Curriculum Vitae

Marc Moreno Maza

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Contents

1 Summary

1.1 Position

Associate 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**
2008/07- date	Assistant Professor (cross-appointed)	Applied Mathematics	Univ. of Western Ontario
2008/07 - date	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

- April 2010, MITACS Award for Excellence in Mentorship.

- 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, Wenyuan 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, Wenyuan 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 Research papers

Titles of papers and publication vehicles are listed in Section 3 page 14.

Book (preprint) in progress	1
Books edited	2
Chapters in books:	1
Papers accepted or published in refereed journals:	10
Papers submitted to refereed journals:	3
Papers in refereed conferences:	48
Technical report:	1

1.6.2 Software packages

I have developed major mathematical software packages and libraries for three different computer algebra systems (C.A.S.) namely AXIOM, Aldor and Maple. These include low-level routines for fast polynomial arithmetic written in C. Most of these packages and libraries implement algorithms that I have designed myself or with my students only.

I believe that good software packages are often more useful to the academic community than even refereed journal papers. Note that a package submitted to MAPLE goes through two levels of refereeing: by the Maplesoft company and then by beta-testers worldwide.

The table below presents some data whereas Section 2.2 discusses the aim and the scope of these software contributions. The numbers in bold correspond to the references in Section 3.

Library name or main files	**CAS**	**Availability**	**Principal developers**	**Total number of lines**	**Publication**
BasicMath	ALDOR	on the web, open	Myself	source code: 76,000 test files: 47,000	[**48**]
Δ (parallel code included)	ALDOR	on request, open	Myself	source code: 60,000 test files: 2,000	[**45**]
libalgbra	ALDOR	on the web, open,	M. Bronstein and myself	source code: 23,000 (test files included)	[**54**]
Contributions to AXIOM 2.2 and AXIOM 2.3	AXIOM	on the web, open	Myself	source code: 8,000 test files: 1,000	[**49, 50**]
TRIANGSOLVE	AXIOM	on request, open	Myself	source code: 9,000 test files: 4,000	
REGULARCHAINS	MAPLE	open, shipped with MAPLE	F. Lemaire and myself	source code: 51,000 test files: 13,000 tools, mpldoc: 12,000	[**55,56, 57**]
`modpn`	C, MAPLE	to be shipped with MAPLE	Myself	source code: 36,000	[**18,20,34**]

1.6.3 Co-authorship

The numbers in the table below correspond to the references in Section 3.

Single-author papers or with my students only	[**11,17,18,19,24,26,35,37,43,45**]
Software packages written at NAG as one of the main authors	[**48,49,50**]
Papers and software written with François Lemaire (and others)	[**13,20,23,24,30,33,41,55,56,57**]
Papers written with Éric Schost (and others)	[**7,15,16,21,27,31,32,34,42,56**]
Papers and software written with Stephen M. Watt (and others)	[**1,36,39,40,46,51,52,53,54**]
Papers written with Greg Reid (and others)	[**2,6,28,29**]
Papers written with Oleg Golubitsky (and others)	[**9,22,23,44**]
Papers written with Philippe Aubry (and others)	[**3,4**]
Papers written with Mikhail V. Foursov	[**5,12,47**]
Papers written with François Boulier (and others)	[**13,24,38**]
Paper written with Irina Kogan	[**14**]
Paper written with Renaud Rioboo	[**9**]

François Lemaire was my PDF in 2003. Oleg Golubitsky was my PDF in 2006-2007 (co-supervised with Stephen M. Watt). Mikhail V. Foursov and Irina Kogan were also PDFs at the time of our cooperation, that is, when I was an assistant professor at the University of Lille (France).

1.6.4 Talks and Posters

I have given over 65 talks: either invited (conferences, workshops and seminars) or contributed (presentations of accepted papers at conferences). About 20 of them are available from my web page. My past and current graduate students have now given a total of over 15 further talks at various conferences. See Section 4.1 for details. In addition, Section 4.2 lists 8 refereed posters.

