

# Curriculum Vitae

## Mark William Giesbrecht

Director of the Cheriton School of Computer Science  
Full Professor with Tenure  
University of Waterloo

### Personal Information

#### Current Address

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### Education

Degree	University	Department	Year
Ph. D.	University of Toronto	Computer Science	1993
M. Sc.	University of Toronto	Computer Science	1988
B. Sc.	University of B.C.	Computer Science	1986

### Employment History

Date	Position	Location
July 2014 – present	Director of School	Cheriton School of Computer Science University of Waterloo
July 2012 – present	Full Professor with tenure	Cheriton School of Computer Science University of Waterloo
Jan. 2009 – July 2011	Associate Director	Cheriton School of Computer Science University of Waterloo
July 2001 – June 2012	Associate Professor with tenure	School of Computer Science University of Waterloo
Sept. 1998 – June 2001	Assistant Professor	Department of Computer Science University of Western Ontario
Jan. 1994 – July 1998	Assistant Professor	Department of Computer Science University of Manitoba
Aug. 1991 – Dec 1994	Compiler Researcher and Developer	Compiler Optimization Group IBM Canada Ltd.

### Awards and Honours

- Association for Computing Machinery (ACM) Distinguished Scientist. Conferred November 2013.
- Synergy Award for Innovation. Natural Sciences and Engineering Research Council of Canada (NSERC). The Symbolic Computation Group (Waterloo), with Maplesoft. 2004.

## Scholarly and Professional Activities

### National and International Level Service

- NSERC Computer Science Liaison Committee. 2015–2019.
- Member Scientific Committee. Scientist Mobility Station (SMS International), Guangxi University for Nationalities, Nanning, China. 2017–present.
- Chair of Panel of Experts, INRIA Evaluation Seminar of theme: *Algorithmics, Computer Algebra and Cryptology*. Chaired a panel of 10 reviewers in the evaluation of 10 INRIA teams. March 2015.
- External Reviewer for Graduate Programs, Department of Computer Science, University of Manitoba. May 2015.
- Chair, ACM Special Interest Group on Symbolic and Algebraic Manipulation (SIGSAM). Elected: August 2007–July 2009.
- Herzberg Prize Committee: Canada’s top prize in Science and Engineering (Natural Sciences and Engineering Research Council of Canada), 2008.
- Brockhouse Prize for Interdisciplinary Research in Science and Engineering Committee: Canada’s top prize in interdisciplinary research in Science and Engineering (Natural Sciences and Engineering Research Council of Canada), 2008.
- NSERC Discovery Grant Selection Committee Member, Natural Sciences and Engineering Research Council, GSC 331, August 2004–May 2007.
- Steering Committee Chair: ACM International Symposium on Symbolic and Algebraic Computation (ISSAC). July 2006–July 2007.
- Steering Committee Member at Large. ACM International Symposium on Symbolic and Algebraic Computation (ISSAC). Elected July 2004–July 2006.
- NSF Grant Selection Panel Member: Numeric, Symbolic and Geometric Computation committee. January, 2000, 2006, 2010.

### Editorial Service

- Editorial Board Member: Journal of Symbolic Computation. May 2003–present.
- Editor: Special Issue of the Journal of Symbolic Computation in Honour of the work of Joachim von zur Gathen (with Daniel Panario). Volume 47, Issue 4, April 2012.
- Editor: Special Issue of the Journal of Symbolic Computation in Honour of the work of Keith Geddes (with Stephen Watt). Volume 46, Issue 7, July 2011.
- Editor in Chief: ACM Communications in Computer Algebra. Bulletin of the ACM Special Interest Group in Symbolic and Algebraic Manipulation. 1999–2001.
- Proceedings Editor, International Symposium on Symbolic and Algebraic Computation (ISSAC), Oxford, U.K. 1994.

### Conferences (Scientific and Program Committees)

- Program Committee Member: International Symposium on Symbolic and Algebraic Computation (ISSAC) 2019. Beijing, China. July 15–28, 2019.
- Program Committee Member: Algorithmic Number Theory Symposium (ANTS), University of Wisconsin, Madison, USA. July 16–20, 2018.
- Program Committee Member: International Symposium on Symbolic and Algebraic Computation (ISSAC) 2017. Kaiserslautern, Germany. July 25–28, 2017.
- Prize Selection Committee: ACM/SIGSAM Richard D. Jenks memorial Prize for Excellence in Software Engineering Applied to Computer Algebra. 2017.

