

Curriculum Vitae

Marc Moreno Maza

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1 Summary

1.1 Position

Professor
 Departments of Applied Mathematics and Computer Science
 University of Western Ontario (UWO)

1.2 Contact information

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1.3 Degrees

Degree	University	Department	Year
Doctorate	Paris 6, France	Computer Science	1997
Master's	Paris 6, France	Computer Science	1992
Master's	Paris 6, France	Pure Mathematics	1991
Bachelor's	Paris 6, France	Applied Mathematics	1990

1.4 Employment history

Date	Rank & Position	Department	Institution
2016/07 - date	Full Professor (cross-appointed)	Applied Mathematics	Univ. of Western Ontario
2016/07 - date	Full Professor	Computer Science	Univ. of Western Ontario
2008/07- 2016/07	Assistant Professor (cross-appointed)	Applied Mathematics	Univ. of Western Ontario
2008/07 - 2016/07	Associate Professor	Computer Science	Univ. of Western Ontario
2003/07- 2008/07	Assistant Professor (cross-appointed)	Applied Mathematics	Univ. of Western Ontario
2002/08 - 2008/07	Assistant Professor	Computer Science	Univ. of Western Ontario
2000/09-2002/08	Maître de Conférences (with tenure)	Computer Science	Univ. of Lille 1, France
1997/07-2002/09	Computational Mathematician	Computational Mathematics Group	NAG, Oxford, UK
1995/09-1997/07	Lecturer	Computer Science	Univ. of Paris 6, France
1992/09-1997/09	Doctoral Student	Computer Science	Univ. of Paris 6, France
1992/09-1997/09	Teaching Assistant	Computer Science	Univ. of Paris 7, France

1.5 Academic honours

- Distinguished Software Presentation Award, at ISSAC'17, Kaiserslautern, Germany. for the CUMODP library.
<http://www.csd.uwo.ca/~moreno//Publications/ISSAC.Software.Demo.Award.pdf>
- Professorship Award under the Chinese Academy of Sciences President's International Fellowship Initiative for Visiting Scientists, 2015.
<http://www.csd.uwo.ca/~moreno/CAS-CIGIT-certificate.pdf>
- UWO Teaching Honour Roll 2012-2013.
[http://www.usc.uwo.ca/teaching_awards/Honour_Roll_2011-2012.pdf]
- Awardee of the *Early Adopter Program* (December 2011) of the NSF/IEEE-TCPP Curriculum Initiative on Parallel and Distributed Computing Core Topics for Undergraduates.
<http://www.cs.gsu.edu/~tcpp/curriculum/?q=home>
<http://www.cs.gsu.edu/~tcpp/curriculum/?q=early-adopter-spring-12.html>
- Distinguished Software Presentation Award, at ISSAC'11, San Jose, USA, for the REGULAR-CHAINS library.
<http://www.csd.uwo.ca/~moreno//Publications/ISSAC.Software.Demo.Award.pdf>
- April 2010, MITACS Award for Excellence in Mentorship.
<http://www.uwo.ca/sci/publications/news/MorenoMaza.html>
- March 2009, Best Novel Use of Mathematics in Technology Transfer “Toward high-performance computer algebra with Maple” MITACS Award for my graduate students Wei Pan and Xin Li.
- July 2009, Best Poster Award at the Conference ISSAC'09: Marc Moreno Maza and Yuzhen Xie “Balanced Polynomial Multiplication on Multicores”.
- Sept. 2008 - Jan. 2010, *Visiting Scientist* at the *Massachusetts Institute of Technology (MIT)*.
- July 2006, Invited tutorial talk at the Conference ISSAC'06: Marc Moreno Maza “Triangular Decompositions of Polynomial Systems: From Theory to Practice”.
- July 2005, *most cited article* published in the *Journal of Symbolic Computation (JSC)* in the category *Theory and Algorithms* and the Top 3 among all JSC papers: Philippe Aubry, Daniel Lazard and Marc Moreno Maza “On the theories of triangular sets”.
- July 2005, Best Poster Award at the Conference ISSAC'05: Xavier Dahan, Marc Moreno Maza, Éric Schost, Wenyan Wu and Yuzhen Xie “On the complexity of the D5 Principle”.
- July 2005, Distinguished Student Paper Award at ISSAC'05: Xavier Dahan, Marc Moreno Maza, Éric Schost, Wenyan Wu and Yuzhen Xie “Lifting techniques for triangular decompositions”.
- May 2004, NSERC Synergy Award (Team Member, \$10,000 to UWO).

- July 2002, ACM Award: Marc Moreno Maza *Local arrangement chair and exhibit chair of ISSAC'2002*.
- Fall 2001, Ontario Research Center in Computer Algebra (ORCCA) Junior Chair.

1.6 Lifetime statistics

1.6.1 Publications

Titles of papers and publication vehicles are listed in Section 2 page 6.

Book (preprint) in progress:	1
Books edited:	4
Chapters in books:	1
Articles published in refereed journals:	27
Articles in refereed conferences:	88
Letters and notes in refereed journals:	20
Technical reports:	3
Software packages:	13

1.6.2 Software packages

I am developing major mathematical software packages. Some of them are *part of the computer algebra system* MAPLE, commercialized by Maplesoft, Waterloo, Canada and which has more than *5,000,000 licenses worldwide*. These packages include:

- low-level routines for fast polynomial arithmetic written in C (the `modpn` library) and,
- high-level code for algebraic algorithms (the `REGULARCHAINS` library).

Among other things, these software packages *support* MAPLE's `solve` command for solving systems of polynomial equations and inequalities. This command is at the heart of the system: many other functionalities rely on `solve` directly or indirectly. More details are given in Section 2.6.1 and 2.6.2.

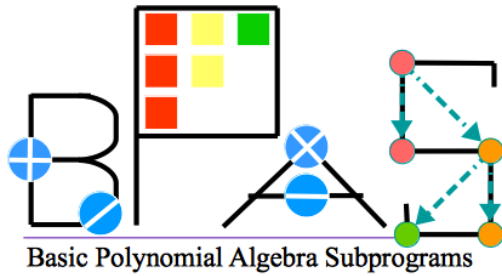
I am also developing three stand-alone software libraries for *high-performance scientific computing*: BPAS, CUMODP and META_FORK, which *can be used independently of* MAPLE. The first two aim at supporting symbolic computation and are written respectively in `CilkPlus` and `CUDA`, while the latter is a suite of source-to-source compilers for multithreaded languages targeting multicore architectures. More details are presented in Section 2.6.3, 2.6.4 and 2.6.5.

These packages and libraries implement algorithms that I have designed myself or with my students only. I believe that good software packages are often as useful to the academic community as refereed articles. Note that a package submitted to the computer algebra system MAPLE goes through two levels of refereeing:

- by the MAPLESOFT company itself and then
- by beta-testers worldwide.

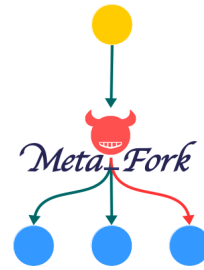
The significance of my software contributions is explained in Sections 2.6.1, 2.6.2 2.6.3, 2.6.4 and 2.6.5.

Each of the software projects mentioned above has a website:



Basic Polynomial Algebra Subprograms

www.bpaslib.org

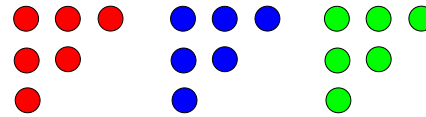


MetaFork

www.metafork.org



www.cumodp.org



www.regularchains.org

The modpn library is distributed with the CUMODP library.

1.6.3 Teaching material

During the last 12 academic years, I have developed 11 new courses at UWO leading to 715 pages of lecture notes (CS424/CS556, CS874, AM583, CS652, CS86, CS447/CS54) and 1400 slides (CS2101, CS3101, CS4402/CS9535, CS855, CS9624). Details are given in Section 3 Page 24.

1.6.4 Supervision of students and PDFs

Names of students and fellows together with titles of theses or projects are reported in Section 4.

	Number successful completed	Number in progress
Doctoral Thesis	6	4
Master's Thesis	9	1
Post-Doctoral Fellows	7	0
Internships	5	2

2 Publications: Research Articles and Software

This section lists my publications, including research articles and software packages.

2.1 Co-authorship statement

Authors of each paper are ordered as they appear on the publication, that is, in lexicographical order, since this is the norm in the area of symbolic computation. Moreover, names of students are in bold while mine appears slanted; names of other co-authors appear in roman fonts.

For each publication that I have co-authored, and therefore for each publication listed below, I have played a leading role in obtaining the research results as well as in writing the corresponding article or software.

2.2 Ranking of publication vehicles

Category I means top-ranked journals and equivalent refereed proceedings; editorial works are also listed in Category I. Category II means refereed at standard level while category III means refereed at ‘moderate’ level.

2.3 Category I vehicles

2.3.1 Description of category I vehicles

Vehicle	Short name	Reason for use
Algebraic Algorithms, and and Error Correcting Codes	AAECC	Top-quality conference
Advances on Symbolic-Numeric Computation	SNC	Book collecting the SNC conference best papers
Computer Algebra in Scientific Computing	CASC	Top-quality conference
Effective Methods in Algebraic Geometry	MEGA	Top-quality conference
International Symposium on Symbolic and Algebraic Computation	ISSAC	Top-quality conference
International Congress on Mathematical Software	ICMS	Top-quality conference
Journal of Symbolic Computation	JSC	Premiere archival journal
Symposium on Parallelism in Algorithms and Architectures	SPAA	Top-quality conference
Theoretical Computer Science	TSC	Premiere archival journal

Note: The Proceedings of the above international conferences are Category I, because they receive full refereeing and have a rejection rate between 50% and 80%.

2.3.2 Papers published in category I vehicles

Proceedings edited:

- [e1] **M. Moreno Maza** and S. M. Watt. *PASCO '07: Proceedings of the 2007 international workshop on Parallel symbolic computation*. ISBN 978-1-59593-741-4. ACM Press, 107 pages, New York, NY, USA, 2007.
- [e2] **M. Moreno Maza** and S. M. Watt. *MICA '08: Proceedings of Milestones in Computer Algebra 2008: A Conference in Honour of Keith Geddes 60th Birthday* ISBN 978-0-7714-2682-7. Trinidad and Tobago, 217 pages, 2008.
- [e3] **M. Moreno Maza** and J.-L. Roch. *PASCO '10: Proceedings of the 2010 international workshop on Parallel symbolic computation*. ISBN 978-1-4503-0067-4. ACM Press, 194 pages, 2010.
- [e4] **M. Moreno Maza**. *SNC '11: Proceedings of the 4th International Workshop on Symbolic-Numeric Computation*. ISBN: 978-1-4503-0515-0. ACM Press, 204 pages, New York, NY, USA, 2011.

Book chapters:

- [h1] **M. Moreno Maza**, G. Reid, **R. Scott** and **W. Wu**. On approximate linearized triangular decompositions. In *Advances on Symbolic-Numeric Computation*, edited by D. M. Wang and L. Zhi, p. 268-287, Springer, 2007.

Journal articles:

- [j1] P. Aubry, D. Lazard, **M. Moreno Maza**. On the theories of triangular sets. *Journal of Symbolic Computation (JSC)*, 28(1-2):105-124, 1999. **304 citations.** <http://scholar.google.com/citations?user=pW3soucAAAAJ&hl=en>
- [j2] P. Aubry and **M. Moreno Maza**. Triangular sets for solving polynomial systems: A comparative implementation of four methods. *Journal of Symbolic Computation*, 28(1-2):125-154, 1999.
- [j3] M.V. Foursov and **M. Moreno Maza**. On computer-assisted classification of coupled integrable equations. *Journal of Symbolic Computation*, 33(1):647-660, 2002.
- [j4] **M. Moreno Maza**, G. Reid, **R. Scott** and **W. Wu**. On approximate triangular decompositions in dimension zero. *Journal of Symbolic Computation*, 42(7):693-716, 2007.
- [j5] **X. Dahan**, **X. Jin**, **M. Moreno Maza** and É Schost. Change of ordering for regular chains in positive dimension. *Theoretical Computer Science*, 392 (1-3): 3765, 2008.
- [j6] **C. Chen**, **M. Moreno Maza**, **W. Pan** and **Y. Xie**. On the verification of polynomial system solvers. In *Frontiers of Computer Science in China*, Vol 2, Numb 1, pages 55-66, 2008.
- [j7] O. Golubitsky, M. Kondratieva, **M. Moreno Maza** and **A. Ovchinnikov**. A bound for the Rosenfeld-Gröbner algorithm. *Journal of Symbolic Computation*, 43(8): 582-610, 2008.
- [j8] **X. Li**, **M. Moreno Maza** and É. Schost. Fast arithmetic for triangular sets: from theory to practice. *Journal of Symbolic Computation*, 44(7): 891-907, 2009.
- [j9] F. Boulier, F. Lemaire and **M. Moreno Maza**. Computing differential characteristic sets by change of ordering. *Journal of Symbolic Computation*, 45(1), 124-149, 2010.
TOP 7 HOTTEST ARTICLE in JSC in 2009-2010. <http://top25.sciencedirect.com/subject/mathematics/16/journal/journal-of-symbolic-computation/07477171/archive/29>
- [j10] F. Lemaire, **M. Moreno Maza**, **W. Pan** and **Y. Xie**. When does $\langle T \rangle$ equal $\text{Sat}(T)$? *Journal of Symbolic Computation*, 46(12): 1291-1305, 2011.
- [j11] **X. Li**, **M. Moreno Maza**, **R. Rasheed** and É. Schost. The Modpn library: bringing fast polynomial arithmetic into MAPLE. *J. of Symbolic Computation*, 46(7): 841-858, 2011.
Top 18 in terms of citations, among all JSC papers published since 2010. <http://www.journals.elsevier.com/journal-of-symbolic-computation/most-cited-articles/>
- [j12] **M. Moreno Maza** and **Y. Xie**. Balanced Dense Polynomial Multiplication on Multi-cores. *International Journal of Foundations of Computer Science*, 22(5): 1035-1055, 2011.

