

Education

PhD, Computer Science	University of Waterloo	2017
Thesis: <i>Computational Methods for Combinatorial and Number Theoretic Problems</i>		
MMath, Computational Mathematics	University of Waterloo	2009
BMath, Computational Mathematics	University of Waterloo	2008

Professional Appointments

Assistant Professor	University of Windsor	Current
Postdoctoral Researcher	Carleton University	2020
Postdoctoral Researcher	University of Waterloo	2019
Visiting Postdoctoral Researcher	Wilfrid Laurier University	2019
Research Intern	Maplesoft	2018

Research Interests

Automated reasoning search algorithms, computer-assisted proofs, experimental mathematics, formal verification / counterexample generation of conjectures, and discrete mathematics.

Grants

- Authored the NSERC PDF proposal “Satisfiability Solving + Computer Algebra: A Powerful New Method for Combinatorial Search” that was awarded \$90K. 2020
- Co-authored the research proposal “Amazon AWS for Automated Reasoning” that was awarded \$145K USD in Amazon AWS Credits. (PI: Vijay Ganesh) 2019

Journal Publications

- C. Bright, I. Kotsireas, A. Heinle, V. Ganesh.* Complex Golay Pairs up to Length 28: A Search via Computer Algebra and Programmatic SAT. *Journal of Symbolic Computation*, 2021.
- C. Bright, I. Kotsireas, V. Ganesh.* New Infinite Families of Perfect Quaternion Sequences and Williamson Sequences. *IEEE Transactions on Information Theory*, 2020.
- C. Bright, K. Cheung, B. Stevens, D. Roy, I. Kotsireas, V. Ganesh.* A Nonexistence Certificate for Projective Planes of Order Ten with Weight 15 Codewords. *Applicable Algebra in Engineering, Communication and Computing*, 2020.
- C. Bright, I. Kotsireas, V. Ganesh.* Applying Computer Algebra Systems with SAT Solvers to the Williamson Conjecture. *Journal of Symbolic Computation*, 2020.
- C. Bright, D. Đoković, I. Kotsireas, V. Ganesh.* The SAT+CAS Method for Combinatorial Search with Applications to Best Matrices. *Annals of Mathematics and Artificial Intelligence*, 2019.
- E. Zulkoski, C. Bright, A. Heinle, I. Kotsireas, K. Czarnecki, V. Ganesh.* Combining SAT Solvers with Computer Algebra Systems to Verify Combinatorial Conjectures. *Journal of Automated Reasoning*, 2017.

C. Bright, R. Devillers, J. Shallit. Minimal Elements for the Prime Numbers. *Journal of Experimental Mathematics*, 2016.

Conference Publications

C. Bright, K. Cheung, B. Stevens, I. Kotsireas, V. Ganesh. A SAT-based Resolution of Lam's Problem. To appear in *Proceedings of the 35th AAAI Conference on Artificial Intelligence*, 2021.

C. Bright, K. Cheung, B. Stevens, I. Kotsireas, V. Ganesh. Unsatisfiability Proofs for Weight 16 Codewords in Lam's Problem. *Proceedings of the 29th International Joint Conference on Artificial Intelligence*, 2020.

C. Bright, K. Cheung, B. Stevens, I. Kotsireas, V. Ganesh. Nonexistence Certificates for Ovals in a Projective Plane of Order Ten. *Proceedings of the 31st International Workshop on Combinatorial Algorithms*, 2020.

C. Bright, I. Kotsireas, V. Ganesh. SAT Solvers and Computer Algebra Systems: A Powerful Combination for Mathematics. *Proceedings of the 29th International Conference on Computer Science and Software Engineering*, 2019.

C. Bright, J. Gerhard, I. Kotsireas, V. Ganesh. Effective Problem Solving Using SAT Solvers. *Maple in Mathematics Education and Research, Third Maple Conference Proceedings*, 2019.

C. Bright, D. Đoković, I. Kotsireas, V. Ganesh. A SAT+CAS Approach to Finding Good Matrices: New Examples and Counterexamples. *Proceedings of the 33rd AAAI Conference on Artificial Intelligence*, 2019.

C. Bright, I. Kotsireas, V. Ganesh. A SAT+CAS Method for Enumerating Williamson Matrices of Even Order. *Proceedings of the 32nd AAAI Conference on Artificial Intelligence*, 2018.

C. Bright, I. Kotsireas, A. Heinle, V. Ganesh. Enumeration of Complex Golay Pairs via Programmatic SAT. *Proceedings of the 43rd International Symposium on Symbolic and Algebraic Computation*, 2018.

C. Bright, V. Ganesh, A. Heinle, I. Kotsireas, S. Nejati, K. Czarnecki. MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. *Proceedings of the 18th International Workshop on Computer Algebra in Scientific Computing and the 1st SC² Workshop*, 2016.