- Program Co-organizer: Third Workshop on Hybrid Methodologies for Symbolic-Numeric Computation (embedded workshop in the International Congress of Industrial Applied Mathematics – ICIAM’15). Beijing, China, August 10-15, 2015.
- Program Committee Member: Workshop on Parallel Symbolic Computation (PASCO’15). Bath, UK, July 10–11, 2015.
- Program Committee Member: Workshop on Symbolic-Numeric Computing (SNC’14). Shanghai, China, July 28–31, 2014.
- Program Committee Member: ACM International Symposium on Symbolic and Algebraic Computation (ISSAC’14), Kobe University, Kobe, Japan, July 23–25, 2014.
- Program Committee Chair: ACM International Symposium on Symbolic and Algebraic Computation (ISSAC’13), Northeastern University, Boston, USA, June 26–29, 2013.
- Program Committee Member: ACM International Symposium on Symbolic and Algebraic Computation (ISSAC’12). Grenoble, France. July 2012.
- Program Co-organizer: Second Fields Workshop on Hybrid Methodologies for Symbolic-Numeric Computation. Waterloo, Canada, November 16–19, 2011.
- Program Committee Member: ACM International Workshop on Symbolic Numeric Computation (SNC’11), San Jose California, USA, June 7–9, 2011.
- Program Co-organizer: SIAM/MSRI Workshop on Hybrid Methodologies for Symbolic-Numeric Computation. MSRI, Berkeley, USA, November 17–19, 2010.
- Program Committee Member: ACM International Symposium on Symbolic and Algebraic Computation (ISSAC’09). Seoul, Korea. July 2009.
- Program Committee Member: Workshop on Symbolic-Numeric Computing (SNC’09). Kyoto, Japan, August 3–5, 2009.
- Program Committee Chair: Milestones in Computer Algebra (MICA’08), Trinidad and Tobago, May 1–3, 2008.
- Program Committee Member: ACM International Symposium on Symbolic Computation (ISSAC’05), Beijing, China, July, 2005.
- Program Committee Member: International Workshop on Symbolic Numeric Computing, Xi’an, China, July, 2005.
- Program Chair: IMACS Applications of Computer Algebra Conference, Raleigh, NC, USA, July 2003.
- Program Committee Member: ACM International Symposium on Symbolic Computation (ISSAC’03), Philadelphia, USA, July 2003.
- Program Committee Member: Symposium on Applied Algebra, Algebraic Algorithms and Error Correcting Codes (AAECC’01), Melbourne, Australia, November 2001.
- Program Committee Member: ACM International Symposium on Symbolic and Algebraic Computation (ISSAC’98), Rostock, Germany. 1998.
- Program Committee member: ACM International Symposium on Symbolic and Algebraic Computation (ISSAC’94), Oxford, UK. 1994.

### Conference Organization

- Session Organizer (with E. Kaltofen and W-s. Lee): *Sparse Models, Interpolation and Polynomials*. SIAM Conference on Applied Algebraic Geometry (SIAM AG13). Ft. Collins, CO, USA. August 2013.
- Session Organizer (with J-G. Dumas): *Symbolic Matrix Algorithms*. International Linear Algebra Society Annual Meeting (ILAS 2013). Providence, RI, USA. June 2013.

- General Chair: Hybrid 2011–Fields Workshop on Symbolic-Numeric Computing. University of Waterloo, November 2011.
- General Chair: Jo60–Conference in honour of Joachim von zur Gathen at 60. Bonn, Germany, May 2010.
- Tutorial Chair: International Symposium on Symbolic and Algebra Computation (ISSAC 2011), San Jose, California. June 2011.
- Session Organizer, IMACS Applications of Computer Algebra Conference, Greece, June 2002.
- General Chair, East Coast Computer Algebra Day (ECCAD 2000). May 13, 2000. University of Western Ontario, London, ON, Canada.
- Organizing Committee member (Treasurer), ACM International Symposium on Symbolic and Algebraic Computation (ISSAC'99), Vancouver, Canada. 1999.

## **University Administrative Duties**

### **July 2014–present: Director of Cheriton School of Computer Science**

The Director is the chief officer for the School of Computer Science, overseeing most aspects of School planning and operations. The School is a semi-autonomous unit within the Faculty of Mathematics at the University of Waterloo, and a very large operation, with more than 100 faculty members, 45 staff, 500 graduate students and 3500 undergraduate students.

Primary directions and duties as Director include:

- Hiring of faculty and staff.
- Fiscal and budgetary oversight.
- School Operations.
- Space management and allocation.
- Strategic plans.
- Industrial relations.
- Development and fundraising.
- Inter-university agreements.
- Program and academic development.
- Faculty and staff performance evaluation.
- Awards.
- Faculty and University-level governance.
- Promotion and tenure of faculty.

### **January 2009–June 2011: Associate Director, Cheriton School of Computer Science**

This is a deputy Director position, providing executive input and support for the Director on important tasks around the School, and acting for the Director when he was unavailable. Committee and other activities included the following:

- Executive Committee
- Operations Committee
- Faculty Performance
- Evaluation Committee
- Space Allocation
- Budget oversight
- Tenure and Promotion Committee
- Undergraduate Academic Plans Committee (curriculum committee).
- Outreach Committee
- Lecturer Hiring Committee

### **July 2008–June 2009: Chair of Graduate Recruitment Committee**

The Graduate Recruitment Chair's role is promoting, advertising and facilitating the recruitment of graduate students into the Cheriton School of Computer Science. This included producing promotional media, organizing recruiting events, and service to the School graduate committee.

### **July 2006–2008: Chair of Undergraduate Recruitment Committee**

The Undergraduate Recruitment Chair is charged with presenting, advertising and marketing the Cheriton School of Computer Science to potential undergraduate students. In 2006 undergraduate applications to Computer Science was at a low, and I implemented more active recruitment events, stronger literature and web presence, and revitalized outreach to high schools in southern Ontario and beyond.

**July 2002–June 2005: Director of Undergraduate Studies**

This was a new position in 2002 (with the creation of the School of CS), combining the undergraduate curriculum and operations chairs. My duties and achievements included:

- Chairing the Undergraduate Operations committee. This includes making teaching assignments for faculty, TA assignments and allocation, and generally overseeing the smooth operation of the undergraduate program.
- Chairing the Undergraduate Academic Plans (curriculum) committee. Primary new projects of the committee included:
  - Development of the double degree in Business and Computer Science (BBA/BCS) between the Cheriton School of CS and the Wilfrid Laurier School of Business and Economics. This was not implemented until 2009 when I was Associate Director of the School.
  - Development of the Bachelor of Computing and Financial Management Degree, between the Cheriton School of CS and the School of Accounting at Finance (UW).
  - Implementation of the new Bachelor of Computer Science (BCS) degree and creation of a new core curriculum (esp. first year).
- Membership on the Software Engineering Curriculum and Operations Committees.
- Membership on the Faculty of Mathematics Undergraduate Affairs Committee, the primary faculty-level undergraduate oversight committee.