Invited presentations at conferences and workshops:	33
Invited presentations at seminars	37
Presentations of accepted papers at conferences by myself	10
Presentations of accepted papers at conferences by my students	25

1.6.5 Teaching material

During the last 5 academic years, I have developed 6 new courses at UWO leading to 715 pages of lecture notes (CS424/CS556, CS874, AM583, CS652, CS86, CS447/CS54) and 800 slides (CS855, CS9624). Details are given in Section 5 Page 27.

1.6.6 Supervision of students and PDFs

Names of students and fellows together with titles of theses or projects are reported in Section 6.

	Number successful completed	**Number in progress**
Doctoral Thesis	2	4
Master's Thesis	4	1
Post-Doctoral Fellows	3	2
Internships	4	0

1.6.7 Scholarly Activity

I have been involved in the organization of 10 conferences and workshops. For two of them, PASCO 2007 and TC 2006, I served as General Chair. I also serve regularly as a paper reviewer for several journals and conferences in my research area. Details are given in Section 7.

1.6.8 Research Funding

Since April 2008, I am the recipient of a Discovery Grant funded by the Natural Sciences and Engineering Research Council of Canada (NSERC). The title of this project is *high-performance computer algebra and applications* and its level of funding is $27,000 per year. I am also a team leader (with Michael Monagan and George Labahn) on a consortium project funded jointly by Mathematics Of Computer Algebra and Analysis (MITACS) and the MapleSoft company, bringing me $12,500 per year for 2009-2011. See Section 8.

1.6.9 Administrative Services

Since September 2004, I am a member of the Graduate Executive Committee of the Computer Science Department. Moreover, for the academic year 2006-2007, I was the Chair of the committee for graduate scholarships, and for the academic year 2007-2008, I am chairing the committee for graduate awards. Data are given in Section 9.

2 An overview of my research

When I am asked to summarize my research activity in a short and simple sentence, I answer that I am applying Computer Science to Mathematics. Indeed, even if certain questions such as computing GCDs of integers have been studied for centuries, it remains a challenge today to solve them efficiently on computers, in particular on parallel architectures.

Another example, which is in fact my favorite problem, is the solving of systems of polynomial equations. This fundamental question, well studied in Algebra textbooks, still offers many algorithmic and implementation challenges in order to address users' needs.

My research activity has four directions. First, I study theoretical aspects of systems of polynomial equations and try to answer the question "what is the best form for the set of solutions?" Then, I study algorithmic answers to the question "how to compute this form of the set of solutions at the lowest cost?" Next, I study implementation techniques for my algorithms to make the best use of today's computers. When the prototype solver is ready, I apply it to unsolved problems. This last step terminates with the distribution of a new solver, before entering a new cycle *theory, algorithms, implementation, applications* motivated by new challenging problems or architectures.

My research is in the area of *symbolic computation*, also known as *computer algebra*. In broad terms, symbolic computation manipulates numbers by using their mathematical definitions rather than using floating point approximations. Consequently, results are exact and complete. However, they can be huge! Moreover, intermediate expressions may be even much larger, slowing down computation dramatically. This is why this area of Mathematics is so challenging for Computer Science!

My contributions have been well recognized in each of the four areas of theory, algorithms, implementation and applications. The table below groups my papers in these four categories. Some papers could belong to two categories or more. The numbers in the table below correspond to the references in Section 3.

Theory of polynomial system solving	**[1,2,3,6,8,9,22,23,26,27,28,29,30,44]**
Algorithms	**[7,10,11,13,15,21,24,25,31,33,35,36,42,45,46]**
Mathematical software	**[4,16,18,19,20,32,34,36,37,39,40,41,43]**
Applications of polynomial system solvers	**[5,12,14,47]**

In Section 2.1, I summarize my main research achievements through a short presentation of 8 of my papers. The term *triangular decompositions*, which appears in many of my papers designates a class of methods, which formalizes the intuitive idea of solving systems of polynomial equations, that is, expliciting the coordinates of the points in the set of solutions.

In addition to these articles, my contributions include major software packages which have been summarized in Section 1.6.2. The aim and the scope of these packages are described in Section 2.2.