- [j13] **W. Pan** and **M. Moreno Maza**. Fast polynomial multiplication on a GPU. High Performance Computing Symposium (HPCS'10). *Journal of Physics: Conference Series* vol. 256, 2011.
- [j14] **W. Pan** and **M. Moreno Maza**. Solving Bivariate Polynomial Systems on a GPU. High Performance Computing Symposium (HPCS'11). *Journal of Physics: Conference Series* vol. 341, 2011.
- [j15] **S. A. Haque** and **M. Moreno Maza**. Determinant Computation on the GPU using the Condensation Method. High Performance Computing Symposium (HPCS'11). *Journal of Physics: Conference Series* vol. 341, 2011.
- [j16] **C. Chen**, **M. Moreno Maza** and **Y. Xie**. Cache Complexity and Multicore Implementation for Univariate Real Root Isolation. High Performance Computing Symposium (HPCS'11). *Journal of Physics: Conference Series*, vol. 341, 2011.
- [j17] **M. Moreno Maza**, B. Xia and **R. Xiao**. On solving parametric polynomial systems. *J. of Mathematics in Computer Science*, 6(4): 457-473, 2012.
- [j18] **C. Chen** and **M. Moreno Maza**. Algorithms for computing triangular decompositions of polynomial systems. *J. of Symbolic Computation*, 47(6): 610-642, 2012.
TOP 7 HOTTEST ARTICLE in JSC in 2012. <http://top25.sciencedirect.com/subject/mathematics/16/journal/journal-of-symbolic-computation/07477171/archive/42/>
- [j19] **S. Haque** and **M. Moreno Maza**. Plain polynomial arithmetic on GPU. *J. of Physics: Conference Series*, 385, 10 pages, 2012.
- [j20] **M. Md. Ali** and **M. Moreno Maza** and Y. Xie. On the Factor Refinement Principle and its Implementation on Multicore Architectures. *J. of Physics: Conference Series*, 385, 10 pages, 2012.
- [j21] **C. Chen**, R.M. Corless, **M. Moreno Maza**, P. Yu, **Y. Zhang**. An application of regular chain theory to the study of limit cycles. *International Journal of Bifurcation and Chaos*, volume 23, number 9, 2013.
- [j22] **C. Chen**, J.H. Davenport, **M. Moreno Maza**, B. Xia and **R. Xiao**. Computing with semi-algebraic sets: Relaxation techniques and effective boundaries. *J. of Symbolic Computation*, vol. 52, 72-96, 2013.
- [j23] **C. Chen**, J.H. Davenport, J.P. May, **M. Moreno Maza**, B. Xia and **R. Xiao**. Triangular decomposition of semi-algebraic systems. *J. of Symbolic Computation*, vol. 49, 3-26, 2013.
- [j24] **C. Chen** and **M. Moreno Maza**. Quantifier elimination by cylindrical algebraic decomposition based on regular chains. *J. of Symbolic Computation*, vol. 75, 74-93, 2016.
- [j25] François Boulrier, François Lemaire, **M. Moreno Maza** and Adrien Poteaux. An Equivalence Theorem For Regular Differential Chains. Submitted to *J. of Symbolic Computation*, 2016.

Conference articles:

- [c1] **M. Moreno Maza** and R. Rioboo. Polynomial gcd computations over towers of algebraic extensions. In proc. of *AAECC-11*, pages 365–382. Springer, 1995.

- [c2] **M. Moreno Maza**. On triangular decompositions of algebraic varieties. *MEGA-2000* conference, Bath, UK, June 2000.
121 citations. <http://scholar.google.com/citations?user=pW3soucAAAAJ&hl=en>
- [c3] M.V. Foursov and **M. Moreno Maza**. On computer-assisted classification of coupled integrable equations. In proc. of *ISSAC 2001*, pages 129-136, ACM Press, 2001.
- [c4] F. Boulier, F. Lemaire and **M. Moreno Maza**. PARDI ! In proc. of *ISSAC 2001*, pages 38-47, ACM Press, 2001.
- [c5] I. Kogan and **M. Moreno Maza**. Computation of canonical forms for ternary cubics. In proc. of *ISSAC 2002*, pages 151-160, ACM Press, 2002.
- [c6] **X. Dahan**, **M. Moreno Maza**, É. Schost, **W. Wu** and **Y. Xie**. Lifting techniques for triangular decompositions. In proc. of *ISSAC 2005*, Beijing, China, ACM Press, 2005. **Distinguished Student Author Award at ISSAC'05.**
- [c7] **A. Filatei**, **X. Li**, **M. Moreno Maza** and É Schost. Implementation techniques for fast polynomial arithmetic in a high-level programming environment. In proc. of *ISSAC 2006*, pages 93-100, ACM Press, 2006.
- [c8] **M. Moreno Maza**. Triangular decompositions of polynomial systems: from theory to practice. In proc. of *ISSAC 2006*, page 8, ACM Press, 2006.
- [c9] **M. Moreno Maza** and **Y. Xie**. An implementation report for parallel triangular decompositions. In proc. *SPAA 2006*, page 235, ACM Press, 2006.
- [c10] **X. Li**, **M. Moreno Maza**. Efficient implementation of polynomial arithmetic in a multiple-level programming environment. In proc. *ICMS 2006*, pp. 12–23, Springer, 2006.
- [c11] F. Lemaire, **M. Moreno Maza and Y. Xie**. Making a sophisticated symbolic solver available to different communities of users. In proc. *ATCM 2006*, 10 pages, Polytechnic University of Hong Kong, 2006.
- [c12] **X. Li**, **M. Moreno Maza** and É. Schost. Fast arithmetic for triangular sets: from theory to practice. In proc. *ISSAC 2007*, pages 269-276, ACM Press, New York, NY, USA, 2007.
- [c13] O. Golubitsky, M. Kondratieva, **M. Moreno Maza** and **A. Ovchinnikov**. Bounds for algorithms in differential algebra: the ordinary case. In proc. of *Challenges in Symbolic Computation Software*, edited by W. Decker, M. Dewar, E. Kaltofen and S. M. Watt. ISSN 1862-4405. Dagstuhl Seminar Proceedings 06271, 9 pages, Schloss Dagstuhl, Germany, 2007.
- [c14] **C. Chen**, F. Lemaire, O. Golubitsky, **M. Moreno Maza**, **W. Pan**. Comprehensive triangular decomposition. In *CASC 2007: Computer Algebra in Scientific Computing*, pages 73-101, Lecture Notes in Computer Science, vol. 4770, Springer-Verlag, 2007.
- [c15] F. Lemaire, **M. Moreno Maza**, **W. Pan** and **Y. Xie**. When does $\langle T \rangle$ equal $\text{Sat}(T)$? In proc. *ISSAC 2008*, pages 207-214, ACM Press, New York, NY, USA, 2008.
- [c16] **S. Liang**, D.J. Jeffrey, **M. Moreno Maza**. The complete root classification of a parametric polynomial on an interval. In proc. *ISSAC 2008*, ACM Press, New York, 2008, pp 189–196.

- [c17] **C. Chen, M. Moreno Maza**, B. Xia, L. Yang. Computing Cylindrical Algebraic Decomposition via Triangular Decomposition. In *Proc. of ISSAC 2009*, ACM Press, pp 95–102, 2009.
- [c18] **X. Li, M. Moreno Maza, W. Pan** Computations modulo regular chains. In *Proc. of ISSAC 2009*, ACM Press, pp 239–246, 2009.
- [c19] **M. Moreno Maza**, Y. Xie. Balanced Dense Polynomial Multiplication on Multi-cores. In *Proc. of Parallel and Distributed Computing, Applications and Technologies (PDCAT)*, IEEE Computer Society, pp 1–9, 2009.
- Best Poster Award at ISSAC 2009.**
- [c20] **M. Moreno Maza**, Y. Xie. FFT-based Dense Polynomial Arithmetic on Multi-cores. In *proc. of High Performance Computing Systems and Applications*. LNCS 5976, Springer, pp 378–399, 2009.
- [c21] F. Boulier, **C. Chen**, F. Lemaire, **M. Moreno Maza**. Real Root Isolation of Regular Chains In *Proc. of Asian Symposium on Computer Mathematics*, Math-for-Industry Lecture Note Series Vol. 22, pp 1–14, 2009. Republished in *Computer Mathematics, 9th Asian Symposium (ASCM) 2009*, Springer, pp 33–48, 2014.
- [c22] **C. Chen**, J.H. Davenport, J.P. May, **M. Moreno Maza**, B. Xia and **R. Xiao**. Triangular decomposition of semi-algebraic systems. In *Proc. of ISSAC 2010*, ACM Press, pp 187–194, 2010.
- [c23] Charles E. Leiserson, **Liyun Li, M. Moreno Maza** and **Yuzhen Xie** Efficient Evaluation of Large Polynomials In *Proc. of the International Congress of Mathematical Software (ICMS 2010)*, LNCS 6327, Springer, 2010.
- [c24] **C. Chen** and **M. Moreno Maza**. Algorithms for computing triangular decompositions of polynomial systems. In *Proceedings of International Symposium on Symbolic and Algebraic Computation (ISSAC 2011)*, ACM Press, pp. 83–90, 2011.
- [c25] **C. Chen**, J.H. Davenport, **M. Moreno Maza**, B. Xia and **R. Xiao**. Computing with semi-algebraic sets represented by triangular decomposition. In *Proceedings of 2011 International Symposium on Symbolic and Algebraic Computation (ISSAC 2011)*, ACM Press, pp. 75–82, 2011.
- [c26] **C. Chen** and **M. Moreno Maza** Semi-algebraic Description of the Equilibria of Dynamical Systems. In *Proc. Computer Algebra in Scientific Computing (CASC)*, p. 101–125, LNCS Vol. 6885, Springer, 2011.
- [c27] **S. Marcus, M. Moreno Maza** and **P. Vrbik**. On Fulton’s Algorithm for Computing Intersection Multiplicities, In *Proc. Computer Algebra in Scientific Computing (CASC)*, p. 198–211, LNCS Vol. 7442, Springer, 2012.
- [c28] **M. Moreno Maza**, É. Schost, **P. Vrbik**. Inversion Modulo Zero-Dimensional Regular Chains, In *Proc. CASC’12*, p. 224–235, LNCS Vol. 7442, Springer, 2012.
- [c29] **M. Moreno Maza** and **R. Xiao**. Degree and dimension estimates for invariant ideals of P -solvable recurrences. In *Proc. of Asian Symposium of Computer Mathematics (ASCM) 2012*, 23 pages, 2012, in Lecture Notes in Artificial Intelligence (LNAI), Springer.