## Teaching

### Graduate Courses Taught and Developed

- Computer Science 887: Advanced Symbolic Computation. University of Waterloo. Spring 2007.
- Computer Science 780: Advanced Symbolic Computation. University of Waterloo. Winter 2004.
- Computer Science 887: Advanced Symbolic Computation. University of Waterloo. Winter 2002.
- Computer Science CS826b: Compiler Optimization. University of Western Ontario. Winter 1999, 2000, 2001.
- Computer Science CS827y: Seminar on Symbolic Mathematical Computation. Fall–Winter 2000.
- Computer Science 716: Computer Algebra: Algorithms and Applications. Winter 1996.
- Computer Science 721: Topics in Computer Algebra. Winter 1994.

### Undergraduate Courses Taught and Developed

- Computer Science 135: Designing Functional Programs. University of Waterloo. Fall 2019.
- Computer Science 370: Scientific Computing. University of Waterloo. Fall 2013.
- Computer Science 136: Elementary Algorithm Design and Data Abstraction. University of Waterloo. Winter 2012, Spring 2007, Winter 2007, Winter 2005.
- Computer Science 487/687: Introduction to Symbolic Computation. University of Waterloo. Winter 2009, Winter 2011.
- Computer Science 134: Principles of Computer Science. University of Waterloo. Fall 2003, Winter 2005.
- Computer Science 132: Developing Programming Principles. University of Waterloo. Winter 2003.
- Computer Science 130: Developing Programming Principles. University of Waterloo. Fall 2001.
- Computer Science 447a/545a: Compiler Theory. University of Western Ontario. Fall 2000.
- Computer Science 026: Fundamentals of Computer Science I. University of Western Ontario. Winter 2001.
- Computer Science 402b/535b: Distributed and Parallel Systems. University of Western Ontario. Winter 1999, Winter 2000.
- Computer Science 422a/539a: Foundations of Computer Algebra. University of Western Ontario. Winter 2001, Fall 1998.
- Computer Science 211a: Software Tools and Systems Programming. University of Western Ontario. Fall 1999, Fall 2000.
- Computer Science 101/102: Introductory Computer Science I, II. University of Manitoba. Fall 1997, Winter 1998, Summer 1998.
- Computer Science 206: Discrete Structures and Programming. University of Manitoba. Fall–Winter 1994–5, Summer 1995 (full year course).
- Computer Science 452: Undergraduate Thesis Coordinator. University of Manitoba. 1995–6.
- Computer Science 213: Discrete Mathematics for Computer Science. University of Manitoba. Summer 1996, Fall 1997.
- Computer Science 222: Introduction to Assembler Language Programming. University of Manitoba. Winter 1995.

## Training of Highly Qualified Personnel

### Current Postdoctoral Fellow Supervision

- Dr. Armin Jamshidpey. September 2018–present.
- Dr. Qiaolong Huang. September 2018–present.
- Dr. Hui Huang. September 2017–present.

### Current Graduate Supervision

- Jesse Elliot. MMath. September 2018–present.

### Completed Ph.D. Students

- Dr. Joseph Haraldson. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Matrix Polynomials and their Lower Rank Approximations*. Completed July 2019. Currently: Amazon Inc.
- Dr. Mustafa Elsheikh. PhD. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Smith Normal Form over Local Rings and Related Problems*. Completed August 2017. Currently: Facebook Inc.
- Dr. Albert Heinle. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Computational Approaches to Problems in Noncommutative Algebra–Theory, Applications and Implementations*. Completed September 2016. Currently: Aeryon Labs.
- Dr. Andrew Arnold. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Sparse polynomial interpolation and testing*. Completed March 2015. Currently: Google Inc.
- Dr. Daniel S. Roche. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Efficient Computation with Sparse and Dense Polynomials*. Completed June 2011. Currently: Associate Professor, Department of Computer Science, U.S. Naval Academy.
- Dr. Jason Selby. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Unconventional Applications of Compiler Analysis*. Completed August 2011. Currently: Kernel Developer, Maplesoft Inc.
- Dr. M. Jason Hinek. Cheriton School of Computer Science, University of Waterloo. Thesis title: *On the Security of Some Variants of RSA*. Completed May 2007. Currently: Lecturer, Carleton University, Ottawa.
- Dr. Yang Zhang. Department of Applied Mathematics, University of Western Ontario (with Greg Reid, UWO). Thesis title: *Algorithms for Non-Commutative Differential Operators*. Completed July 2004. Currently: Associate Professor, Department of Mathematics, University of Manitoba.

### Completed Masters Students

- Mr. Nam Pham. Cheriton School of Computer Science, University of Waterloo. Thesis title: *A Symbolic-Numeric Approach to the Projection Method*. Completed August 2016.
- Mr. Joseph Haraldson. Cheriton School of Computer Science, University of Waterloo (with George Labahn). Thesis title: *Computing Approximate GCRDs of Differential Polynomials*. Completed September 2015.
- Mr. Kelvin Chung. Cheriton School of Computer Science, University of Waterloo (with Ilias Kotsireas, WLU). Thesis title: *Using Integer Programming in Finding  $t$ -Designs*. Completed May 2012.
- Mr. Fei Wang. Cheriton School of Computer Science, University of Waterloo (with Ilias Kotsireas, WLU). Thesis title: *Finding Orthogonal Designs with Gröbner Bases*. Completed August 2011.