C. Bright, A. Storjohann. Vector Rational Number Reconstruction. *Proceedings of the 36th International Symposium on Symbolic and Algebraic Computation*, 2011.

Other Publications

C. Bright, I. Kotsireas, V. Ganesh. The SAT+CAS Paradigm and the Williamson Conjecture (Extended Abstract). *ACM Communications in Computer Algebra*, 2018.

Submitted Publications

C. Bright, I. Kotsireas, V. Ganesh. Satisfiability Checking + Symbolic Computation: A New Approach to Combinatorial Mathematics

Invited Talks

A Resolution of Lam's Problem via Satisfiability Solvers. Canadian Mathematical Society Winter Meeting, Montréal, Canada (Presented Online), December 4, 2020.

SAT Solving with Computer Algebra for Fast, Verified Mathematical Search. University of Windsor School of Computer Science Seminar, Windsor, Canada, March 12, 2020.

SAT Solving with Computer Algebra and its Application to Graph Theory and Geometry. Computational Geometry Lab Seminar, Ottawa, Canada, February 28, 2020.

SAT Solving with Computer Algebra: A Powerful Combinatorial Search Method. UBC Discrete Mathematics Seminar, Vancouver, Canada, September 10, 2019.

SAT Solving with Computer Algebra: A Powerful Combinatorial Search Method. University of Victoria Discrete Mathematics Seminar, Victoria, Canada, September 6, 2019.

SAT Solving with Computer Algebra: A Powerful Combinatorial Search Method. SFU Discrete Mathematics Seminar, Vancouver, Canada, September 3, 2019.

SAT+CAS: A Powerful New Combinatorial Search Method. Ottawa–Carleton Combinatorics & Optimization Seminar Series, Ottawa, Canada, October 5, 2018.

Faster SAT Solving with Applications to Sudoku. Maplesoft, Waterloo, Canada, August 31, 2018.

Improvements to Satisfy and ChromaticNumber. Maplesoft, Waterloo, Canada, March 23, 2018.

Conference and Workshop Talks

Unsatisfiability Proofs for Weight 16 Codewords in Lam’s Problem. International Joint Conference on Artificial Intelligence, Yokohama, Japan (Presented Online), January 14, 2021.

Nonexistence Certificates for Ovals in a Projective Plane of Order Ten. International Workshop on Combinatorial Algorithms, Bordeaux, France (Presented Online), June 8, 2020.

SAT Solvers and Computer Algebra Systems: A Powerful Combination for Mathematics. International Conference on Computer Science and Software Engineering, Markham, Canada, November 4, 2019.

Effective Problem Solving using SAT Solvers. Maple Conference 2019, Waterloo, Canada, October 17, 2019.

Searching for Projective Planes with Computer Algebra and SAT Solvers. Applications of Computer Algebra, Montréal, Canada, July 19, 2019.

A SAT+CAS Approach to Finding Good Matrices: New Examples and Counterexamples. AAI Conference on Artificial Intelligence, Honolulu, USA, January 30, 2019.

MathCheck: A SAT+CAS Mathematical Conjecture Verifier. International Congress on Mathematical Software, Notre Dame, USA, July 26, 2018.

Enumeration of Complex Golay Pairs via Programmatic SAT. International Symposium on Symbolic and Algebraic Computation, New York, USA, July 17, 2018.

A SAT+CAS Method for Enumerating Williamson Matrices of Even Order. AAI Conference on Artificial Intelligence, New Orleans, USA, February 4, 2018.

A SAT+CAS Method for Enumerating Williamson Matrices of Even Order. International Workshop on Satisfiability Checking and Symbolic Computation, Kaiserslautern, Germany, July 29, 2017.

MathCheck2: Combining Learning-based Search (SAT) with Symbolic Computation (CAS).

International Workshop on Satisfiability Checking and Symbolic Computation, Timișoara, Romania, September 24, 2016.

MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. Computer Algebra in Scientific Computing, Bucharest, Romania, September 20, 2016.

MathCheck: A Math Assistant Combining SAT with Computer Algebra Systems. International Joint Conference on Artificial Intelligence, New York, USA, July 12, 2016.

MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. International Workshop on Satisfiability Modulo Theories, Coimbra, Portugal, July 2, 2016.

MathCheck2: A SAT+CAS Verifier for Combinatorial Conjectures. Computationally Assisted Mathematical Discovery and Experimental Mathematics, London, Canada, May 13, 2016.

Vector Rational Number Reconstruction. International Symposium on Symbolic and Algebraic Computation, San Jose, USA, June 9, 2011.

Poster Presentations

Unsatisfiability Proofs for Weight 16 Codewords in Lam’s Problem. International Joint Conference on Artificial Intelligence, Yokohama, Japan (Presented Online), January 14, 2021.

A SAT+CAS Approach to Finding Good Matrices. AAAI Conference on Artificial Intelligence, Honolulu, USA, January 30, 2019.