2.1 Eight favorite papers

Title	**Reference**
On the theories of triangular sets	**[3]** on p. 15
On triangular decomposition of algebraic varieties	**[11]** on p. 16
On computer-assisted classification of coupled integrable equations	**[5]** on p. 15
Lifting techniques for triangular decompositions	**[15]** on p. 16
On approximate triangular decompositions in dimension zero	**[6]** on p. 15
Efficient implementation of polynomial arithmetic in a multiple-level programming environment	**[19]** on p. 16
Component-level parallelization of triangular decompositions	**[35]** on p. 19
On the verification of polynomial system solvers	**[8]** on p. 21

2.1.1 On the theories of triangular sets

Following the work of J.F. Ritt, algorithms for computing triangular decompositions of algebraic systems are developed since the end of the 80's mainly by W.T. Wu, D.M. Wang, M. Kalkbrener, D. Lazard and many other researchers. At the time of starting my PhD, these different approaches suggested a theoretical work to understand their relations together with an experimental work for implementing and comparing the associated algorithms. The results of my thesis answered these questions. In particular it led to a unification of the theories of triangular sets. The main points are the equivalences $(i) \iff (iii)$ and $(i) \iff (ii)$ of Theorem 6.1 in **[3]** (Proposition III.19 and Theorem III.6 in my PhD thesis). The former allows the correspondence between the notion of a characteristic set (as introduced by J.F. Ritt and W.T. Wu) and that of a regular chain (as defined by M. Kalkbrener). The latter one allows the correspondence between regular chains and towers of simple extensions (as used by D. Lazard).

During the ISSAC'05 Conference, the paper **[3]** was announced to be the most cited article among those published in the *Journal of Symbolic Computation* (JSC) in the category *Theory and Algorithms* and the Top 3 among all JSC papers.

The fundamental results of **[3]** were extended to differential algebra by F. Boulier and F. Lemaire in their ISSAC paper of 2000. More recently, F. Boulier, F. Lemaire and myself have gathered the fundamental theorems supporting the proofs of the algorithms for computing triangular decompositions **[30]**. The results of **[30]** are not new but their proofs are.

2.1.2 On triangular decomposition of algebraic varieties

The comparative implementation of the existing methods at the time of my PhD (reported also in **[3]** shows the superiority of the methods based on regular chains (such as those of M. Kalkbrener and D. Lazard) w.r.t those using more general triangular sets (such as the method of W.T. Wu). It shows also that, since the triangular decompositions of D. Lazard satisfy better algebraic properties, they are generally more expensive to compute than those of M. Kalkbrener. This is why I developed a new algorithm, presented in **[11]**, called TRIADE, for TRIAngular DEcompositions, and providing the following properties.

- It allows to compute all triangular decompositions based on regular chains.

- Moreover, it computes those of D. Lazard more efficiently. This is achieved by relaxing some properties of the triangular decompositions of D. Lazard during the computations, until a triangular decomposition is obtained. Then, the *weak* decomposition is converted to one of D. Lazard.

The main feature of my algorithm is that it produces the output components in order of decreasing dimension. This allows a good control of the redundant intermediate components, which is a key issue for triangular decompositions. To do so, I use a *lazy evaluation* strategy. Each procedure of the algorithm works in a lazy way: only the computations leading to components of maximal dimension are performed, the other computations are delayed until they appear to be either necessary or redundant. (In the latter case they are discarded).

The previous algorithms could not allow such strategy. Indeed, either they were relying on a *one-variable-after-another* elimination process (W.T. Wu, D.M. Wang, M. Kalkbrener) or on a *one-equation-after-another* elimination process (D. Lazard). Last, but not least, my algorithm presented in [**11**] is the first one, among those computing triangular decompositions of D. Lazard, to be completely proved.

The sub-algorithms and techniques developed in [**11**] have been used in other algorithms. For instance, in the algorithm called PARDI algorithm by F. Boulier, F. Lemaire and myself [**13**], which performs

- changes of variables ordering for triangular decompositions of systems of algebraic equations,
- changes of ranking in the differential case.