- Mr. Hrushikesh Tilak. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Computing sparse multiples of polynomials*. Completed August 2010.
- Mr. Ruitong Huang. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Decomposition of Finite-Dimensional Matrix Algebras over  $\mathbb{F}_q(y)$* . Completed August 2010.
- Mr. Myung Sub Kim. Cheriton School of Computer Science, University of Waterloo. Thesis title: *Hermite form computation of matrices of differential polynomials*. Completed August 2009.
- Mr. Chao Li. Cheriton School of Computer Science, University of Waterloo (with Arne Storjohann). Thesis title: *Lattice Compression of Polynomial Matrices*. Completed May 2008.
- Mr. Bradford Hovinen. School of Computer Science, University of Waterloo. Thesis title: *Blocked Lanczos-style Algorithms over Small Finite Fields*. Completed September 2004.
- Mr. Brad Botting. School of Computer Science, University of Waterloo. Thesis title: *Structured Total Least Squares for Approximate Polynomial Operations*. Completed September 2004.
- Mr. Ivo Moravec. School of Computer Science, University of Waterloo. Thesis title: *Fast Arithmetic and Code Generation for Univariate Functions*. Completed January, 2004.
- Mr. Fraser Ruffell. School of Computer Science, University of Waterloo. Thesis title: *Lightweight Statistical Trace Selection for the Dynamic Optimization of Programs*. Completed January 2004.
- Mr. Jason Selby. Department of Computer Science, University of Western Ontario. Thesis title: *A framework for the automatic run-time specialization of Java bytecode*. Completed June 2001.
- Mr. Thulasiraman Jeyaraman. Department of Computer Science, University of Manitoba. Thesis title: *Run-time parallelization of irregular DOACROSS loops*. Completed October 1996.

### Completed Postdoctoral Fellows

- Dr. Andy Novocin. University of Waterloo. September 2011–August 2012. With George Labahn and Arne Storjohann.
- Dr. Clément Pernet. University of Waterloo. October 2006–2008. With George Labahn, Arne Storjohann and Keith Geddes.
- Dr. John May. University of Waterloo. September 2004–August 2006. With George Labahn and Arne Storjohann.
- Dr. Pascal Giorgi. University of Waterloo. January 2005–December 2005. With George Labahn, Arne Storjohann and Keith Geddes.
- Dr. Wen-Shin Lee, University of Waterloo. October 2001–October 2004. With G. Labahn.
- Dr. Arne Storjohann, University of Waterloo. July 2001–July 2002.
- Dr. Arne Storjohann, University of Western Ontario. November 2000–July 2001. With R. Corless, D. Jeffrey, G. Reid, and S. Watt.
- Dr. William Naylor, University of Western Ontario. October 2000 –July 2001. With R. Corless, D. Jeffrey, G. Reid, and S. Watt.
- Dr. Ilias Kotsireas, University of Western Ontario. October 1999– November 2000. With R. Corless, D. Jeffrey, G. Reid, and S. Watt.
- Dr. Andreas Stein, University of Manitoba. 1997–1998. With Hugh C. Williams. Dr. Stein is now a Professor at Universität Oldenburg, Germany.

### Habilitation Committee Membership

- Referee for Habilitation Defence (Habilitation à diriger des Recherches): Dr. Clément Pernet. Université de Grenoble Alpes. Thesis title: *High Performance and Reliable Algebraic Computing*. November 21, 2014, Grenoble, France.

**Ph.D. Committee Membership**

- Dr. Javad Doliskani. Western University, London, Ontario. Thesis title: *Computing in Algebraic Closures of Finite Fields*. Supervisor: Dr. Éric Schost. Completed September 2015.
- Dr. Konstantin Ziegler. Department of Mathematics, University of Bonn. Thesis title: *Counting Classes of Special Polynomials*. Supervisor: Dr. Joachim von zur Gathen. Completed March 2015.
- Dr. Paul Vrbik. Western University, London, Ontario. Thesis title: *Computing Intersection Multiplicity via Triangular Decomposition*. Supervisors: Dr. Marc Moreno Maza and Dr. Éric Schost. Completed December 2014.
- Dr. Fayed Mohammad Mahdi Javadi. Simon Fraser University. Thesis title: *Efficient Algorithms for Computations with Sparse Polynomials*. Supervisor: Dr. Michael Monagan. Completed January 2011.
- Dr. John May. North Carolina State University. Thesis title: *Approximate Factorization Of Polynomials In Many Variables And Other Problems In Approximate Algebra Via Singular Value Decomposition Methods*, Supervisor: Dr. Erich Kaltofen. Completed May 2004.
- Dr. Thomas Cluzeau. L'Université de Limoges, Limoges, France. Thesis title: *Algorithmique modulaire des équations différentielles linéaires*, Supervisor: Dr. Moulay Barkatou and Jacques-Arthur Weil. Completed August 2004.
- Dr. Ha Le. School of Computer Science, University of Waterloo. Thesis title: *Algorithms for the construction of minimal telescopers*. Supervisor: Dr. K. Geddes. Completed February 2003.
- Mr. Howard Cheng. School of Computer Science, University of Waterloo, Canada. Supervisor: Dr. George Labahn. Completed June 2003.
- Dr. Jean-Guillaume Dumas. L'Institut National Polytechnique de Grenoble, Grenoble, France. Thesis title: *Algorithmes parallèles efficaces pour le calcul formel : algèbre linéaire et calcul dans des extensions algébriques*. Supervisor: Dr. T. Gautier. Completed December, 2000.
- Dr. Xianping Liu. Department of Applied Mathematics, University of Western Ontario, Canada. Thesis title: *Symbolic tools for the analysis of nonlinear dynamical systems*. Supervisor: Dr. R. Corless. Completed September 1999.