- [c30] C. Chen and **M. Moreno Maza**. An Incremental Algorithm for Computing Cylindrical Algebraic Decompositions. In *Proc. of Asian Symposium of Computer Mathematics (ASCM) 2012*, 20 pages, 2012, in Lecture Notes in Artificial Intelligence (LNAI), Springer.
- [c31] **P. Alvandi**, C. Chen and **M. Moreno Maza**. Computing the Limit Points of the Quasi-component of a Regular Chain in Dimension One. In *CASC 2013: Computer Algebra in Scientific Computing*, Lecture Notes in Computer Science Volume 8136, 2013, pp 30-45.
- [c32] C. Chen and **M. Moreno Maza**. Quantifier elimination by cylindrical algebraic decomposition based on regular chains. In *Proceedings of 2014 International Symposium on Symbolic and Algebraic Computation (ISSAC 2014)*, ACM Press, pp. 91–98, 2014.
- [c33] R.J. Bradford, C. Chen, J.H. Davenport, M. England, **M. Moreno Maza**, D.J. Wilson. Truth Table Invariant Cylindrical Algebraic Decomposition by Regular Chains. In *Proceedings of Computer Algebra in Scientific Computing - Lecture Notes in Computer Science*, volume 8660, Springer, pages 44-59.
- [c34] **S. A. Haque**, **F. Mansouri** and **M. Moreno Maza**. On the Parallelization of Sub-product Tree Techniques Targeting Many-Core Architectures. In *Proceedings of Computer Algebra in Scientific Computing - Lecture Notes in Computer Science*, volume 8660, Springer, pages 171-185.
- [c35] **S. A. Haque**, **X. Li**, **F. Mansouri**, **M. Moreno Maza**, **W. Pan** and **N. Xie**. Dense Arithmetic over Finite Fields with the CUMODP Library. In *Proceedings of ICMS 2014 - 4th International Congress*, Seoul, South Korea, Lecture Notes in Computer Science, volume 8592, pages 725-732.
- [c36] C. Chen, **S. Covanov**, **F. Mansouri**, **M. Moreno Maza**, **N. Xie** and Y. Xie. The Basic Polynomial Algebra Subprograms. In *Proceedings of ICMS 2014 - 4th International Congress*, Seoul, South Korea, Lecture Notes in Computer Science, volume 8592, pages 669-676.
- [c37] C. Chen and **M. Moreno Maza**. Solving Parametric Polynomial Systems by `ReaComprehensiveTriangularize`. In *Proceedings of ICMS 2014 - 4th International Congress*, Seoul, South Korea, Lecture Notes in Computer Science, volume 8592, pages 504-511.
- [c38] **P. Alvandi**, C. Chen, S. Marcus, **M. Moreno Maza**, . Schost, **P. Vrbik**: Doing Algebraic Geometry with the `RegularChains` Library. In *Proceedings of ICMS 2014 - 4th International Congress*, Seoul, South Korea, Lecture Notes in Computer Science, volume 8592, pages 472-479.
- [c39] C. Chen and **M. Moreno Maza**. Cylindrical Algebraic Decomposition in the `RegularChains` Library. In *Proceedings of ICMS 2014 - 4th International Congress*, Seoul, South Korea, Lecture Notes in Computer Science, volume 8592, pages 425-433.
- [c40] C. Chen and **M. Moreno Maza**. Real Quantifier Elimination in the `RegularChains` Library. In *Proceedings of ICMS 2014 - 4th International Congress*, Seoul, South Korea, Lecture Notes in Computer Science, volume 8592, pages 283-290.
- [c41] C. Chen and **M. Moreno Maza**. Simplification of Cylindrical Algebraic Formulas. In *Proceedings of Computer Algebra in Scientific Computing - Lecture Notes in Computer Science*, volume 9301, Springer, pp. 119–134, 2015.

- [c42] **P. Alvandi**, **M. Moreno Maza**, . Schost, **P. Vrbik**. A Standard Basis Free Algorithm for Computing the Tangent Cone. In *Proceedings of Computer Algebra in Scientific Computing - Lecture Notes in Computer Science*, volume 9301, Springer, pp. 45–60, 2015.
- [c43] **P. Alvandi**, C. Chen, A. Hashemi and **M. Moreno Maza**. Regular Chains under Linear Changes of Coordinates and Applications. In *Proceedings of Computer Algebra in Scientific Computing - Lecture Notes in Computer Science*, volume 9301, Springer, pp. 30–44, 2015.
- [c44] C. Chen, **X. Chen**, A.-K. Keita, **M. Moreno Maza** and **N. Xie**. MetaFork: A Compilation Framework for Concurrency Models Targeting Hardware Accelerators and its Application to the Generation of Parametric CUDA Kernels. In *Proceedings of CASCON 2015*, ACM Press, pp. 70–79, 2015.
- [c45] **S. A. Haque**, **N. Xie**, **M. Moreno Maza**. A Many-Core Machine Model for Designing Algorithms with Minimum Parallelism Overhead. In *Proceedings of the International Conference on Parallel Computing (ParCo 2015)*, pages 35–44, OS Press 2016, 2016.
- [c46] **P. Alvandi**, **M. Kazemi** and **M. Moreno Maza**. Computing Limits of Real Multivariate Rational Functions. In *Proc. of ISSAC 2016*, ACM Press, pp 74–93, 2016.
- [c47] C. Chen, **S. Covanov**, **F. Mansouri**, **M. Moreno Maza**, **N. Xie** and Y. Xie. Parallel International Polynomial Multiplication. In *Proceedings of the International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC 2016)*, IEEE Society, pp 72–80, 2016.
- [c48] **P. Alvandi**, **M. Ataei** and **M. Moreno Maza**. On the Extended Hensel Construction and its Application to the Computation of Limit Points. In *Proc. of ISSAC 2017*, ACM Press, pp 13–20, 2017.
- [c49] **L. Chen**, **S. Covanov**, **D. Mohajeran** and **M. Moreno Maza**. Big Prime Field FFT on the GPU. In *Proc. of ISSAC 2017*, ACM Press, pp 85–92, 2017.
- [c50] **R.J. Jing** and **M. Moreno Maza**. Computing the Integer Points of a Polyhedron, I: Algorithm. In *Proceedings of Computer Algebra in Scientific Computing - Lecture Notes in Computer Science*, volume 10490, Springer, pp. 242–256 2015.
- [c51] **R.J. Jing** and **M. Moreno Maza**. Computing the Integer Points of a Polyhedron, II: Complexity Estimates. In *Proceedings of Computer Algebra in Scientific Computing - Lecture Notes in Computer Science*, volume 10490, Springer, pp. 225–241, 2015.

2.3.3 Manuscripts in progress to category I vehicles

Book in progress:

- [b1] **M. Moreno Maza**. *Algorithmic Properties of Polynomial Rings*. 250 pages, 2011.

2.4 Category II vehicles

2.4.1 Description of category II vehicles

Proceedings papers and extended abstracts are listed here. The corresponding conferences and journal have standard level of refereeing, but are not so competitive as the ones listed in category

I. This is generally because they are *one-time events* or new series of workshops. Usually the motivation for publishing in these vehicles is appropriateness to the audience, or a wide readership.

Vehicle	Short name	Reason for use
International Conference on Polynomial System Solving	ICPSS	One-time event in honour of Professor Daniel Lazard
International Conference on Computational Science	ICCS	A wide readership
Parallel Symbolic Computation	PASCO	Appropriateness to the audience
Symbolic-Numeric Computation	SNC	Appropriateness to the audience
Transgressive Computing	TC2006	One-time event in honour of Professor Jean Della Dora
Milestones in Computer Algebra	MICA 2008	One-time event in honour of Professor Keith Geddes
ACM Communications in Computer Algebra	SIGSAM Bulletin	ISSAC software demos

2.4.2 Papers published in category II vehicles

Journal articles:

- [n1] **C. Chen**, F. Lemaire, **M. Moreno Maza**, . **L. Li**, **W. Pan** and **Y. Xie**. The `ConstructibleSetTools` and `ParametricSystemTools` modules of the `RegularChains` library in MAPLE (Extended Abstract). *ACM Commun. Comput. Algebra*, 42(3): 182-184 (2008).
- [n2] **X. Li**, **M. Moreno Maza**, **R. Rasheed**, É. Schost. The `Modpn` library: bringing fast polynomial arithmetic into MAPLE (Extended Abstract). *ACM Commun. Comput. Algebra*, 42(3): 172-174 (2008).
- [n3] **C. Chen**, **L. Li**, **M. Moreno Maza**, **W. Pan** and **Y. Xie**. On the representation of constructible sets (Extended Abstract). *ACM Commun. Comput. Algebra*, 42(3): 162-163 (2008).
- [n4] J. P. May, M. Giesbrecht, **D. S. Roche**, **M. Moreno Maza** and **Y. Xie**. Marc Moreno Maza, Yuzhen Xie. Automatic variable order selection for polynomial system solving (Extended Abstract). *ACM Commun. Comput. Algebra*, 42(1-2): 83 (2008).
- [n5] **M. Moreno Maza** and Y. Xie. Balanced dense polynomial multiplication on multi-cores (Extended Abstract). **Best Poster Award at ISSAC 2009.** *ACM Commun. Comput. Algebra*, 43(3/4): 85-87 (2009).
- [n6] S.A. Haque, S. Hossain, **M. Moreno Maza**. Cache friendly sparse matrix-vector multiplication (Extended Abstract). *ACM Commun. Comput. Algebra*, 44(3/4): 111-112 (2010)
- [n7] X. Dahan, **M. Moreno Maza**, É. Schost, A. Poteaux. Almost linear time operations with triangular sets (Extended Abstract). *ACM Commun. Comput. Algebra*, 44(3/4): 103-104 (2010).

- [n8] **M. F. I. Chowdhury, M. Moreno Maza, W. Pan, É .Schost.** Complexity and performance results for non FFT-based univariate polynomial multiplication (Extended Abstract). *ACM Commun. Comput. Algebra*, 44(3/4): 99-100 (2010).
- [n9] **C. Chen, M. Moreno Maza,** and Y. Xie. Cache complexity and multicore implementation for univariate real root isolation (Extended Abstract). *ACM Commun. Comput. Algebra*, 44(3/4): 97-98 (2010).
- [n10] **L. Meng,** J.R. Johnson, F. Franchetti, Y. Voronenko, **M. Moreno Maza,** and Y. Xie. Abstract only: SPIRAL-generated modular FFTs (Extended Abstract). *ACM Commun. Comput. Algebra*, 44(1/2): 25-26 (2010).
- [n11] **C. Chen,** J.H. Davenport, F. Lemaire, **M. Moreno Maza,** B. Xia, **R. Xiao** and Y. Xie. Computing the real solutions of polynomial systems with the RegularChains library in Maple (Extended Abstract for Software Demonstration). *ACM Commun. Comput. Algebra*, 45(3/4): 166-168 (2011).
- Distinguished Software Presentation Award at ISSAC 2011.**
- [n12] **M. Moreno Maza** and **W. Pan.** Solving bivariate polynomial systems on a GPU (Extended Abstract). *ACM Commun. Comput. Algebra*, 45(1/2): 127-128 (2011)
- [n13] **M. Moreno Maza** and **P. Vrbik.** Inverting matrices modulo regular chains (Extended Abstract). *ACM Commun. Comput. Algebra*, 45(1/2): 129-130 (2011).
- [n14] R. M. Corless, **M. Moreno Maza,** **S. E. Thornton.** Zigzag Form over Families of Parametric Matrices (Extended Abstract). *ACM Commun. Comput. Algebra*, 48(3/4): 109-112 (2014).
- [n15] C. Chen, **S. Covanov,** F. Mansouri, **R. H. C. Moir,** **M. Moreno Maza,** **N. Xie** and Y. Xie. The Basic Polynomial Algebra Subprograms (Extended Abstract). *ACM Commun. Comput. Algebra*, 48(3/4): 197-201 (2014).
- [n16] **P. Alvandi,** **M. Kazemi** and **M. Moreno Maza.** Computing Limits with the Regularchains and Powerseries Libraries: From Rational Functions to Zariski Closure (Extended Abstract for Software Demonstration). *ACM Commun. Comput. Algebra*, 50(3):93–96, 2016.
- [n17] C. Chen, **S. Covanov,** F. Mansouri, **R. H. C. Moir,** **M. Moreno Maza,** **N. Xie** and Y. Xie. The Basic Polynomial Algebra Subprograms (Extended Abstract for Software Demonstration). *ACM Commun. Comput. Algebra*, 50(3):97–100, 2016.
- [n18] **P. Alvandi** and **M. Moreno Maza.** Real limit points of quasi-componenets of regular chains *ACM Commun. Comput. Algebra*, 50(4): 148-150 (2016).
- [n19] **S.A. Haque,** **X. Li,** **F. Mansouri,** **D. Mohajerani,** **M. Moreno Maza,** and **W. Pan.** A CUDA Library for Modular Polynomial Computation. To appear in *ACM Commun. Comput. Algebra*.
- Distinguished Software Presentation Award at ISSAC 2017.**
- [n20] **R.J. Jing** and **M. Moreno Maza.** The Z-Polyhedra library in Maple. To appear in *ACM Commun. Comput. Algebra*.