Nine years after its creation, the TRIADE algorithm remains the most efficient algorithm for computing triangular decompositions, as confirmed by the recent comparative experimentation reported in [**23, 45**]. It has served as a starting point for other algorithmic discoveries [**7, 13, 15, 32, 35**]. It has been implemented in three different computer algebra systems (AXIOM, ALDOR and MAPLE) which have been used to resolve application problems [**5, 14, 47**]. For these reasons, the paper [**11**] is certainly one of my most important contributions to computer algebra.

The article [**11**] was accepted for presentation at the conference MEGA 2000 and considered for inclusion in the proceedings. However, since one referee could not check the final version in due time, the paper was finally not formerly published and I decided to leave it as a technical report.

2.1.3 On computer-assisted classification of coupled integrable equations

My algorithms and software for computing triangular decompositions have been applied in the following areas: digital signal processing, mathematical physics and classical invariant theory.

In collaboration with M.V. Foursov, I used the ALDOR implementation of the TRIADE algorithm [**11**] to solve systems from mathematical physics. Our goal was to search a family of differential systems for particular (and very rare) systems which admit solitons for solutions. Solitons are travelling waves that preserve their shape after a collision with other solitons. They are used in many applications, e.g. in propagation of light pulses along an optic fiber. We discovered two new systems possessing solitons and we established a relation between the famous Sawada-Kotera and Kaup-Kupershmidt equations. Our work is mainly reported in [**5**] and also in [**47**]. Our ISSAC paper [**12**] is a preliminary version of the journal article [**5**].

This work is a very important application for computer algebra since we managed to process very large systems (homogeneous of degree 2, with more than 100 unknowns and 500 equations) which seemed out of reach for exact methods.

2.1.4 Lifting techniques for triangular decompositions

Another of my major theoretical contribution was the discovery of the notion of *Equiprojectable Decomposition*. In **[15, 27]**, the joint work by X. Dahan, myself, É. Schost, W. Wu and Y. Xie shows that this notion provides a new way of encoding the solutions of polynomial systems, which has good computational properties, in particular, good specialization properties.

In **[15]**, we obtain height estimates for the coefficients in the equiprojectable decomposition of a zero-dimensional variety over the field of rational numbers. Using Hensel lifting techniques, we design an efficient modular algorithm for solving polynomial systems of dimension zero with rational coefficients. Our preliminary implementation shows the capacity of this approach to solve problems out of the scope of other comparable solvers. The paper **[15]** received a *Distinguished Student Author Award* at ISSAC'05. A new option for solving by this modular algorithm was added to the `RegularChains` library and released with maple 11 in 2006.

2.1.5 On approximate triangular decompositions in dimension zero

The new notion of equiprojectable decomposition **[15]** has led me to new research directions, such as obtaining fast algorithms for computing polynomial GCDs over direct products of fields **[31]**. It has led me also to introduce the notion of an *approximate triangular decomposition*, for the case of input polynomial systems with inexact coefficients and finitely many solutions. In the joint work by myself, G. Reid, R. Scott and W. Wu **[6, 28]** we demonstrate experimentally the favourable computational features of this new approach, and give a statistical analysis of its error.

In **[2, 29]** we continue our study of approximate triangular decompositions by considering linear homogeneous systems with positive-dimensional solution spaces and approximate coefficients.

2.1.6 Efficient implementation of polynomial arithmetic in a multiple-level programming environment

The papers **[16, 19, 21, 34]** explore fast algorithms and implementation techniques for polynomial arithmetic in view of supporting polynomial system solvers. I believe that the impact of efficient low-level routines for such software can be dramatic. As illustrated in these articles, the resulting speed-up factors between an inefficient and a highly efficient polynomial arithmetic can be in the order of hundreds or more.

In the paper **[19]** my PhD student Xin Li and I investigate implementation techniques for polynomial arithmetic in a multiple-level programming environment. Indeed, certain polynomial data types and algorithms can further take advantage of the features of lower level languages, such as their specialized data structures or direct access to machine arithmetic. Whereas, other polynomial operations, like Gröbner basis over an arbitrary field, are suitable for generic programming in a high-level language.