**Masters Committee Membership**

- Ms. Zheng Qin. School of Computer Science, University of Waterloo. Supervisor: Dr. M. McCool. Completed January, 2004.
- Ms. WeiWei Zheng. School of Computer Science, University of Waterloo. Thesis title: *High Precision Computing Using Iterative Refinement*. Supervisor: Dr. Keith Geddes. Completed September, 2002.
- Mr. Manqing Li. Department of Computer Science, University of Western Ontario. Thesis title: *An Analysis on the Efficient Predicate Dispatching Technique*. Supervisor: Dr. W. Holst. Completed January 2001.
- Ms. Dicheng Liu. Department of Computer Science, University of Western Ontario. Thesis title: *A Notation Selection Tool for MathML*. Supervisor: Dr. S. Watt. Completed January 2001.
- Mr. Gary Molenkamp. Department of Computer Science, University of Western Ontario. Thesis title: *Quality of service violation detection and location in distributed systems*. Supervisor: Dr. H. Lutfiyya. Completed September 2000.
- Mr. Edmund Daniel. Department of Computer Science, University of Western Ontario. Thesis title: *Performance management of distributed systems*. Supervisor: Dr. H. Lutfiyya. Completed December 1999.
- Mr. Nabil Obeid. Department of Computer Science, University of Western Ontario. Thesis title:

*On the simplification of tensor expressions.* Supervisor: Dr. S. Watt. Completed May 2001.

- Mr. Xuehong Li. Department of Computer Science, University of Western Ontario. Thesis title: *XML and the communication of mathematical objects.* Supervisor: Dr. S. Watt. Completed April 1999.
- Ms. Yuxia Guo. Department of Computer Science, University of Western Ontario. Thesis title: *User/Group administration for RBAC.* Supervisor: Dr. S. Osborn. Completed May 1999.
- Mr. Mohammad Farook. Department of Computer Science, University of Manitoba. Thesis title: *Fine-granularity lock free data structures.* Supervisor: Dr. P. Graham. Completed October 1997.
- Mr. Michael Jacobson. Dept. of Computer Science, University of Manitoba. Thesis title: *Computational techniques in quadratic fields.* Supervisor: Dr. H.C. Williams. Completed August 1995.

**Research Funding**

All amounts in Canadian dollars

- 2018–2023.** Natural Sciences and Engineering Research Council (NSERC) Discovery Grant. Principal investigator on individual grant. Title: *Efficiency, Structure and Robustness in Algebraic Computation*. \$205,000 (\$41,000/yr)
- 2013–2018.** Natural Sciences and Engineering Research Council (NSERC) Discovery Grant. Principal investigator on individual grant. Title: *High performance algorithms for sparse and structured symbolic computations*. \$180,000 (\$36,000/yr)
- 2009–2011.** Mathematics of Information Technology and Complex Systems (MITACS) Consortium Grant. Title: *Mathematics of Computer Algebra and Analysis*. One of 12 co-investigators on multi-university (Waterloo, Western, Simon Fraser) grant, in collaboration with industrial partner Maplesoft Inc. \$500,000.
- 2008–2013.** Natural Sciences and Engineering Research Council (NSERC) Discovery Grant. Principal investigator on individual grant. Title: *Sparsity, Complexity and Practicality in Mathematical Computation*. \$160,000.
- 2007–2009.** Mathematics of Information Technology and Complex Systems (MITACS) Consortium Grant. Title: *Mathematics of Computer Algebra and Analysis*. One of 14 co-investigators on this multi-university (Waterloo, Western Ontario, Simon Fraser) grant, in collaboration with industrial partner Maplesoft Inc. \$500,000.
- 2005–2007.** Mathematics of Information Technology and Complex Systems (MITACS) Consortium Grant. Title: *Mathematics of Computer Algebra and Analysis*. One of 14 co-investigators on this multi-university (Waterloo, Western Ontario, Simon Fraser University) grant, in collaboration with industrial partner Maplesoft Inc. In this instance I was officially Principal Co-Investigator (with Peter Borwein, SFU). \$488,000
- 2004.** Natural Sciences and Engineering Research Council (NSERC) Synergy Award for Innovation. With 7 colleagues at Waterloo, Western and SFU, and Maplesoft Inc. The NSERC Synergy Award for Innovation is the national prize from the Canadian Natural Sciences and Engineering Research Council which recognizes examples of collaboration that stand as a model of effective partnership between industry and colleges or universities. \$25,000.
- 2005–2007.** Mathematics of Information Technology and Complex Systems (MITACS) Consortium Grant. Title: *Mathematics of Computer Algebra and Analysis*. One of 14 co-investigators on this multi-university (Waterloo, Western Ontario, Simon Fraser) grant, in collaboration with industrial partner Maplesoft Inc. In this instance I was officially Principal Investigator (with Peter Borwein, SFU). \$900,000.
- 2002–2006.** Natural Sciences Engineering Research Council (NSERC) Strategic Grant. Co-Principal Investigator with Stephen Watt (UWO). Title: *Compiler Middleware for Optimizing Evolving Research Programming Languages*. With industrial partners Maplesoft and IBM Canada. \$489,000.
- 2002–2008.** Natural Sciences and Engineering Research Council (NSERC) Discovery Grant. Principal investigator on individual grant. Title: *Exact and Approximate Algebraic Computation*. \$180,000.
- 2000.** Natural Sciences and Engineering Research Council (NSERC) Research Tools and Instruments Grant. I was Principal Investigator, with 3 other researchers. Title: *Symbolic Computation Server*. \$40,461.
- 1999–2003.** Ontario Research and Development Fund (ORDCF) Grant. Ontario Research Centre for Computer Algebra infrastructure funding. One of 6 researchers (non-PI) on grant to fund ORCCA Research Centre, of which I was a founding member. With industrial support of Maplesoft Inc.

\$6,160,000.

**1992–2002.** Natural Sciences and Engineering Research Council (NSERC) Discovery Grant. Principal investigator on individual grant. Title: *Efficient Symbolic Matrix Computations*. \$120,750.

## Research Publications

*Contributions with supervised students and postdocs are underlined.*

### Submitted for publication

- M. Giesbrecht, H. Huang, G. Labahn and E. Zima. Efficient Rational Creative Telescoping. September 2019. 33pp.