Conference articles:

- [w1] **X. Dahan**, **M. Moreno Maza**, É. Schost, **W. Wu** and **Y. Xie**. Equiprojectable decompositions of zero-dimensional varieties. In proc. of *International Conference on Polynomial System Solving*, pages 69-71, University of Paris 6, France, 2004.
- [w2] **M. Moreno Maza**, G. Reid, **R. Scott** and **W. Wu**. On approximate triangular decompositions I: Dimension zero. In proc. of *Symbolic-Numeric Computation*, D. M. Wang and L. Zhi editors, pages 252-275, Xi'an, China, 2005.
- [w3] **M. Moreno Maza**, G. Reid, **R. Scott** and **W. Wu**. On approximate triangular decompositions II: Linear systems. In proc. of *Symbolic-Numeric Computation*, D. M. Wang and L. Zhi editors, pages 276-296, Xi'an, China, 2005.
- [w4] F. Boulier, F. Lemaire and **M. Moreno Maza**. Well known theorems on triangular systems and the D5 Principle. In proc. of *Transgressive Computing 2006*, J.-G. Dumas et al., editors, pages 79-92, ISBN 84-689-8381-0, Universidad de Granada, Spain, 2006.
- [w5] **X. Dahan**, **M. Moreno Maza**, É. Schost, and **Y. Xie**. On the complexity of the D5 Principle. In proc. of *Transgressive Computing 2006*, J.-G. Dumas et al., editors, pages 149-168, ISBN 84-689-8381-0, Universidad de Granada, Spain, 2006.
- [w6] **M. Moreno Maza**, É. Schost, and **W. Zhou**. Primary decomposition of zero-dimensional ideals: Putting Monico's algorithm into practice. In proc. of *Transgressive Computing 2006*, J.-G. Dumas et al., editors, pages 419-428, ISBN 84-689-8381-0, Universidad de Granada, Spain, 2006.
- [w7] **C. Chen**, F. Lemaire, **M. Moreno Maza**, **W. Pan** and **Y. Xie**. Efficient computations of irredundant triangular decompositions with the `RegularChains` library. In proc. *Computer Algebra Systems and Their Applications'07*, Y. Shi et al. (Eds.): ICCS 2007, Part II, LNCS 4488, pp. 268271, Springer-Verlag Berlin Heidelberg 2007.
- [w8] **X. Li**, **M. Moreno Maza** and É. Schost. On the virtues of generic programming for symbolic computation. In proc. *Computer Algebra Systems and Their Applications'07*, Y. Shi et al. (Eds.): ICCS 2007, Part II, LNCS 4488, pp. 251258, Springer-Verlag Berlin Heidelberg 2007.
- [w9] **M. Moreno Maza** and **Y. Xie**. Component-level parallelization of triangular decompositions. In proc. *Parallel Symbolic Computation'07*, pages 69-77, ACM Press, New York, NY, USA, 2007.
- [w10] **M. Moreno Maza**, B. Stephenson, **Y. Xie** and S.M. Watt. Multiprocessed parallelism support in ALDOR on SMPs and multicores. In proc. *Parallel Symbolic Computation'07*, pages 60-68, ACM Press, New York, NY, USA, 2007.
- [w11] **X. Li** and **M. Moreno Maza**. Multithreaded parallel implementation of arithmetic operations modulo a triangular set. In proc. *Parallel Symbolic Computation'07*, pages 53-59, ACM Press, New York, NY, USA, 2007.
- [w12] **X. Li**, **M. Moreno Maza**, **R. Rasheed** and É. Schost. The Modpn ibrary: Bringing Fast Polynomial Arithmetic into Maple. In *Milestones in Computer Algebra 2008*, pages 73-80, Trinidad and Tobago, 2008.
- [w13] **C. Chen**, **L. Li**, **M. Moreno Maza**, **W. Pan** and **Y. Xie**. On the Representation of Constructible Sets. In *Milestones in Computer Algebra 2008*, pages 103-108, Trinidad and Tobago, 2008.

- [w14] **C. Chen**, F. Lemaire, **L. Liyun**, **M. Moreno Maza**, **W. Pan** and **Y. Xie**. The ConstructibleSetTools and ParametricSystemsTools modules of the RegularChains library in MAPLE. In *Proc. of the International Conference on Computational Science and Applications*, IEEE Computer Society, pp 342-352, 2008.
- [w15] **X. Li**, **M. Moreno Maza**, **R. Rasheed** and É. Schost. High-Performance Symbolic Computation in a Hybrid Compiled-Interpreted Programming Environment. In *Proc. 2008 International Conference on Computational Sciences and Its Applications*, pages 331–341. IEEE Computer Society, 2008.
- [w16] **C. Chen**, J. H. Davenport, J. May, **M. Moreno Maza**, B. Xia, R. Xiao and Y. Xie. User Interface Design for Geometrical Decomposition Algorithms in Maple In *Proc. Mathematical User-Interface 2009*, 12 pages, 2009.
- [w17] **C. Chen** and **M. Moreno Maza**. Intersection Formulas and Algorithms for Computing Triangular Decompositions (extended abstract), In *Proc. MACIS'09*, Math-for-Industry Lecture Note Series Vol. 22, 2009.
- [w18] C. E. Leiserson, **Liyun Li**, **M. Moreno Maza** and Y. Xie. Parallel computation of the minimal elements of a poset. In *Proc. of the 4th International Workshop on Parallel and Symbolic Computation (PASCO'10)*, ACM Press, 2010, pp. 53–62.
- [w19] **S. A. Haque**, Shahadat Hossain and **M. Moreno Maza**. Cache friendly sparse matrix-vector multiplication In *Proc. of the 4th International Workshop on Parallel and Symbolic Computation (PASCO'10)*, ACM Press, 2010, pp. 175-176.
- [w20] L. Meng, Y. Voronenko, J. R. Johnson, **M. Moreno Maza**, F. Franchetti and Y. Xie. SPIRAL-generated modular FFT algorithms. In *Proc. of the 4th International Workshop on Parallel and Symbolic Computation (PASCO'10)*, ACM Press, 2010, pp. 169-170.
- [w20] **M. Moreno Maza**, B. Xia and **R. Xiao**. On solving parametric polynomial systems. In *Proceedings of the Fourth International Conference on Mathematical Aspects of Computer Science and Information Sciences (MACIS 2011)*, Edited by Stefan Raschan, pp. 205–215, 2011.
- [w21] **C. Chen**, J.H. Davenport, F. Lemaire, **M. Moreno Maza**, **N. Phisanbut**, B. Xia, **R. Xiao** and Y. Xie. Solving semi-algebraic systems with the RegularChains library in Maple. In *Proceedings of the Fourth International Conference on Mathematical Aspects of Computer Science and Information Sciences (MACIS 2011)*, Edited by Stefan Raschau, pp. 38–51, 2011.
- [w22] **C. Chen**, **M. Moreno Maza** and Y. Xie. Computing the Supremum of the Real Roots of a Parametric Univariate Polynomial. In the *Proceedings of the Fifth International Conference on Mathematical Aspects of Computer Science and Information Sciences (MACIS 2013)*.
- [w23] R.J. Bradford, C. Chen, J.H. Davenport, M. England, **M. Moreno Maza**, D.J. Wilson. Problem Formulation for Truth-Table Invariant Cylindrical Algebraic Decomposition by Incremental Triangular Decomposition. In the *Proceedings of Intelligent Computer Mathematics - International Conference, CICM 2014*, Coimbra, Portugal, July 7, Lecture Notes in Computer Science, volume 8543, Springer, pages 45-60.

- [w24] **X. Chen, M. Moreno Maza, S. Shekar** and P. Unnikrishnan. *MetaFork: A Framework for Concurrency Platforms Targeting Multicores*. In the *Proceedings of the International Workshop on OpenMP (IWOMP)*, volume 8766 of Lecture Notes in Computer, Springer, 2014.
- [w25] R. M. Corless, **S. E. Thornton, M. Moreno Maza**. Jordan Canonical Form with Parameters From Frobenius Form with Parameters In the *Proceedings of the Seventh International Conference on Mathematical Aspects of Computer Science and Information Sciences (MACIS 2017)*, Volume 10693 of the Lecture Notes in Computer Science series, Springer-Verlag, 19 pages, 2017.
- [w26] **R.J. Jing** and **M. Moreno Maza**. Computing the Integer Points of a Polyhedron (Extended Abstract). In *Proceedings of the 2nd International Workshop on Satisfiability Checking and Symbolic Computation co-located with the 42nd International Symposium on Symbolic and Algebraic Computation ISSAC 2017*, CEUR Workshop Proceedings, volume 1974, 15 pages, 2017.
- [w27] **S.A. Haque**, A. Hashemi, **D. Mohajerani** and **M. Moreno Maza**. Plain, and Somehow Sparse, Univariate Polynomial Division on Graphics Processing Units. In *Proc. of the 6th International Workshop on Parallel and Symbolic Computation (PASCO'17)*, ACM Press, 2010, pp. 10:1–10:10, 2017.
- [w28] **M. Moreno Maza**. Multithreaded programming on the GPU: pointers and hints for the computer algebraist. In *Proc. of the 6th International Workshop on Parallel and Symbolic Computation (PASCO'17)*, ACM Press, 2010, pp. 3:1–3:1, 2017.

2.5 Category III vehicles

2.5.1 Description of category III vehicles

Proceedings papers are listed here. The corresponding conferences have moderate level of refereeing, or an informal paper review process. The motivation for publishing in these vehicles is appropriateness to the audience, or a wide readership.

Vehicle	Short name	Reason for use
Applications of Computer Algebra	ACA	Appropriateness to the audience
Algebraic Geometry and Geometric Modelling	AGGM	Appropriateness to the audience
Asian Workshop on Foundations of Software	AWFS	Appropriateness to the audience
International Conference on Intelligent Systems and Computer Science	ICISCS	Appropriateness to the audience
Encuentros de Àlgebra Computacional y Aplicaciones maple Summer Conference	EACA	Wide readership Appropriateness to the audience

2.5.2 Papers published in category III vehicles

Conference articles:

- [m1] F. Boulier, **M. Moreno Maza** and **C. Oancea**. A new Henselian construction and its application to polynomial GCDs over direct products of fields. In proc. of *EACA '04*, pages 47-52, ISBN 84-688-6988-04, Universidad de Santander, Spain, 2004.
- [m2] **J. Cai**, M. Dunstan, **M. Moreno Maza** and S.M. Watt. Debugging ALDOR via a unified runtime environment. In proc. of *EACA '04*, pages 119- 124, ISBN 84-688-6988-04, Universidad de Santander, Spain, 2004.
- [m3] **J. Cai**, M. Dunstan, **M. Moreno Maza** and S.M. Watt. Debugging a high level language via a unified interpreter and compiler runtime environment. In proc. of *ACA '04*, pages 125-138, ISBN 0-9759946-0-3, University of Texas at Beaumont, USA, 2004.
- [m4] F. Lemaire, **M. Moreno Maza** and **Y. Xie**. The RegularChains library in Maple 10. In proc. of *Maple Summer Conference '05*, Ilias S. Kotsireas editor, ISBN 1-894511-85-9, pages 355-368, Waterloo, Canada, 2005.
- [m5] **X. Dahan**, **X. Jin**, **M. Moreno Maza** and É Schost. Change of ordering for regular chains in positive dimension. In proc. *AGGM'06*, pages 49-53, Universidad de Barcelona, 2006.
- [m6] **M. Moreno Maza and Y. Xie**. Parallelization of triangular decompositions. In proc. *AGGM'06*, pages 96-100, Universidad de Barcelona, 2006.
- [m7] O. Golubitsky, M. Kondratieva, **M. Moreno Maza** and **A. Ovchinnikov**. Bounds and algebraic algorithms in differential algebra: the ordinary case. In proc. of the *9th Intern. Conf. on Intelligent Systems and Computer Science'06*, pages 7-11, Faculty of Mechanics and Mathematics, Moscow State University, 2006.
- [m8] **C. Chen**, **M. Moreno Maza**, **W. Pan** and **Y. Xie**. On the verification of polynomial system solvers. In proc. of the *Fifth Asian Workshop on Foundations of Software*, pages 116-144, University of Xiamen, China, 2007. Invited paper.
- [m9] M. Bronstein, **M. Moreno Maza** and S.M. Watt. Generic programming techniques in ALDOR, In proc. of the *Fifth Asian Workshop on Foundations of Software*, pages 72-77, University of Xiamen, China, 2007.

Technical Report:

- [m10] M.V. Foursov and **M. Moreno Maza**. On the relationship between the Kaup–Kupershmidt and Sawada–Kotera equations. Tech. Rep. LIFL 2001-04. Univ. of Lille 1, 2001.
- [m11] **X. Chhen**, **M. Moreno Maza**, J. Paudel, **N. Xie**. Comprehensive optimization of parametric kernels for raphics processing units. Tech. Rep. University of Western Ontario, 2017.
- [m12] R. M. Corless, **R.H.C. Moir**, **M. Moreno Maza**, **N. Xie**. Symbolic-Numeric Integration of Rational Functions. Tech. Rep. University of Western Ontario, 2017.

2.6 Software packages

My software contributions are either accessible from the following URLs or shipped with the computer algebra systems MAPLE or AXIOM.

- [s1] The Computational Mathematics Group. *The BasicMath library in ALDOR*. NAG, Oxford, UK, 1998.
<http://www.nag.co.uk/projects/FRISCO.html>
- [s2] The Computational Mathematics Group. *AXIOM 2.2*. NAG, Oxford, UK, 1998.
<http://www.nag.co.uk/projects/FRISCO.html> <http://wiki.axiom-developer.org/FrontPage>
- [s3] The Computational Mathematics Group. *AXIOM 2.3*. NAG, Oxford, UK, 2000. <http://www.nag.co.uk/projects/FRISCO.html> <http://wiki.axiom-developer.org/FrontPage>
- [s4] *Aldor*. University of Western Ontario, Canada, 2002. www.aldor.org
- [s5] **P. Alvandi**, C. Chen F. Lemaire, **M. Moreno Maza** and Y. Xie. The RegularChains library. Shipped with MAPLE, since its release 10, May 2005, Maplesoft, Canada, 2009. [www.maplesoft.com] Also Available from www.regularchains.org since 2014.
- [s6] **X. Li**, **M. Moreno Maza** and **W. Pan**. The Modpn library. Shipped with MAPLE, since its release 13, Maplesoft, Canada, 2009. Also Available from www.cumodp.org since 2014.
- [s7] C. Chen, **S. Covanov**, **F. Mansouri**, **M. Moreno Maza**, **N. Xie** and Y. Xie. The *Basic Polynomial Algebra Subprograms* (BPAS). Available from www.bpaslib.org since 2014.
- [s8] **S. A. Haque**, **X. Li**, **D. Mohajerani**, **F. Mansouri**, **M. Moreno Maza** and **W. Pan**. The *CUDA Modular Polynomial* (CUMODP) Library. Available from www.cumodp.org since 2014.
- [s9] **X. Chen**, **M. Moreno Maza** and **N. Xie**. The MetaFork Compilation Framework. Available from www.metafork.org since 2014.
- [s10] **R. Xiao** and **M. Moreno Maza**. The PolyhedralSets Library. Shipped with Maple since its release 2015,
see <https://fr.maplesoft.com/support/help/Maple/view.aspx?path=PolyhedralSets>.
- [s11] **V. Fuentes**, **R. Xiao** and **M. Moreno Maza**. The ProgramAnalysis Library. Shipped with Maple since its release 2016,
see <https://fr.maplesoft.com/support/help/Maple/view.aspx?path=CodeTools/ProgramAnalysis>.
- [s12] **P. Alvandi** and **M. Moreno Maza**. The PowerSeries Library. Available from <http://www.regularchains.org/downloads.html> since 2016.
- [s13] **R.J. Jing** and **M. Moreno Maza**. The Z-Polyhedra Library. Available from <http://www.regularchains.org/downloads.html> since 2017.