We have developed implementation techniques in the multiple-level programming environment provided by the computer algebra system AXIOM, including LISP, C and Assembly code. For a given algorithm, designed to perform a polynomial operation and available at the user level, we

combine the strengths of each language level and the features of a specific machine architecture. Our experiments show that this allows us to improve performances of this operation in a significant manner.

The results reported in **[19]** certainly do not contradict to our intuition. However, they illustrate that good implementation techniques can have a much bigger impact than one could expect. This paper is also, up to our knowledge, the first report on AXIOM as a multiple-level programming environment. At ICMS'06 where **[19]** was presented, I also gave an invited talk on AXIOM.

2.1.7 Component-level parallelization of triangular decompositions

The papers **[18, 35, 36, 37, 43]** explore the parallelization of polynomial system solvers. Over the past decade, the area of parallel computer algebra has received less intense attention, but recent developments in widely available parallel hardware make the subject now more relevant than ever.

In the paper **[35]** my PhD student Yuzhen Xie and I report on the development of a solver for which the number of processes in use depends on the geometry of the solution set of the input system, that is, the intrinsic complexity of this system. A coarse-grained parallelism based on the celebrated *D5 Principle* is considered. This is actually highly challenging since the solution set of almost each polynomial system arising in practice is equiprojectable, that is, "in one piece", which implies that computations might not split.

By using the modular methods introduced in **[15]**, we create opportunities for coarse-grained (or component-level) parallel solving of polynomial systems with rational number coefficients.

To exploit these opportunities, we have transformed the TRIADE algorithm **[11]**. In particular, for a given input system, we reduce the depth of the task tree and create more work at each node.

We have realized a preliminary implementation in ALDOR using multiprocessed parallelism **[36]** and shared memory segment for data communication. Our experimental results show that, for most input systems, the speed-up factor is very close to the number of components (computed modulo a prime number) with maximum degree.

I believe that this is a very promising result. We are now investigating multilevel parallel polynomial system solvers. The paper **[37]** reports on fine-grained multithreaded parallel polynomial arithmetic. I am looking forward to the combination of the works **[35]** and **[37]**.

2.1.8 On the verification of polynomial system solvers

The papers **[8, 20, 39, 40, 41]** explore the design (user interface, debugging, verification) of polynomial system solvers. Symbolic solvers are highly complex software, especially those computing triangular decompositions. Therefore, developing verification algorithms and reliable verification software tools is needed clearly. However, this verification problem has received little attention in the literature.

In the paper **[45]**, my PhD students Changbo Chen, Wei Pan, Yuzhen Xie and I present new techniques for verifying a large class of symbolic solvers. We also report on intensive experimentation illustrating the high efficiency of our approach w.r.t. known techniques.

The key of this success is a highly efficient algorithm for computing the set theoretical difference of two constructible sets. This algorithm is actually interesting by itself. First, it leads to an efficient inclusion test between (quasi-)components represented by triangular sets **[33]**. Up to my knowledge, no satisfactory and proved solutions were known, although this is a very important

question. Indeed, (quasi-)component inclusion tests are to triangular decompositions what ideal membership tests are to polynomial ideals.

Secondly, it has led me to the notion of comprehensive triangular decomposition (CTD), introduced and studied in [**23**]. This notion is to triangular decompositions what comprehensive Gröbner bases (CGB) are to polynomial ideals. However, the comparative experimentation of [**23**] illustrates the superiority of CTD w.r.t. CGB.

2.2 Contributions to Mathematical Software

My software contributions are motivated by the implementation of symbolic solvers based on the TRIADE algorithm [**11**]. It has been implemented in three different computer algebra systems: AXIOM, ALDOR and MAPLE. These include low-level routines for fast polynomial arithmetic written in C.