### 2019

- M. Giesbrecht, J. Haraldson and E. Kaltofen. *Computing Approximate Greatest Common Right Divisors of Differential Polynomials*. Journal of the Foundations of Computational Mathematics. In Press/online June 2019. 36pp.
- J. von zur Gathen, M. Giesbrecht and K. Ziegler. *Counting decompositions of additive polynomials via invariant subspaces*. Journal of Symbolic Computation. Accepted for publication, April 2019. 28pp.
- M. Giesbrecht, J. Haraldson and G. Labahn. *Computing Nearby Non-trivial Smith Forms*. To appear, Journal of Symbolic Computation. 26pp. Accepted July 2019.
- M. Giesbrecht, H. Huang, G. Labahn and E. Zima. *Efficient Integer-Linear Decomposition of Multivariate Polynomials*. Proc. 44th International Symposium on Symbolic and Algebraic Computation (ISSAC'19), 2019, pp. 171–189.
- M. Giesbrecht, A. Jamshidpey and É. Schost. *Quadratic-time Algorithms for Normal Elements*. Proc. 44th International Symposium on Symbolic and Algebraic Computation (ISSAC'19), 2019, pp. 179–186.

### 2018

- M. Giesbrecht, J. Haraldson and G. Labahn. *Computing Lower Rank Approximations of Matrix Polynomials*. Accepted for publication, December 2018.
- M. Giesbrecht, J. Haraldson and G. Labahn. *Computing Nearby Non-trivial Smith Forms*. Proc. International Symposium on Symbolic and Algebra Computation (ISSAC 2018), pp. 159–166. Winner of the ACM SIGSAM Distinguished Student Author Award.

### 2017

- M. Giesbrecht, J. Haraldson and G. Labahn. *Computing the Nearest Rank-Deficient Matrix Polynomial*. Proc. International Symposium on Symbolic and Algebra Computation (ISSAC 2017), pp. 181–188.

### 2016

- M. Giesbrecht, A. Heinle, and V. Levandovskyy. *Factoring differential operators in  $n$  variables*. Journal of Symbolic Computation, v. 75, July-August 2016, pp. 126–148.
- A. Arnold, M. Giesbrecht and D. Roche. *Multivariate polynomial interpolation of straight-line programs*. Journal of Symbolic Computation. v. 75, July-August 2016, pp. 4–24.

### 2015

- M. Elsheikh, M. Giesbrecht. *Relating  $p$ -adic eigenvalues and the local Smith normal form*. Linear Algebra and It's Applications, v. 481, September 2015, pp. 330–349.
- J. Bergen, M. Giesbrecht, P.N. Shivakumar and Y. Zhang. *Factorizations for difference operators*. Advances in Difference Equations. v. 2015:57, February 2015, pp. 1–6.

### 2014

- A. Arnold, M. Giesbrecht and D. Roche. *Sparse interpolation over finite fields via low-order roots of unity*. Proc. International Symposium on Symbolic and Algebraic Computation (ISSAC'14), July 2014, pp. 27–34.

- M. Giesbrecht, A. Heinle and V. Levandovskyy. *Factoring Differential Operators in  $n$  Variables*. Proc. International Symposium on Symbolic and Algebraic Computation (ISSAC'14), July 2014, pp. 194–201.
- M. Giesbrecht and J. Haraldson. *Computing GCRDs of Approximate Differential Polynomials*. Proc. Workshop on Symbolic-Numeric Computing (SNC'14), July 2014, pp. 78–87.

**2013**

- M. Giesbrecht. *Algorithms for irreducibility testing and constructing irreducible polynomials*. Handbook of Finite Fields (invited article). pp. 374–380. CRC Press. 2013.
- A. Arnold, M. Giesbrecht and D. Roche. *Faster sparse interpolation of straight-line programs*. To appear, Proceedings of Computer Algebra in Scientific Computation (CASC 2013), Lecture Notes in Computer Science, v.8136.
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- M. Giesbrecht and J.P. May, *New algorithms for exact and approximate polynomial decomposition*. International Workshop on Symbolic-Numeric Computation (SNC'05), pp. 297–307, 2005.
- B. Botting, M. Giesbrecht, and J.P. May, *Using the Riemannian SVD for Problems in Approximate Algebra*. International Workshop on Symbolic-Numeric Computation (SNC'05). July 2005, pp 209–219.

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- W. Eberly and M. Giesbrecht, *Efficient decomposition of separable algebras*. Journal of Symbolic Computation. Volume 37, Issue 1, pp. 35–18, 2004.
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**2003**

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**2001**

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**2000**

- W. Eberly and M. Giesbrecht. *Efficient decomposition of associative algebras over finite fields*. Journal of Symbolic Computation, v. 29, pp. 441–458, 2000.
- W. Eberly, M. Giesbrecht, and G. Villard, *On computing the determinant and Smith form of an integer matrix*. Proceedings of the 41<sup>st</sup> IEEE Symposium on the Foundations of Computer Science (FOCS), pp. 675–685, 2000.
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- R. Corless, M. Giesbrecht, I. Kotsireas and S. Watt, *Numerical implicitization of parametric hypersurfaces with linear algebra*, Artificial Intelligence and Symbolic Computation (AISC'2000), pp. 174–183, 2000.

**1999**

- R. Corless, M. Giesbrecht, D. Jeffrey and S. Watt. *Approximate polynomial decomposition*. ACM International Symposium on Symbolic and Algebraic Computation (ISSAC'99), pp. 213–219, 1999.

**1998**

- M. Giesbrecht. *Factoring skew polynomials over finite fields*. Journal of Symbolic Computation, Vol. 10, No. 4, pp. 463–486, 1998.
- M. Giesbrecht, A. Lobo & B. D. Saunders. *Certifying inconsistency of sparse linear systems*. ACM International Symposium on Symbolic and Algebraic Computation (ISSAC'98), pp. 113–119, 1998.