The SAT+CAS Paradigm and the Williamson Conjecture. International Symposium on Symbolic and Algebraic Computation, New York, USA, July 17, 2018.

A SAT+CAS Method for Enumerating Williamson Matrices of Even Order. AAAI Conference on Artificial Intelligence, New Orleans, USA, February 4, 2018.

Vector Rational Number Reconstruction. East Coast Computer Algebra Day, Waterloo, Canada, April 9, 2011.

Teaching Experience

Introduction to Algorithms and Programming II	111 students	Winter 2021
Elementary Algorithm Design and Data Abstraction	88 students	Fall 2015
Introduction to Computer Science 1	145 students	Spring 2015
Designing Functional Programs	103 students	Fall 2014

Awards

Recipient of a Maple Application Center Editor’s Choice award for developing an interactive Maple worksheet demonstrating how to solve Sudoku using a SAT solver. 2018

Invited paper in the Journal of Automated Reasoning. 2017

Received a 0x\$1.20 reward check from Donald Knuth for pointing out an error in *The Art of Computer Programming*. 2017

Invited paper in the SC² track at Computer Algebra in Scientific Computing. 2016

Recipient of the Morgan Deters award, a \$1200 USD travel grant awarded to select graduate students in the field of Satisfiability Modulo Theories. 2016

Recipient of a TA performance award, receiving \$500 for outstanding performance as a teaching assistant. 2013

Recipient of a University of Waterloo Computer Science special graduate scholarship, receiving \$1000 for my academic standing. 2011

Peer Reviewed and Deployed Programming

Main developer of the SAT+CAS system MathCheck for verifying or finding counterexamples to combinatorial conjectures. Current

Contributor to the computer algebra system Maple 2018 and 2019. My research led to a dramatic improvement in the performance of graph theory and logic commands. 2018

Contributor to the open source number theory library FLINT. Oversaw the implementation of a fast lattice basis reduction algorithm. 2014

Student Supervision

Abinaya Venkatesan, MASC Electrical and Computer Engineering. University of Waterloo. Mentoring a project to apply SAT solvers to problems in circuit complexity (with Vijay Ganesh and Supratik Chakraborty). 2020

Madhur Kumar Sharma, BASC Electrical and Computer Engineering. University of Waterloo. Mentoring a project to find new complementary sequences using SAT solvers. 2020

Noah Rubin, BMath Mathematics. Carleton University. Mentored a Research Training Award (RTA) project for combining integer and constraint programming to search for combinatorial designs (with Kevin Cheung and Brett Stevens). 2020

Abhinav Baid, BEng Computer Science. Birla Institute of Technology and Science. Mentored during Google's Summer of Code program (with William Hart). The project resulted in a high performance implementation of a lattice basis reduction algorithm in the number theory library FLINT. 2014

Service

Co-chair of the 2021 *International Workshop on Satisfiability Checking and Symbolic Computation*. 2021

On the program committee for the 2021 *AAAI Conference on Artificial Intelligence*. 2020

On the program committee for the 2020 *Maple Conference*. 2020

On the program committee for the 2020 *International Workshop on Satisfiability Checking and Symbolic Computation*. 2020

Reviewed papers for the following conferences and journals:

Journal of Integer Sequences

International Symposium on Artificial Intelligence and Mathematics

Computer Algebra in Scientific Computing (2)

International Symposium on Formal Methods

International Workshop on Satisfiability Checking and Symbolic Computation (3)

International Conference on Principles and Practice of Constraint Programming

International Symposium on Symbolic and Numeric Algorithms for Scientific Computing

International Conference on Formal Structures for Computation and Deduction (2)

Notes on Number Theory and Discrete Mathematics

International Symposium on Symbolic and Algebraic Computation

IEEE Access

International Conference on Tools with Artificial Intelligence (2)

Administered the webpage of the Computer Science Graduate Student Association at the University of Waterloo for several years, starting in 2014.

Have been an executive member and volunteer instructor of three university clubs: Mambo Club at the University of Waterloo, KW Salseros at Wilfrid Laurier University, and UOSalsa at the University of Ottawa.

References

Vijay Ganesh
Associate Professor
University of Waterloo
Canada
vganesh@uwaterloo.ca
+1 (519) 888-4567 x32866

Ilias Kotsireas
Professor
Wilfrid Laurier University
Canada
ikotsire@wlu.ca
+1 (519) 884-0710 x2218

Brett Stevens
Professor
Carleton University
Canada
brett@math.carleton.ca
+1 (613) 520-2600 x2125

Erika Ábrahám
Professor
RWTH Aachen University
Germany
abraham@cs.rwth-aachen.de
+49-241/80-21242

Jürgen Gerhard
Director of Research
Maplesoft
Canada
Gerhard.Juergen@web.de

Kevin Cheung
Associate Professor
Carleton University
Canada
kcheung@math.carleton.ca
+1 (613) 520-2600 x2124