	PhD	Georgia Tech	Santosh Pande	2024
Shuo Ding	PhD	Georgia Tech	Qirun Zhang	2024
Anissa Kheireddine	PhD	Sorbonne	Souheib Baarir	2023

Liang Xue	PhD	Waterloo	Sherman Shen	2023
Sun Sheng Gu	MASc	Waterloo	Krzysztof Czarnecki	2021
Sima Jamali	PhD	Simon Fraser	David Mitchell	2021
Thibaud Lutillier	PhD	Waterloo	Lin Tan	2020
Mahsa Emam Tabi	PhD	Waterloo	Ladan Tahvildari	2018
Frank Imeson	PhD	Waterloo	Stephen Smith	2017
Vajih Montaghami	PhD	Waterloo	Derek Rayside	2017
Albert Heinle	PhD	Waterloo	Mark Giesbrecht	2016
Ana Sima Claudia	MS	EPFL	George Candea	2015
Elaheh Fata	MASc	Waterloo	Shreyas Sundaram	2013

PhD/MS COMPREHENSIVE (QUALS) EXAM COMMITTEE MEMBER/THESIS READER*

Name	Role	Supervisor	Year
Sharjeel Khan	PhD Quals Committee	Santosh Pande	2024
Shuo Ding	PhD Quals Committee	Qirun Zhang	2024
Ziteng Yang	PhD Quals Committee	Vivek Sarkar	2024
Ben Mikek	PhD Quals Committee	Qirun Zhang	2024
Liang Xue	PhD Comp Exam Committee	Sherman Shen	2022
Hari Govind	PhD Comp Exam Committee	Arie Gurfinkel	2020
Thibaud Lutillier	PhD Comp Exam Committee	Lin Tan	2017
Steven Stewart	MS Comp Exam Committee	Derek Rayside	2015
Frank Imeson	PhD Comp Exam Committee	Steven Smith	2015
Mahsa Emam Tabi	PhD Comp Exam Committee	Ladan Tahvildari	2014
Quinn Hamm	MASc Thesis Reader	Lin Tan	2014
Lie Zhang	MASc Thesis Reader	Lin Tan	2014
Vajih Montaghami	PhD Comp Exam Committee	Derek Rayside	2013
Keyvan Golestan	PhD Comp Exam Committee	Fakhri Karray	2013

* Students not under my co-supervision

The primary focus of my research is the theory and practice of mathematical reasoning or constraint solving algorithms (aka SAT and SMT solvers), and in this context, I have led the development of the following solvers and mathematical reasoning: the STP bit-vector and array solver, the HAMPI string solver, the Z3 family of string solvers (Z3str3 and its predecessors Z3str2 and Z3str), the MapleSAT family of Boolean SAT solvers (MapleCOMSPS, MapleSAT etc.), the MaplePainLeSS parallel SAT solver-based cryptanalysis tools, and the MathCheck conjecture verifier.

In addition to constraint solvers, I have also led the development of around dozen software tools such as automatic software testers, fuzzers, compilers, symbolic simulation engines, instruction-set simulators, retargetable compilers for hardware languages, and math conjecture verifiers. In recent years, I have started working on NeuroSymbolic AI (e.g., combinations of LLMs and DNNs with SAT/SMT solvers), with the goal of making LLMs more logically resilient and trustworthy. Many of my tools are currently in use in more than 100 significant projects in academia and industry.

The MapleSAT Boolean SAT solver is a tool that combines machine-learning based branching and restart heuristics with deduction, a la, conflict analysis. A variant of this solver won two gold medals at the highly competitive SAT competition (main and application tracks) in 2016 and two silver medals at the SAT competition (main and no-limits track) in 2017.

The STP Bitvector and Array Solver is the backend for the KLEE, S2E, BAP, BitBlaze, WebBlaze, and Souper tools. It is used in dozens of companies including at Google, HP, and Apple. The STP solver won the highly competitive annual solver competition, SMTCOMP, in 2006/2010 and placed second in 2011/2014 (bit-vector category). The STP solver played an important role in the development of symbolic execution-based analysis and testing, widely considered a breakthrough in software engineering.

The Z3str family of SMT solvers support a rich theory of strings, regular expressions, and integers aimed at bug-finding, verification, and analysis of string-intensive programs. Additionally, we have also implemented a combination of decision procedure for theories over string equations and bit-vectors in Z3str3 that natively supports functions such as strcpy, strcmp, strncpy, etc. aimed at analysis and testing of C/C++ programs. As of May 2017, Z3str3 string solver is now officially part of Microsoft's Z3 solver.

MathCheck is a tool that combines a SAT solver and a computer algebra system (CAS) aimed at finite verification or counter-example construction for combinatorial math conjectures. As of 2019, we have finitely verified several math conjectures up to bounds not previously attained or have constructed counterexamples for them. For example, using MathCheck we showed that the smallest counterexample to the Williamson conjecture is of order 35, thus settling a problem that had been open since 1944.

SOFTWARE TOOLS

Name of Software	Purpose/Key Innovation	Dates	Awards, Conference Venues, and Journals
MapleSAT family	Reinforcement learning	2015 – present	Winner of two gold medals in 2016,

of SAT solvers	based branching heuristic		two silver medals in 2017, and one bronze medal. SAT 2017/2016, AAAI 2016, HVC 2015, SAT 2014
STP bit-vector and array solver	A constraint solver for bit-vector and arrays	2005 – present	Winner of SMTCOMP (bit-vector) in 2006/2010, & second in 2011/2014. CAV 2007
Z3 family of String solvers	A solver for string equations, regular expressions, and length	2013 – present	ICSE 2017, FMSD 2017 SMT 2016, CAV 2015, FSE 2013
MathCheck conjecture verifier	A math conjecture verifier via a combination of SAT and CAS	2014 – present	JAR 2017, CASC 2016, Invited paper at IJCAI 2016, CADE 2015
Parallel SAT-based Cryptanalysis	A parallel SAT solver using a ML based splitter	2016 – present	SAT 2017, CP 2018
MPro	Smart contract security analysis tool combining static & symbolic analysis	2019 – present	ISSRE 2019
Lynx	A programmatic Boolean SAT solver	2011 – 2012	SAT 2012
HAMPI	A solver for string equations, and regular expressions	2009 – 2012	CAV 2011, ACM SIGSOFT Award at ISSTA 2009 (also, an invited paper at TOSEM 2012)
Mohawk	A model-checking tool for access-control policies	2010 – 2011	CCS 2011, TISSEC 2013
BuzzFuzz	A taint-based whitebox fuzzer for C programs	2008 – 2009	ICSE 2009
jFuzz	A concolic testing tool for Java	2009	NFM 2009