**1997**

- M. Giesbrecht, *Efficient parallel solution of sparse systems of linear diophantine equations*. ACM International Symposium on Parallel Symbolic Computation (PASCO'97), pp. 1–10, 1997.

**1996**

- M. Giesbrecht, *Probabilistic computation of the Smith normal form of a sparse integer matrix*. Algorithms in Number Theory Symposium (ANTS'96), pp. 173–186. Lecture Notes in Computer Science 1122, 1996.
- W. Eberly and M. Giesbrecht, *Efficient decomposition of associative algebras*. ACM International Symposium on Symbolic and Algebraic Computation (ISSAC'96), pp. 170–178, 1996.

**1995**

- M. Giesbrecht, *Nearly optimal algorithms for canonical matrix forms*, SIAM Journal on Computing, Vol. 24, No.5, pp. 948–969, 1995.
- M. Giesbrecht, *Fast computation of the Smith form of an integer matrix*, Proceedings of ACM

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#### 1994

- M. Giesbrecht, *Fast algorithms for rational forms of integer matrices*, Proceedings of the ACM International Symposium on Symbolic and Algebraic Computation (ISSAC'94), Oxford, England, July, pp. 305–311, 1994.

#### 1992

- M. Giesbrecht, *Fast algorithms for matrix normal forms*, Proceedings of the 33<sup>rd</sup> IEEE Symposium on the Foundations of Computer Science (FOCS), pp. 121–130, 1992.
- M. Giesbrecht, *Factoring in skew polynomial rings*. Proceedings of LATIN'92 conference, pp. 191–203, Springer Lecture Notes in Computer Science 583, 1992.

#### 1990

- J. von zur Gathen & M. Giesbrecht. *Constructing normal bases in finite fields*. Journal of Symbolic Computation, volume 10, pp. 547–570, 1990.

#### Books

- J. von zur Gathen and M. Giesbrecht, Editors, *Proceedings of the 1994 ACM International Symposium on Symbolic and Algebraic Computation (ISSAC'94)*, ACM Press, 1994.

#### Theses

- M. Giesbrecht, *Nearly optimal algorithms for canonical matrix forms*, Ph.D. Thesis, 1993.
- M. Giesbrecht, *Some Results on the Functional Decomposition of Polynomials*, M.Sc. Thesis, 1988.

**Invited Talks (last 10 years)****2019**

- March 12, 2019. Invited speaker, Institute of Coding, University of Manchester. Computer Science Education at Scale, The Waterloo CS Experience 2006–2019.

**2018**

- September 14, 2018. Invited speaker, Department of Mathematics and Computer Science. University of Stirling, UK. Title: *Eigenvalues, invariant factors and algorithms for sparse integer matrices.*
- September 4, 2018. Invited speaker, Department of Applied Mathematics and Computer Science, Technical University of Denmark. Title: *Algorithms and statistics for additive polynomials.*
- August 30, 2018. Invited speaker, Department of Computer Science, Department of Computer Science, University of Copenhagen. Title: *Sparsity, Complexity and Practicality in Symbolic Computation.*
- June 11, 2018. Joint International Meeting of the Chinese Mathematical Society and American Mathematical Society. Fudan University, Shanghai, China. Title: *An optimization approach to low-rank approximation and interesting Smith forms of matrix polynomials.*
- June 5, 2018. Invited speaker. SMS Research Institute, Guangxi University for Nationalities, Nanning, China. Title: *Eigenvalues, invariant factors, and random integer matrices.*

**2017**

- May 17, 2018. Invited speaker. Research Institute for Symbolic Computation (RISC), Johannes Kepler Universität, Linz, Austria. Paule60 Workshop on Combinatorics, Special Functions and Computer Algebra. Title: *Eigenvalues, invariant factors and random integer matrices. 2017*
- November 17, 2017. Invited participant and speaker. Erwin Schrödinger Institute for Mathematics and Physics. Programme on Algorithmic and Enumerative Combinatorics, Workshop on Computer Algebra in Combinatorics. Title: *Quasideterminants, degree bounds and “fast” algorithms for matrices of differential and difference polynomials.*
- November 9, 2017. Invited speaker. Department of Applied Mathematics, University of Grenoble, France. Title: *Eigenvalues, invariant factors and random matrices.*
- April 20, 2017. Invited speaker. Department of Mathematics, North Carolina State University. Title: *Eigenvalues, invariant factors, and random integer matrices.*
- April 7, 2017. Invited speaker. Department of Computer Science, University of Delaware, Title: *Eigenvalues, invariant factors and random integer matrices (with a little bit of computing).* Conference for the retirement of B. David Saunders.

**2016**

- Kwan Chao-Chih Distinguished Lecture, Chinese Academy of Sciences, Beijing. July 1, 2016. Title: *Eigenvalues, invariant factors and random integer matrices.*
- PIMS Distinguished Lecture, University of Manitoba. Title: *Sparsity, Complexity and Practicality in Symbolic Computation.* March 17, 2016.

**2015**

- Invited Speaker: Department of Mathematics, Simon Fraser University, Vancouver. Title: *Eigenvalues, invariant factors and random integer matrices.* December 14, 2015.
- Invited Speaker: Workshop on Linear Computer Algebra and Symbolic-Numeric Computation, Fields Institute, Toronto. Title: *Quasideterminants, Degree Bounds and Algorithms for Matrices of Differential and Difference Polynomials.* October 27, 2015.
- Invited Colloquium Speaker: Department of Computer Science, CUNY Graduate Center, New

York. Title: *Sparsity, Complexity and Practicality in Symbolic Computation*. April 23, 2015.

- Invited Speaker: Department of Mathematics, CUNY Graduate Center, New York. Title: *Approximate Computation with Differential Polynomials: Approximate GCRDs*. April 23, 2015.