I realized the first implementation in 1998 using AXIOM, which was integrated in this computer algebra system since its release 2.2 [**49**] and was enhanced in the release 2.3 [**50**]. This was one of the major new library features of these releases. I was also in charge, as author or "integrator", of other new library components. Since the release 2.3 of AXIOM, I have kept improving the AXIOM implementation of the TRIADE algorithm, leading to a library called TRIANGSOLVE. This AXIOM implementation has been developed in a very high-level manner in the sense that, the design is very close to the mathematical theory. This makes it powerful and flexible. However, it is not suitable for high-performance, and it is hard to use for non-experts.

Since 1999, I have been developing an optimized version of TRIADE using the ALDOR programming language. This library, called Δ, is one of the major applications built on top of the *BasicMath* library [**48**]. This latter is a general purpose computer algebra library (providing matrix and polynomial arithmetic over a large variety of coefficient rings) of which I was also in charge during my position at NAG. The other contributors of the *BasicMath* library were T. Gómez Díaz and P. Broadbery. The parallel solver for computing triangular decompositions and the parallel framework in ALDOR on SMPs and multi-cores, that my PhD student Yuzhen Xie and I have been developing in the last two years [**18,35,36,43**], rely also on the *BasicMath* and Δ libraries.

The ALDOR implementation of the TRIADE algorithm is less general than the AXIOM one but has several advantages. First of all, the ALDOR compiler produces binaries which can act as servers or regular applications. This makes it easier for interfacing the ALDOR solver with other software. Moreover, ALDOR provides an efficient interface with the machine resources, which allows the development of high-performance strategies.

Since 2000, I am one of the principle investigators (with S.M. Watt, UWO and late M. Bronstein, INRIA, France) leading the development and contributing to the ALDOR distribution [**51, 52, 53, 54**], consisting of

- a compiler for various operating systems (Linux, Solaris, Windows)
- a fundamental library LIBALDOR for data-structures and Input/Output facilities
- a mathematical library LIBALGEBRA for exact computations with polynomials and matrices
- complete documentation for the compiler and its libraries, amounting more than 1000 pages available in several format (dvi, html).

In 1999, François Lemaire and I have chosen to realize also an implementation of TRIADE in MAPLE in order to offer triangular decompositions to a large public: engineers, educators and students. Today, this MAPLE implementation is available in the form of a library called REGULARCHAINS [**41, 55, 56, 57**]. The core of this library has been implemented by François Lemaire (Uinversité of Lille 1, France) and myself during his post-doctoral position at UWO in 2002-2003. In 2004-2005, my PhD student, Yuzhen Xie, has made major contributions to REGULARCHAINS. At present, the user interface of the REGULARCHAINS library provides a total of 81 functions, organized in 5 modules, summarized in the table below.

The functionalities of the REGULARCHAINS library in MAPLE are not limited to solving systems of algebraic equations. In fact, after M. Kalbrener and D. Lazard, one of the central ideas of the TRIADE algorithm is to reduce multivariate operations over a field to univariate ones over direct products of fields. However, most computer algebra systems, and in particular MAPLE, do not provide arithmetic over direct products of fields. This is why REGULARCHAINS offers the following range of functionalities: linear algebra over direct products of fields (given by regular chains), polynomial GCDs over direct products of fields, regularity test and inverse computation over direct products of fields, triangular decompositions of radical ideals, in the sense of M. Kalkbrener, and triangular decompositions of algebraic varieties, in the sense of D. Lazard. An amazing by-product of the work for the `RegularChains` library in MAPLE was the development of **structured comments for** MAPLE **source code**. Our prototype has been adopted by Maplesoft and has given birth to the `mpldoc` tool and standard, which are distributed with MAPLE 11.

With the introduction of the notion of *comprhensive triangular decomposition* [**23**], the REGULARCHAINS library has been enhanced with two new modules. The first one is dedicated to operations (set theoretical ones and other more advanced ones) on constructible sets represented by regular systems. (Up to my knowledge, the module `ConstructibleSetTools` is the only symbolic package implementing these operations on constructible sets.) The second new module, the `ParametricSystemTools` module, provides a solver for parametric systems by means of comprehensive triangular decomposition. A byproduct of this work is an algorithmic realization of a famous theorem of Chevalley. Indeed, one function allows to compute the image (pre-image) of a constructible set by a rational map.