2.6.1 The RegularChains library

In the course of the past 10 years, the REGULARCHAINS library has become a comprehensive and powerful toolkit for solving polynomial systems. No other software package offers the same range of functionalities.

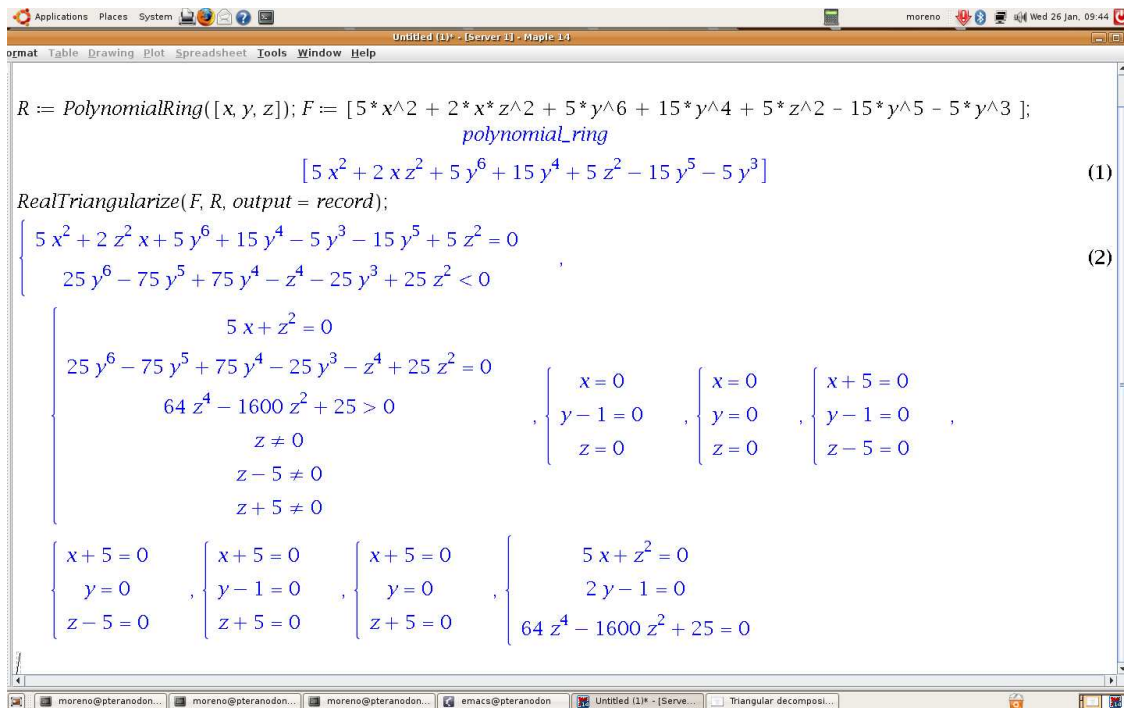


Figure 1: Computing the real solutions of polynomial system exactly.

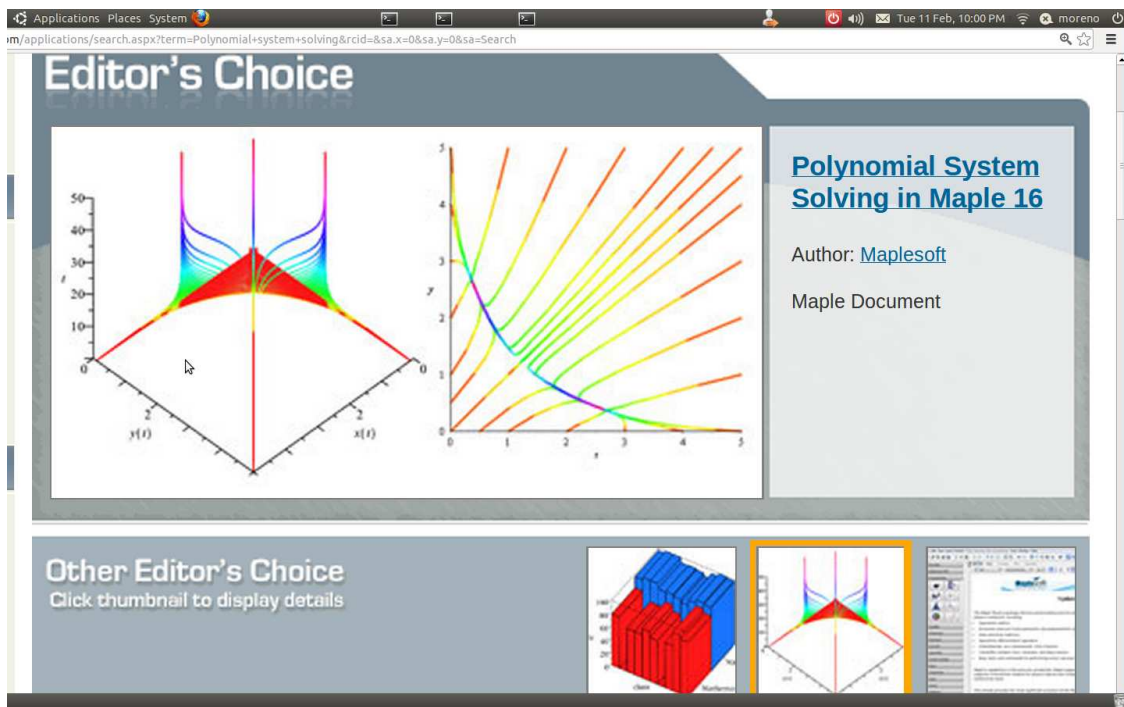


Figure 2: Maplesoft uses our polynomial system solving software to advertise Maple.

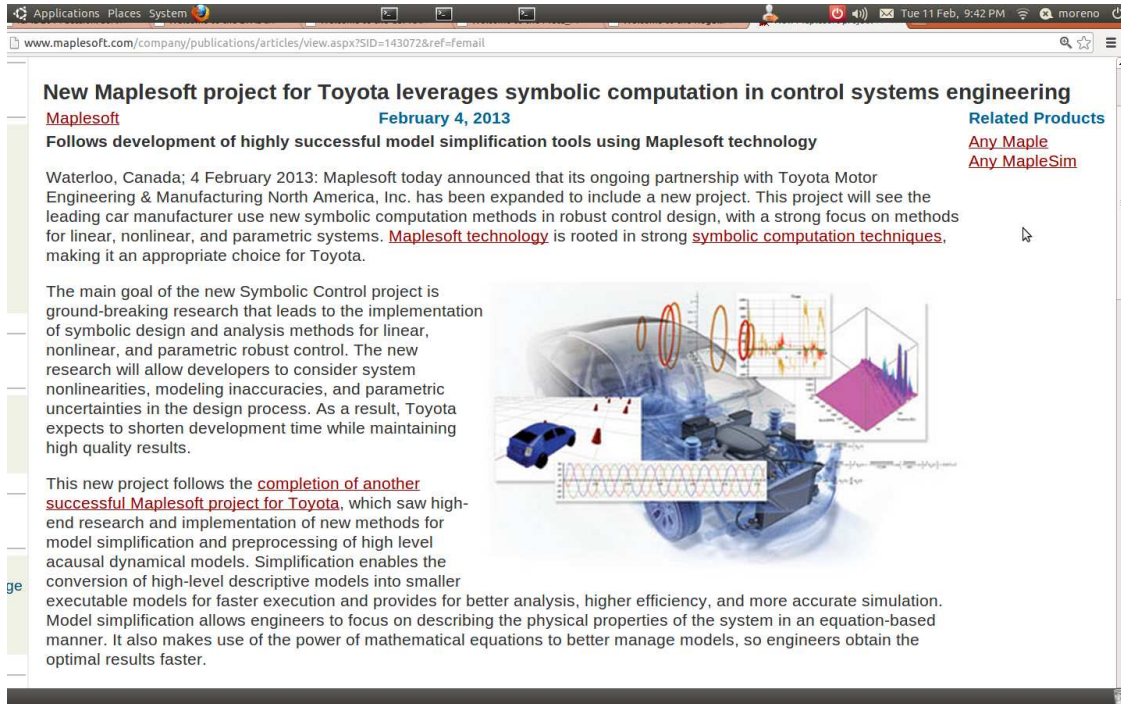


Figure 3: Toyota engineers use our software to design control systems

Actually, since 2011, the REGULARCHAINS library offers the **first software solver applicable to any input system of polynomial equations, inequations and inequalities**. In particular, this is the first solver capable of producing an exact description of the real solutions of an arbitrary polynomial system. This corresponding command, called `RealTriangularize`, is illustrated by Figure 1. With `RealTriangularize`, MAPLE becomes the first computer algebra system equipped with a solver capable of computing exactly the real solutions of any polynomial system. This gives a decisive advantage upon its competitors.

On its *Application Center*, Maplesoft uses our polynomial system solving software to advertise Maple. See the second item in the third column in the lower part of Figure 2.

The REGULARCHAINS library is being successfully applied to the areas of optimization and control through Maplesoft’s industrial consulting projects, see the article on Figure 3, where Toyota leverages symbolic computation in control systems engineering.

As far as performance is concerned, I would like to highlight the following fact. As mentioned above, the `solve` command in MAPLE is at core of many of computations in MAPLE and this command is one of the most often called by end-users. **Since the release 15 of MAPLE, the solve command relies on the RegularChains library for solving systems of polynomial equations**. Since MAPLE has more than 5,000,000 licenses world-wide, this is a strong recognition for my work and that of my students.

Some other figures about the REGULARCHAINS library are listed below.

- 131 exported functions,
- more than 300 internal functions,

- 67,000 lines of MAPLE source code,
- 10,000 lines of test programs,
- 3,000 lines of software development source code (C, LEX, scripts),
- 12,000 lines of documentation,
- 260 pages for the specification document.

At the Internal Symposium of Symbolic and Algebraic Computation (ISSAC) 2011, I received the **Distinguished Software Presentation Award** for a presentations of the REGULARCHAINS library.

<http://www.sigsam.org/awards/index.phtml>

2.6.2 The `modpn` library

The `modpn` library is dedicated to fast arithmetic for multivariate polynomials. It was at the core of the PhD theses of my students Xin Li and Wei Pan. Today, Xin Li and Wei Pan are full-time researchers respectively at the *Universidad Carlos III, Madrid, Spain* and *Intel Corp, Santa Clara, USA*.

For the integration of `modpn` into MAPLE, they have received the the *2009 MITACS Award* for the

Best Novel Use of Mathematics in Technology Transfer

The main objective of `modpn` is to provide highly efficient routines for supporting the implementation of algebraic algorithms in high-level programming languages such as MAPLE. This library consists of

- 36,000 lines of C and ASSEMBLY code
- 5,000 lines of MAPLEcode
- 74 exported functions in the MAPLE interface.

The performances of the `modpn` library has been reported and published in peer-reviewed venues.

2.6.3 The *Basic Polynomial Algebra Subroutines* library

The Basic Polynomial Algebra Subprograms (BPAS) provides arithmetic operations (multiplication, division, root isolation, etc.) for univariate and multivariate polynomials over prime fields or with integer coefficients. The current distribution focuses on dense polynomials and the sparse case is work in progress. The code is mainly written in CilkPlus targeting multicores. A strong emphasis is put on adaptive algorithms as the library aims at supporting a wide variety of situations in terms of problem sizes and available computing resources. One of the purposes of the BPAS project is to take advantage of hardware accelerators in the development of polynomial systems solvers. The BPAS library is publicly available in source at www.bpaslib.org.

Inspired by the Basic Linear Algebra Subprograms (BLAS), BPAS functionalities are organized into three levels. At Level 1, one finds basic arithmetic operations that are specific to a polynomial representation or a coefficient ring, e.g. multi-dimensional FFTs/TFTs, univariate real root isolation. At Level 2, arithmetic operations are implemented for all types of coefficients rings supported by BPAS (prime fields, ring of integers, field of rational numbers). Level 3 gathers advanced arithmetic operations taking as input a zero-dimensional regular chains, e.g. normal form of a polynomial, multivariate real root isolation.