## 2014

- Invited Speaker: Department of Applied Mathematics, University of Western Ontario. Title: *What's in a random integer matrix?* March 26, 2014.
- Invited Speaker: b-IT Institute, Universität Bonn. Title: *What's in a random integer matrix?* May 8, 2014.
- Invited Speaker: Lehrstuhl D für Mathematik, RWTH Aachen University. Title: *Algorithms and statistics for additive polynomials*. May 13, 2014.
- Invited Speaker: Department of Mathematics, University of Newcastle, Australia. Title: *Algorithms and statistics for additive polynomials*. June 24, 2014
- Invited Colloquium Speaker: Université Joseph Fourier, Grenoble, France. Title: *Sparsity, complexity and practicality in symbolic computation*. November 20, 2014.

## 2013

- Invited Speaker: Special Semester on Applications of Algebra and Number Theory: Workshop on Computer Algebra and Polynomials. RICAM, Johannes Kepler University, Linz, Austria. Title: *Algorithms and Statistics for Additive Polynomials*. November 25–29, 2013.
- Invited Speaker: Research Institute for Symbolic Computation (RISC), Linz, Austria. *Quasideterminants and "Fast" Algorithms for Matrices of Ore Polynomials*. November 27, 2013.
- Speaker: SIAM Conference on Applied Algebraic Geometry. Colorado State University. Title: *New Approaches to Sparse Interpolation and Signal Reconstruction*. August 1–4, 2013.
- Invited Speaker. Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM). St. John's, Newfoundland. Title: *Decomposition of additive polynomials and matrix similarity classes*. June 10–13, 2013.

## 2012

- Invited Speaker. Joint Mathematics Meeting (organized by the AMS and MAA), Special Session on Mathematics of Computation: Algebra and Number Theory. Boston, MA, USA. Talk title: *Counting decompositions of additive polynomials*. January 4–7, 2012.
- Invited Speaker: Symbolic Computation and its Applications (SCA). RWTH Aachen, Germany. Title: *Quasideterminants, Size Bounds and "Fast" Algorithms for Matrices of Ore Polynomials*. May 17–20, 2012.
- Plenary Speaker: East Coast Computer Algebra Day 2012 (ECCAD'12). Oakland University, Rochester Michigan. Title: *Sparsity, Complexity and Practicality in Algebraic Computation*. May 12, 2012.
- Invited Speaker: Department of Mathematics, North Carolina State University. Title: *Fast Computation of Smith Normal Forms of Sparse Matrices Over Local Rings*. April 4, 2012.

## 2011

- Plenary Speaker: MACIS 2011: Fourth International Conference on Mathematical Aspects of Computer and Information Sciences. Beijing, China. Title: *Sparsity and complexity in algebraic computation*. October 19–21, 2011.
- Invited Speaker: DEAM2, Conference on Differential Equations by Algebraic Methods. Johannes Kepler University, Linz, Austria. Title: *Provably Fast Algorithms for Normal Forms of Matrices of Ore Polynomials*. February 9–11, 2011.
- Invited Speaker: Department of Mathematics, Simon Fraser University, Vancouver Canada. Title:

*Algorithms for Additive and Projective Polynomials*. January 20, 2011.

**2010**

- Speaker: Jo60–Conference in honour of Joachim von zur Gathen. Title: *Decomposing for 24 years and counting the collisions*. May 29, 2010.
- Invited Speaker: University of Western Ontario. Title: *Algorithms for Additive and Projective Polynomials*. November 12, 2010.

**2009**

- Invited Speaker: NSF Workshop On Future Directions of Symbolic Computation Research And Their Applications to the Domain Sciences. University of Rhode Island. Title: *Sparse Polynomials, Models and Methods in Computer Algebra*. April 30–May 1, 2009.
- Invited Speaker: Dept. of Computer Science, University of Bonn, Germany. Title: *Some New Algorithms for Sparse Polynomials*. March 31, 2009.
- Invited Speaker: Dept. of Computer Science, University of Bath, UK. Title: *Some Dense Thoughts on Sparse Polynomials*. July 22, 2009.
- Invited Speaker: Dept. of Computer Science, University of Calgary, Canada. *Some Dense Thoughts on Sparse Polynomials*. August 12, 2009.

**2008**

- Invited Speaker: Conference on The Mathematical Interests of Peter Borwein. IRMACS, Simon Fraser University, Burnaby, British Columbia. May 12–16th, 2008.

**2007**

- Invited Speaker: Canadian Mathematics Society Winter Meeting, London, Ontario, Canada. Title: *New Algorithms for Lacunary Polynomials*. December 8–10, 2007.

**2006**

- Invited Speaker: Institut d'Informatique et Mathématique Appliquées de Grenoble (Institut IMAG), Grenoble, France. Title: *Interpolation of Sparse Approximate Polynomials*. April 6, 2006.
- Invited Speaker: Department of Mathematics and Computer Science, University of Antwerp, Belgium. Title: *The Riemannian SVD and Approximate Decomposition of Polynomials*. May 22, 2006.
- Invited Speaker: b-IT–Bonn-Aachen International Center for Information Technology. Title: *Complexity and Practicality in Computing with Integer Matrices*. May 25, 2006.
- Invited Speaker: Department of Mathematics and Statistics, Simon Fraser University. Title: *Probabilistically Stable Algorithms for Numerical Sparse Polynomial Interpolation*. August 9, 2006.
- Invited Speaker: Fields Institute Toronto–Workshop on Computational Challenges Arising in Algorithmic Number Theory and Cryptography. Title: *Speedy new algorithms for solving integer linear systems*. October 30–November 3, 2006.
- Invited Speaker: Department of Computer Science, University of Delaware. Title: *Probabilistically Stable Algorithms for Numerical Sparse Polynomial Interpolation*. November 22, 2006.