Level 1 functions are highly optimized in terms of data locality and parallelism. In particular, instruction level parallelism is carefully considered and FFT code is automatically generated by configurable Python scripts. At Level 2, the user can choose between algorithms minimizing work (at the expense of decreasing parallelism) and algorithms maximizing parallelism (at the expense of increasing work). This leads, at Level 3, to adaptive algorithms which select appropriate Level 2 functions depending on available resources (number of cores, input data size).

2.6.4 The cumodp library

The CUMODP library is a GPU counterpart of the BPAS library. One of its main applications is the *first polynomial system solver based on GPU code* which is integrated into Maple.

The CUMODP library has also gained the interest of other software projects in high-performance scientific computing, namely the LinBox (for symbolic linear algebra) and SPIRAL (for Digital Signal Processing) with whom we are now actively cooperating.

The CUMODP library is publicly available in source at www.cumodp.org.

2.6.5 The Meta_Fork library

META_FORK is a compilation framework which aims at facilitating the design and implementation of concurrent programs. To this end, META_FORK performs automatic code translation between concurrency platforms targeting hardware accelerators. META_FORK is also a high-level programming language which combines several models of concurrency, including fork-join and pipelining parallelisms as well as SIMD language constructs.

In its publicly available release, META_FORK supports the fork-join model and pipelining, targeting multi-core architectures and performing automatic code translation between CilkPlus and OpenMP. With respect to the previous release, MetaFork has been integrated with Clang, the C language family frontend for LLVM.

Our work in progress focuses on language constructs for generating SIMD code in languages targeting many-core GPU architectures. One of our research interests is to be able to generate code that depends on machine or program parameters (e.g. cache size, number of processors, number of threads per thread block).

META_FORK is supported by the IBM Toronto labs as IBM CAS Project CAN13001-880. and can be downloaded from www.metafork.org

3 Teaching Material

The table below summarizes the courses I have taught at the University of Western Ontario during the last 12 academic years.

Course number	Course title	Terms taught
CS1026	Computer Science Fundamentals I	Winter 2010
CS210	Data-structures and algorithms	Fall 2003
CS211	Software Tools and Systems Programming	Fall 2005
		Winters 2007, 2008, 2010
CS2101	Foundations of Programming for High Performance Computing	Winter 2012
		Falls 2012, 2013, 2014, 2015
CS2209	Applied Logic for Computer Science	Fall 2017
CS3101	Theory of High-performance Computing	Winters 2013, 2014, 2015
CS3350	Computer Architecture	Winters 2015, 2017
CS4402/CS9535	Distributed and Parallel Systems	Winters 2012, 2013, 2014, 2015, 2017
CS424/CS556	Foundations of Computational Algebra	Winters 2004, 2005, 2006
		Winters 2007, 2008
CS447/CS545	Compiler Theory	Winters 2003, 2004
		Fall 2004
CS874	Advanced computer algebra: asymptotically fast methods for exact computations	Winter 2003
AM583	Advanced Computer Algebra: Modular Computations.	Fall 2004
CS9652	Algorithms and Software for Symbolic Solvers for Polynomial Systems	Winter 2004
		Fall 2017
CS867	Algorithmic Properties of Polynomial Rings	Winter 2005
CS855	Parallel Scientific Computing: Models, Algorithms and Implementation	Winters 2006, 2007, 2008
CS9624	High Performance Computing with a Focus on Hardware Acceleration Technologies	Winter 2010

3.1 Undergraduate courses (cross-listed courses included)

- *CS211, Software Tools and Systems Programming.*
http://www.csd.uwo.ca/~moreno/cs2211_moreno/index.html
- *CS 2101 – Foundations of Programming for High Performance Computing*
http://www.csd.uwo.ca/~moreno/cs2101a_moreno/index.html
- *CS 2109 – Applied Logic for Computer Science*
<http://www.csd.uwo.ca/courses/CS2209a/>
- *CS 3101 – Theory of High-performance Computing*
<http://www.csd.uwo.ca/~moreno/CS3101-1213.html>
- *CS3350 - Computer Architecture*
http://www.csd.uwo.ca/~moreno/cs3350_moreno/index.html
- *CS 4402 and CS 9535 – Distributed and Parallel Systems*
<http://www.csd.uwo.ca/~moreno/CS96xx-4402-1718.html>

- *CS424/CS556, Foundations of Computer Algebra.*
<http://www.csd.uwo.ca/~moreno/CS424b-CS556b-foundCA-0708.html>
- *CS 4435 and CS 9624 and – High Performance Computing: From Models of Computation to Applications.*
<http://www.csd.uwo.ca/~moreno/CS9624-4435-1011.html>
- *CS447, Compiler Theory.*
<http://www.csd.uwo.ca/~moreno/MainPages/CS447-2004.html/index.html>

3.2 Graduate courses

- *CS855 - Parallel Scientific Computing: Models, Algorithms and Implementation.*
<http://www.csd.uwo.ca/~moreno/CS855b-parSC-0708.html>
- *CS 9624 - High Performance Computing with a Focus on Hardware Acceleration Technologies*
<http://www.csd.uwo.ca/~moreno/CS433b-CS9624b-0910.html>
- *CS867 - Algorithmic Properties of Polynomial Rings.*
<http://www.csd.uwo.ca/~moreno/CS867b-polyRing-0405.htm>
- *AM 583 - Advanced Computer Algebra: Modular Computations.*
<http://www.csd.uwo.ca/~moreno/node45.html>
- *CS 9652 - Algorithms and Software for Symbolic Solvers for Polynomial Systems.*
<http://www.csd.uwo.ca/~moreno/CS6652-1718.html>
- *CS874 - Advanced Computer Algebra: Asymptotically Fast Methods for Exact Computations.*
<http://www.csd.uwo.ca/~moreno/CS874b-advCompAlg-0203.html>

4 Supervision of Students and PDFs

I have supervised the PhD and Master's theses listed in Section 4.1, the post-doctoral projects listed in Section 4.2 and the internships and undergraduate projects listed in Section 4.3.

4.1 Completed graduate students

1. Parisa Alvandi *Computing Limit Points of Quasi-components of Regular Chains and its Applications.* PhD thesis UWO, started September 2012, defended May 2017.
2. Xiaohui Chen *MetaFork: A Compilation framework for concurrency models targeting hardware accelerators.* PhD thesis UWO, started September 2012, defended March 2017.
3. Ning Xie *Towards Comprehensive Parametric Code Generation Targeting Graphics Processing Units in Support of Scientific Computation.* PhD thesis UWO, started September 2012, defended November 2016.
4. Davood Mohajerani *Big prime field FFT on the GPU.* UWO, started September 2015, defended December 2016.

5. Li Zhang *Implementation techniques for the truncated Fourier transform*. Master thesis UWO, started September 2014, defended September 2015.
6. Paul Urbik *Computing Intersection Multiplicity via Triangular Decomposition*. PhD thesis UWO, started September 2009, defended December 2014, co-supervised by É Schost.
7. Svyatoslav Covanov *Putting Fürer's Algorithm into Practice*. École Polytechnique (France) & UWO, Master thesis, started September 2012, defended August 2014.
8. Farnam Mansouri *On the parallelization of integer polynomial multiplication*. Master thesis, UWO, started January 2013, defended April 2014.
9. Sushek Shekar *On the Interoperability of Programming Languages based on the Fork-Join Parallelism Model*. Master thesis, UWO, started September 2012, defended December 2013.
10. Sardar Anisul Haque *Hardware Acceleration Technologies in Computer Algebra: Challenges and Impact*. PhD thesis, UWO, started January 2009, defended November 2013.
11. Md Mohsin Ali *On the Factor Refinement Principle and its Implementation on Multicore Architectures*. Master thesis, UWO, started September 2010, defended December 2011.
12. Zunaid Haque *Multi-threaded real root isolation on multi-core architectures*. Master thesis, UWO, started September 2010, defended April 2012.
13. Jiajian Yang *Fast polynomial arithmetic on the GPU*. Directed Study, UWO, started September 2011, defended December 19, 2011
14. Changbo Chen *Solving Polynomial Systems via Triangular Decomposition*. PhD thesis, UWO, started in September 2007, defended August 30, 2011.
15. Wei Pan *Algorithmic Contributions to the Theory of Regular Chains*. PhD thesis, UWO, started in September 2006, defended January 25, 2011.
16. Liyun Li *Efficient Evaluation of Large Polynomials*. Master thesis, UWO, started in September 2008, defended August 23, 2010.
17. Xin Li *Toward High-performance Polynomial System Solvers Based on Triangular Decompositions*. PhD thesis, UWO, started in September 2005, defended on April 21, 2009.
18. Yuzhen Xie *Fast algorithms, modular methods, parallel approaches and software engineering for solving polynomial systems symbolically*. PhD thesis, UWO, started in January 2003, defended on September 4, 2007.
19. Raqeeb Rasheed. *Modular Methods for Solving Nonlinear Polynomial Systems*. Master's thesis, UWO, started in September 2006, defended on August 23, 2007.
20. Akpodigha Filatei. *Implementation of Fast Polynomial Arithmetic in Aldor.*, Master's thesis, UWO, started in May 2005, defended on March 28, 2006.
21. Xin Li, *Efficient management of symbolic computations in compiled and interpreted environments.*, Master's thesis, UWO, started in May 2004, defended on August 15, 2005.

22. Jinlong Cai. *Unified functional closures extending the Aldor development environment and supporting its interactive debugger*, Master's thesis, UWO, started in May 2003, defended in August 2004.

4.2 Completed post-doctoral fellows

1. Sylvain Neut during the Fall 2003 for the project *Application of Cartan's equivalence method to the Painlevé equations* at UWO.
2. François Lemaire in Summer 2003 for the project REGULARCHAINS library in MAPLE at UWO.
3. Oleg Golubitsky, jointly with Stephen M. Watt. UWO, from September 2006 to December 2007.
4. Ekaterina Shemyakova, for the project *Heuristical strategies for variable ordering section in solving large sparse polynomial systems*, UWO, from January 2010 to June 2010.
5. Yuzhen Xie, jointly with Ilias Kotsireas, for the MITACS-Elevate project *Cache-oblivious and adaptive algorithms in symbolic computation*, UWO & WLU, from May 2011 to January 2012.
6. Rong Xiao, for the MITACS-Elevate project *High Performance Real Solving Tools in Support of Industrial Applications*, UWO, from September 2009 to December 2012.
7. Changbo Chen, for the project MITACS-Elevate project *Computer Algebra and High-Performance Computing Support for Model Predictive Control*, UWO, from September 2011 to December 2013 .
8. Yi Li, for the project *Linear Programming over Rational Functional Fields*, UWO, from March 2014 to July 2014.
9. Liangyu Chen, for the project *Resultant computation on the GPU*, UWO, from March 2014 to February 2015.

4.3 Completed internships

1. Undergraduate thesis: Yiming Guan *Computing the integer points of a polyhedron*. UWO, September 2015 - August 2016.
2. Undergraduate project (CS CS3380F/G/Z) Amha Tsegaye *Parallel sparse polynomial multiplication in the BPAS library*. UWO, May-August 2016.
3. Undergraduate project (CS CS3380F/G/Z) Yiming Guan *The Omega test*. UWO, May-August 2015.
4. Undergraduate project (CS CS3380F/G/Z) Haowei Chen *Benchmarking the MetaFork-to-CUDA code generator* UWO, May-August 2015.
5. Undergraduate research assistant: Gabriel Sarfis (Université Paris 7, France) *Parallel Implementation of Canon's Algorithm in Julia*. UWO, August 2014.

6. Undergraduate research assistant: Afsaneh Bakhtiari (Applied Mathematics Department). *Implementation of the Half-GCD Algorithms in Aldor*. UWO, May 2005 to May 2006.
7. Undergraduate project (CS 490 Y) of Wei Hu (co-supervised with Serge Mister). *Security Testing of Protocol Implementations*. UWO, September 2004 to March 2005.
8. Undergraduate research assistant: Steve Wilson (Mathematics Department). *Implementation of Multivariate Hensel lifting in Aldor*. UWO, Summer 2004.
9. Internship in licence MIAGE-2 of Karim Zgoulli. *Automatisation du suivi de la production de l'entreprise OSYS*. Université de Lille 1, France, 2001.
10. Internship in licence MIAGE-2 of Édith Deman. *Gestion informatique de la bibliothèque interne de l'entreprise UNIS*. Université de Lille 1, France, 2001.

4.4 Titles of theses in progress

1. Supervision of the PhD Thesis of Mohammadali Asadi. *Computing topological closures in higher dimension*. UWO, started September 2017.
2. Supervision of the PhD Thesis of Mehdi Samadieh. *A quadratic lifting scheme for the extended Hensel construction*. UWO, started September 2017.
3. Supervision of the PhD Thesis of Davood Mohajerani *Arbitrary precision arithmetic on the GPU*. UWO, started January 2017.
4. Co-supervision of the PhD Thesis of Steven E. Thorton with Robert M. Corless. *Rational algorithms for parametric linear systems*. UWO, started September 2014.
5. Co-supervision of the PhD Thesis of Robert H. C. Moir with Robert M. Corless. *Feasible Computation in Symbolic and Numeric Integration*. UWO, started September 2014.
6. Co-supervision of the PhD Thesis of Egor Chesakov with Yuri Boykov. *Vascular Tree Structure: Fast Curvature Regularization and Validation*. UWO, started January 2016, withdrawn October 2017.
7. Supervision of the Master Thesis of Masoud Ataei *Computing Limit Points of Constructible Sets*. UWO, started September 2016.
8. Supervision of the Master Thesis of Alexander Brandt. *iMultithreaded algorithms for sparse polynomial arithmetic*. UWO, started September 2017.
9. Supervision of the Master Thesis of Colin Costello. *Multithreaded algorithms for the inverse truncated Fourier transform*. UWO, started September 2017.
10. Supervision of the Master Project of Yiming Guan. *Cache-oblivious algorithm for Fourier-Motzkin elimination*. UWO, started September 2016.
11. Supervision of the Master Thesis of Delaram TalaAshrafi. *Multithreaded algorithms for the Omega test*. UWO, started September 2017.

12. Supervision of the Master Thesis of Amha Tsegaye. *Asymptotically fast algorithms for parsing polynomial expressions*. UWO, started September 2017.
13. Supervision of the Master Project of Haoze Yuan. *Multithreaded algorithms for integer programming on graphics processing units*. UWO, started September 2016.
14. Supervision of the Master Thesis of Linxiao Wang. *Fast algorithms for large generalized Fermat prime fields*. UWO, started September 2016.
15. Supervision of the Undergraduate Thesis of Yuchen Wang. *Models of Computation for Graphics Processing Units*. UWO, started September 2017.
16. Supervision of the Undergraduate Thesis of Haoyu Gu. *Integer of the Message Passing Interface in the MetaFork Framework*. UWO, started September 2017.

4.5 Visiting PhD students

1. Adviser (but not co-supervisor) for the PhD thesis of Ruijuan Jing *Parametric Integer Programming*, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, started September 2015. Visit at UWO from September 2016 to September 2017.
2. Adviser (but not co-supervisor) for the PhD thesis of Mahsa Kazemi *Bifurcation analysis of singularities*. Maths, Isfahan University of Technology, started September 2012. Visit at UWO from September 2015 to November 2016.

4.6 Theses for which I served, or I am serving, as adviser, or an examiner

1. Examiner for the PhD thesis of Armin Jamshidpey, *Algebraic Tori: A Computational Approach*. Mathematics, UWO, August 8, 2017.
2. Examiner for the PhD thesis of Michael J. Burrell. *Resource Bound Guarantees via Programming Languages*. Computer Science, UWO, June 22, 2017.
3. Examiner for the PhD thesis of Monagi Alkinani. *Patch-based Denoising Models and Algorithms for Single and Multi-view Image*. Computer Science, UWO, April 13, 2017.
4. Examiner for the PhD thesis of Seyed Mohsen Zabihi. *Developing Predictive Models of Driver Behaviour for the Design of Advanced Driving +Assistance Systems*. Computer Science, UWO, March 2, 2017.
5. Examiner for the Master's thesis of Fawzi Yassine. *InterLinker: An Algorithm for Integrating Heterogeneous Data Sources using the Semantic Web*. Computer Science, UWO, April 5, 2017.
6. Examiner for the PhD thesis of Fei Wang, *Computation of Real Radical Ideals by Semi-definite Programming and Iterative Methods*, Applied Mathematics, UWO, October 20, 2016.
7. Examiner for the Master's thesis of Eunice Yu Sze Chan, *A comparison of solution methods for Mandelbrot-like polynomials*, Applied Mathematics, UWO, August 17, 2016.

8. Examiner for the Master's thesis of Egor Chesakov, *Vascular Tree Structure: Fast Curvature Regularization and Validation*, CS, UWO, December 22, 2015.
9. Examiner for the PhD thesis of Javad Doliskani, *Computing in Algebraic Closures of Finite Fields*, CS, UWO, September 23, 2015.
10. Examiner for the PhD thesis of Martin Helmer, *Algorithms to compute characteristic classes*, Applied Mathematics, UWO, June 25, 2015.
11. Examiner for the PhD thesis of Hayssam El-Razouk, *Hardware Implementations for Symmetric Key Cryptosystems*, Electrical and Computer Engineering, UWO, June 5, 2015.
12. Examiner for the PhD thesis of Xuan Liu, *Determination of Lie Superalgebras of Supersymmetries of Super Differential Equations*, Applied Mathematics, UWO, April 6, 2015.
13. Examiner for the PhD thesis of Michael Rogelstad, *Combinatorial Techniques in the Galois Theory of p -Extensions*, Mathematics, UWO, May 25, 2015.
14. Mahmud Hasan, *BM3D Image Denoising using SSIM Optimized Wiener Filter*, Master Thesis, CS, UWO, December 1, 2014.
15. Examiner for the PhD thesis of Gaohong Wang *Ghost number of group algebras*. Mathematics, UWO, July 28, 2014.
16. Examiner for the PhD thesis of Esmail Mehrabi *On The Applications of Lifting Techniques*. CS, UWO, June 19, 2014.
17. Examiner for the Master's thesis of Mohammad Mahedi Hasan *Adaptive Edge-guided Block-matching and 3D filtering (BM3D) Image Denoising Algorithm*. CS, UWO, April 21, 2014.
18. Examiner for the Master's thesis of Devin Price *High Multiplicity Strip Packing*. CS, UWO, March 13, 2014.
19. Examiner for the PhD thesis of Ebrahim Abdulrahman Hasan Abdulrahman *Efficient Arithmetic for the Implementation of Elliptic Curve Cryptography*. Electrical and Computer Engineering, UWO, November 22, 2013.
20. Examiner for the PhD thesis of Muhammad Foizul Islam Chowdhury *Application of Computer Algebra in List Decoding*. CS, UWO, November 8, 2013.
21. Adviser (but not examiner) or the PhD thesis of Yiming Zhang *Computation Sequences for Series and Polynomials*. Applied Mathematics, UWO, October 1, 2013.
22. Examiner for the Master's thesis of Yanxin Li *Integrated development and parallelization of automated dicentric chromosome identification software to expedite biodosimetry analysis*. CS, UWO, April 16, 2013.
23. Examiner for the Master's thesis of Asaduzzaman Babu *Ratio-Based Edge Detection Inspired Speckle Reducing Anisotropic Diffusion*. CS, UWO, April 3, 2013.

24. Examiner for the Master's thesis of Ilse Leal Aulenbacher *Generating Log File Analyzers*. CS, UWO, August 21, 2012.
25. Examiner for the PhD thesis of Irene Cheung *Forgiveness in close relationships*. Social Sciences, UWO, April 10, 2012.
26. Examiner for the PhD thesis of Zhendong Shao *The Research on the $L(2,1)$ -labeling problem from Graph Theoretic and Graph Algorithmic Approaches*. CS, UWO, April 18, 2012.
27. Examiner for the Master's thesis of Jonathan Leaver *Multi-Core Unit Propagation in Functional Languages*. CS, UWO, April 17, 2012.
28. Examiner for the Master's thesis of Jahedur Chowdhury *State Complexity of Combined Operations on Finite Languages*. CS, UWO, December 15, 2011.
29. Examiner for the PhD thesis of Mehdi Garrounian *Algebraic and Combinatorial aspects the Logarithmic Ideals of Arrangements and Multiarrangements*. Mathematics, UWO, April 21, 2011.
30. Examiner for the PhD thesis of Yehia Kotb *Workflow-Based cooperative multi-agent systems*. CS, UWO, August 17, 2011.
31. Examiner for the Master's thesis of Javad Doliskani *Point Counting On Genus 2 Curves*. CS, UWO, April 21, 2011.
32. Examiner for the Master's thesis of Nivedita Patil *Directed Manipulation of Formal Sums*. CS, UWO, June 30, 2010.
33. Examiner for the Master's thesis of Rachita Mohan *Uniform Treatment of Code and Data in the Web Setting*. CS, UWO, June 29, 2010.
34. Examiner for the Master's thesis of Ling Ding *High Performance Code Generation for Polynomials and Power Series*. CS, UWO, April 20, 2009.
35. Examiner for the Master's thesis of Muhammad Chowdhury *Homotopy Techniques for Multiplication Modulo Triangular Sets* UWO, April 22, 2009.
36. Examiner for the PhD thesis of Hui Ding *Numerical and Symbolic Computation of the Lambert W Function in $\mathbb{C}^{n \times n}$* . UWO, April 21, 2009.
37. Examiner for the Master's thesis of Ling Ding *High Performance Code Generation for Polynomials and Power Series*. UWO, April 20, 2009.
38. Examiner for the PhD thesis of Xiaofang Xie *On the Recognition of Handwritten Mathematical Symbols* UWO, December 14, 2007.
39. Examiner for the Master's thesis of Matthew Malefant *A Comparison of Two Families of Algorithms for Symbolic Polynomials* UWO, December 13, 2007.
40. Examiner for the PhD thesis of Azar Shakoori. *Polynomial Algebra by Values for Solving Bivariate Systems* UWO, December 11, 2007.

41. Examiner for the PhD thesis of Laurentiu Dragan. *On Measuring and Optimizing the Performance of Parametric Polymorphism*. UWO, September 4, 2007.
42. Examiner for the PhD thesis of Qing Zhao. *SC-Expressions in Object-Oriented Languages*. UWO, August 9, 2007.
43. Adviser (but not supervisor) for the PhD thesis of Wenyuan Wu. *Geometric Symbolic-numeric methods for differential and algebraic systems*. UWO, July 23, 2007.
44. Examiner for the PhD thesis of Wenqin Zhou. *Symbolic Computation Techniques for Solving Large Expression Problems from Mathematics and Engineering*. UWO, April 19, 2007.
45. Examiner for the Master's thesis of Heba Anbeer. *Complexity measures for biological strings*. UWO, December 8, 2006.
46. Examiner for the Master's thesis of Songxin Liang. *Component-free vector algebra in Aldor*. UWO, April 17, 2006.
47. Examiner for the PhD thesis of Elena Losseva. *Optimal Methods of Encoding Information for DNA Computing*. UWO, December 8, 2005.
48. Examiner for the Master's thesis of Nargol Rezvani. *Approximate Polynomials in Different Bases*. UWO, December 2, 2005.
49. Examiner for the PhD thesis of Cosmin Oancea. *Parametric Polymorphism for Software Component Architectures*. UWO, November 1, 2005.
50. Examiner for the Master's thesis of Andrew Skryzhynskyy. *Methods for Improving the Relevance of Search Results from a Search Engine*. UWO, July 7, 2005.
51. Examiner for the PhD thesis of Juntao Ye. *Computational Aspects of the Dynamics of Cloth*. UWO, May 3, 2005.
52. Examiner for the Master's thesis of Ben Huang. *Network Performance Studies in High Performance Computing Environments*. UWO, March 3, 2005.
53. Examiner for the Master's thesis of Kevin Durdle. *Supporting Mathematical Handwriting Recognition through an Extended Digital Ink Framework*. UWO, December 13, 2004.
54. Examiner for the Master's thesis of Yong Lei. *Test Case Minimization and Fault Localization with Random Unit Testing and Log File Analysis*. UWO, September 8, 2004.

4.7 Student awards and scholarships

The following is a list of the competitive awards and scholarships received by my students under my supervision.

Year	Student	Scholarship or Award
2004	Yuzhen Xie	Ontario Graduate Scholarship (OGS)
2005	Yuzhen Xie	Ontario Graduate Scholarship (OGS)
2005	Yuzhen Xie	Distinguished Student Author Award (ISSAC 2005)
2005	Yuzhen Xie	Best Poster Award (ISSAC 2005)
2006	Xin Li	Ontario Graduate Scholarship in Science and Technology (OGSST)
2006	Yuzhen Xie	CS Publications Incentive Award (Computer Science Department, UWO)
2006	Yuzhen Xie	Ontario Graduate Scholarship (OGS)
2006	Yuzhen Xie	UWO Thesis Award
2007	Xin Li	Best presentation at the UWO Research Conference in Computer Science
2007	Xin Li	NSERC Post-Graduate Doctoral Scholarship (for 2 years)
2007	Yuzhen Xie	NSERC Post-Doctoral Fellowship (for 2 years)
2009	Xin Li & Wei Pan	MITACS Award for Best Novel Use of Mathematics in Technology Transfer
2009	Anisul S. Haque	UWO Biocomputing Student Award
2010	Changbo Chen	UWO Graduate Thesis Award
2010	Wei Pan	MITACS Accelerate internship
2010	Changbo Chen	MITACS Accelerate internship
2010	Paul Vrbik	NSERC Post-Graduate Doctoral Scholarship
2011	Anisul S. Haque	Queen Elizabeth II Graduate Scholarship
2012	Anisul S. Haque	Queen Elizabeth II Graduate Scholarship
2012	Anisul S. Haque	MITACS Accelerate internship
2013	Parisa Alvandi	MITACS Accelerate internship
2013	Ning Xie	MITACS Accelerate internship
2013	Farnam Mansouri	MITACS Accelerate internship
2013	Xiaohui Chen	IBM CAS Research fellowship
2014	Xiaohui Chen	IBM CAS Research fellowship
2015	Xiaohui Chen	IBM CAS Research fellowship
2016	Steven Thorn	Ontario Graduate Scholarship (OGS)
2017	Steven E. Thorn	Ontario Graduate Scholarship (OGS)
2016	Robert H. C. Moir	Ontario Graduate Scholarship (OGS)
2017	Robert H. C. Moir	Ontario Graduate Scholarship (OGS)
2016	Xiaohui Chen	IBM CAS Research fellowship
2017	Masoud Ataei	IBM CAS Research fellowship
2017	Alexander Brandt	NSERC CGSM
2017	Davood Mohajerani	Distinguished Software Award ISSAC

5 Scholarly Activities

5.1 Organization of conferences and workshops

Conference/Workshop	Location & Date	Activity
HPCA 2015	3-day session at ACA 2017 Jerusalem, July 17-21, 2017.	Co-chair
CIGIT 2015	Chengdu, China, August 2015	Summer-school organizer and lecturer (invited)
AUB 2014	Beirut, Lebanon, June 2014	Summer-school organizer and lecturer (invited)
ICMS 2014	Seoul, Korea, August 2014	Mini-symposium co-organizer
SIAM PP 2014	Portland USA, February, 2014	Mini-symposium co-organizer
SIAM AG 2013	Fort Collins, August, 2014	Mini-symposium co-organizer
SIAM AG 2013	Fort Collins, USA, August, 2013	Mini-symposium co-organizer
SIAM DM 2012	Halifax, Canada, July, 2012	Mini-symposium co-organizer
CAIMS 2012	Toronto, Canada, June, 2012	Mini-symposium co-organizer
AMMCS 2011	Waterloo, Canada, July, 2011	Mini-symposium co-organizer
PASCO 2010	Grenoble, France, July, 2010	Co-chair and PC Chair
HPCA 2009	2-day session at ACA 2009 Montréal, 25-28 June 2009.	Co-chair
MOCAA 2008 M ³	London, Canada	Co-chair

HPCA 2017. Co-Chair (with Jeremy Johnson) of the *High-performance Computer Algebra* session at ACA 2017, Jerusalem, July 17-21, 2017.

<http://www.csd.uwo.ca/~moreno/HPCA-ACA-2017/hpca.2017-abstract.htm>.

Summer School at the Chengdu Information Technology in Collaboration with the Chongqing Institute of Green and Intelligent Technology

http://www.csd.uwo.ca/~moreno/CIGIT_Mini_course.html

Mini-Course at the American University of Beirut (AUB)

http://www.csd.uwo.ca/~moreno/AUB_Mini_course.html.

<http://www.aub.edu.lb/Events/Pages/EventDetails.aspx?ItemId=792>.

ICMS 2014 Session: Software, design and practice in triangular decompositions of polynomial systems.

http://www.csd.uwo.ca/~moreno/ICMS_Triangular_Decomposition_Session.html.

SIAM Workshop on High Performance Symbolic Computation.

http://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=17938.

SIAM Workshop on Cylindrical Algebraic Decomposition and Quantifier Elimination.

http://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=16789

SIAM Workshop on the Interactions between Computer Algebra and Discrete Mathematics.

http://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=14645

CAIMS Workshop on the Applications of computer algebra in applied and industrial mathematics.

http://www.fields.utoronto.ca/programs/scientific/11-12/CAIMS_SCMAl/program.html

AMMCS Workshop on High Performance Computing: From Models of Computation to Applications . <http://www.ammcs2011.wlu.ca/SS-HPC.html>

PASCO 2010. Co-Chair (with Jean-Louis Roch) of the International Workshop on *Parallel Symbolic Computation 2010* Grenoble, France, 2010.
<http://pasco2010.imag.fr/>

HPCA 2009. Co-Chair (with Jeremy Johnson) of the *High-performance Computer Algebra* session at ACA 2009, Montréal, 25-28 June, 2009.
http://www.csd.uwo.ca/~moreno/HPCA-ACA-2009/hpca_abstract.htm

MOCAA 2008. Co-Chair (with Michael Monagan and Mark Giesbrecht) of the MOCAA M³ workshop in computational algebra. UWO, London, Canada, 2007.
<http://www.cecm.sfu.ca/events/MOCAA08/>

PASCO 2007. General Chair and Program Committee Chair of the International Workshop on *Parallel Symbolic Computation 2007* UWO, London, Canada, 2007.
<http://www.orcca.on.ca/conferences/pasco2007/site/index.html>

TC 2006. General Chair of the *Transgressive Computing 2006* Conference, University of Granada, Spain, 2006. <http://www.orcca.on.ca/conferences/tc2006/site/index.html>

ACA 2005. Co-organizer with Éric Schost (École Polytechnique, France) of a special session on *Newton and Hensel techniques in scientific computing* at the Conference on Applications for Computer Algebra. <http://www.jssac.org/Conference/ACA/>.

CATLAN' 04. Co-organizer with S.M. Watt of the *Workshop on Categorical Programming Languages*. Santander, Spain, July 2004. <http://www.orcca.on.ca/conferences/catlan2004/>

AGPDE'03. *Algorithmic Geometrical PDE Workshop 2003*. Co-organizer with Greg Reid (UWO).
<http://www.csd.uwo.ca/~moreno/MainPages/AGPDE-2003.html/index.html>.

ISSAC'2002. Local arrangement chair and exhibit chair at *ISSAC'2002*, Lille, France, 2002.
<http://www.sigsam.org/issac/2002/>

CATLAN' 02. Co-organizer with S.M. Watt *Workshop on Categorical Programming Languages*. Lille, France, 2002.
<http://www.sigsam.org/issac/2002/related.html>

ISSAC'2000. Exhibit chair at *ISSAC'2000*, St Andrews, Scotland, 2000.
<http://www.groups.dcs.st-and.ac.uk/issac2000/>

ICIAM'99 Co-organizer with Laureano González Vega (Universidad de Santander) of a workshop dedicated to the *FRISCO* European research project during the *ICIAM'99*. conference, 9-July-1999.

FRISCO'99. Co-organizer with M. Dewar (NAG Ltd) of the final workshop of *FRISCO* project.

5.2 Refereeing (selected)

JSSC. Editor for the *Journal of Systems Science and Complexity*.

NSA. Reviewer for the *NSA Mathematical Sciences Grant Program*.

NSERC. Reviewer for the *Strategic Grant Proposal Program*.

JSC. Article referee for the *Journal of Symbolic Computation*.

MCS. Article referee for the *Journal Mathematics in Computer Science*.

IFIP-TCS. Article referee for the *4th IFIP-TCS conference*. <http://www.wcc-2006.org/>

CASC. Program Committee Member of the International Conference *Computer Algebra in Scientific Computing* from 2009 to 2018.

SNC. Program Committee Member of the International Workshop on *Symbolic-Numeric Computation* in 2007

PASCO. Program Committee Member of the International Workshop on *Parallel Symbolic Computation* in 2007, 2010, 2017.

Calculus. Program Committee Member of the *12th Symposium on the Integration of Symbolic Computation and Mechanized Reasoning* in 2005.
<http://imps.mcmaster.ca/calculus-2005>

ICPSS-04. Article referee for the *International Conference on Polynomial System Solving*.
<http://www-calfor.lip6.fr/ICPSS/>

ISSAC. Article referee for the *International Symposium on Symbolic and Algebraic Computation* from 2005 to 2017.

ISSAC. Program Committee Member in 2011 and 2015.

SIGSAM. Article referee for the Bulletin of the *Special Interest Group on Symbolic and Algebraic Manipulation*. <http://www.acm.org/sigsam/>

6 Research Funding

Start Date	End Date	Principal Investigator	Co-Investigators	Granting Agency	Grant Title	Total Amount	Amount/year for myself
2016/06	2017/06	myself		IBM	CAS	\$24,000	\$24,000
2017/06	2018/06	myself		IBM	CAS	\$24,000	\$24,000
2016/12	2019/11	myself		NSERC	CRD	\$144,000	\$48,000
2015/07	2015/11	myself		Chinese Ac. of Sciences		RMB 132,000	RMB 132,000
2015/06	2016/06	myself		IBM	CAS	\$30,000	\$30,000
2014/06	2015/06	myself		IBM	CAS	\$26,000	\$26,000
2013/06	2014/06	myself		MITACS	Accelerate	\$102,000	\$102,000
2013/04	2018/03	myself		NSERC	Discovery	\$100,000	\$20,000
2012/09	2013/04	myself		MITACS	Accelerate	\$25,000	\$25,000
2011/05	2012/04	myself	I. Kotsireas	MITACS	Elevate	\$55,000	\$55,000
2011/05	2012/04	myself	R.M. Corless P. Yu	ADF	Major grant	\$50,000	\$50,000
2010/11	2012/11	myself		MITACS	Elevate	\$140,000	\$70,000
2010/04	2011/03	myself	R.E. Mercer É. Schost	NSERC	RTI	\$150,000	\$150,000
2009/04	2010/03	M. Monagan	myself	MITACS	MOCAA (Web site)	\$5,000	\$5,000 [100%]
2009/04	2011/03	M. Monagan G. Labahn	19 across Canada	MITACS Maplesoft	MOCCA Project	\$420,000	\$12,500 [16%]
2008	2008	M. Monagan	myself	MITACS	MOCAA-08	\$6000	N/A
2009/01	2010/12	myself		SHARCNET	Graduate Fellowship	\$26,000	\$13,000 [100%]
2008/04	2013/03	myself		NSERC	Discovery	\$135,000	\$27,000
2007/04	2009/03	P. Borwein (SFU)	19 across Canada	MITACS	MOCCA	\$473,000	\$11,825 [5%]
2006	2007	myself	S.M. Watt	Fields Institute	PASCO-SNC	\$6000	\$3000
2006	2007	myself	S.M. Watt	MITACS	PASCO-SNC	\$6000	\$3000
2003/04	2008/03	myself		NSERC	Discovery	\$130,000	\$26,000
2005/04	2007/03	P. Borwein (SFU)	19 across Canada	MITACS	MOCCA (renewal)	\$213,000	\$5,325 [5%]
2003/04	2005/03	P. Borwein (SFU)	19 across Canada	MITACS	MOCCA	\$400,000	\$10,000 [5%]
2003/04	2005/03	S.M. Watt (UWO)	8 others	MapleSoft	MOCCA	\$254,000	\$12,700 [10%]
2002/09	2007/08	S.M. Watt (UWO)	Giesbrecht, M.G. (UW) myself	NSERC	Strategic Project Grant	\$651,520	\$32,576 [25%]
2002/08	2005/04	myself		UWO	Start Up Funds	\$27,500	\$9166

Short name	Full name or URL
IBM CAS	IBM Center for Advanced Studies https://www-927.ibm.com/ibm/cas/
MapleSoft	http://www.maplesoft.com
MITACS	Mathematics of Information Technology and Complex Systems http://www.cecm.sfu.ca/~pborwein/MITACS
MOCAA	Mathematics Of Computer Algebra and Analysis
NSERC	Natural Sciences and Engineering Research Council of Canada
PASCO	Parallel Symbolic Computation Workshop
SNC	Symbolic/Numeric Computation Conference
SFU	Simon Fraser University

For grants held by several PI's, the percentage in square brackets represents my share of the total.

7 Administrative Work

7.1 Departmental activities

University	Department	Description	Year
UWO	Computer Science	Graduate Chair	2016-18
UWO	Computer Science	P & T committee member	2016-19
UWO	Faculty of Science	External scholarship committee chair	2016-2017
UWO	Computer Science	Graduate awards committee chair	2006-08, 2009-14
UWO	Computer Science	Graduate admission committee	2013-15
UWO	Computer Science	Awards committee chair	2006-08, 2014-15
UWO	Computer Science	Graduate executive committee member	2004-08
UWO	Computer Science	Undergraduate counselling and appeals committee member	2003-04
UWO	Computer Science	Colloquium committee member	2003-06
UWO	Computer Science	Award committee member	2002-06, 2013-14, 2016-17
UWO	Computer Science	Curriculum Committee	2009-10
UWO	Computer Science	Appointment Committee	2009-10
UWO	Faculty of Science	“Consult the Experts” sessions (providing advice to graduate students writing scholarships)	2011-14
Univ. of Paris 6	Computer Science	Development of new programs for undergraduate students under the direction of Michèle Soria	1995-1997

7.2 Extra-departmental activities

Since 2008, I have been serving on the *Resource Allocation Committee* of SHARCNET. In particular, I was a reviewer for the Round VI, Round VII, Round VIII, Round IX and Round X of the Fellowships/Dedicated Resources competitions. In total, I was in charge of more than 60 applications as a primary reviewer and about the same amount as a secondary reviewer.

Since 2011, I have been participating to the IEEE/NSF Technical Committee on Parallel Processing (TCPP) on the *Curriculum Initiative on Parallel and Distributed Computing*.