Module name	**# Functions**	**Main purpose**
`RegularChains`	20	triangular decompositions, computations modulo regular chains
`ChainTools`	29	advanced operations on regular chains
`MatrixTools`	6	linear algebra over non-integral domains
`ConstructibleSetTools`	22	operations on constructible sets (represented by regular systems)
`ParametricSystemTools`	11	comprehensive triangular decompositions
`SemiAlgebraicSetTools`	14	Real solutions of polynomial systems
`FastArithmeticTools`	13	highly optmized low-level routines

Modules of the RegularChains library

3 Papers and Distributed Software

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

3.1 Ranking of publication vehicles

Category I means top-ranked journals and equivalent refereed proceedings, category II means refereed at standard level while category III means refereed at 'moderate' level.

3.2 Category I vehicles

3.2.1 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
Asian Technology Conference in Mathematics	ATCM	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 Error Correcting Codes	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%.

3.2.2 Papers published in category I vehicles

Book edited:

[1] ***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.

[2] ***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.

[1] ***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.

Book chapters:

[4] ***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. Long and enhanced version of [**29**].

Journal articles:

[5] P. Aubry, D. Lazard, ***M. Moreno Maza***. On the theories of triangular sets. *Journal of Symbolic Computation* (JSC), 28(1-2):105-124, 1999.
Top 1 JSC paper in the category *Theory and Algorithms.*
Top 3 among all JSC papers.

[6] 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.

[7] M.V. Foursov and ***M. Moreno Maza***. On computer-assisted classification of coupled integrable equations. *Journal of Symbolic Computation*, 33(1):647-660, 2002. Long and enhanced version of [**12**].

[8] ***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. Long and enhanced version of [**28**].

[9] **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. Long and enhanced version of [**42**].

[10] **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. Enhanced version of [**45**].

[11] 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. Long and enhanced version of [**44**]. 29 pages.

[12] **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. Long and enhanced version of [**23**].

[13] F. Boulier, F. Lemaire and ***M. Moreno Maza***. Computing differential characteristic sets by change of ordering. *J. of Symbolic Computation*, 45(1), 25 pages, 2010. Long and enhanced version of [**12**].

[14] F. Lemaire, ***M. Moreno Maza***, **W. Pan** and **Y. Xie**. When does $\langle T \rangle$ equal $\mathrm{Sat}(T)$? To appear in *J. of Symbolic Computation*. Long and enhanced version of [**26**]. 22 pages.

[15] **X. Li**, ***M. Moreno Maza***, **R. Rasheed** and É. Schost. The `Modpn` library: bringing fast polynomial arithmetic into MAPLE. To appear in *J. of Symbolic Computation*.

[16] ***M. Moreno Maza and* Y. Xie**. Balanced Dense Polynomial Multiplication on Multi-cores To appear in the *International Journal of Foundations of Computer Science*. Long and enhanced version of [**xx**]. 20 pages.

[17] ***M. Moreno Maza and* W. Pan**. Fast polynomial multiplication on a GPU *Journal of Physics: Conference Series* 256 (2010) 012009, 14 pages.

Conference articles:

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

[19] ***M. Moreno Maza***. On triangular decompositions of algebraic varieties. *MEGA-2000* conference, Bath, UK, June 2000.

[20] 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.

[21] F. Boulier, F. Lemaire and ***M. Moreno Maza***. PARDI ! In proc. of *ISSAC 2001*, pages 38-47, ACM Press, 2001.

[22] I. Kogan and ***M. Moreno Maza***. Computation of canonical forms for ternary cubics. In proc. of *ISSAC 2002*, pages 151-160, ACM Press, 2002.

[23] **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.**

[24] **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.

[25] ***M. Moreno Maza***. Triangular decompositions of polynomial systems: from theory to practice. In proc. of *ISSAC 2006*, page 8, ACM Press, 2006.

[26] ***M. Moreno Maza*** and **Y. Xie**. An implementation report for parallel triangular decompositions. In proc. *SPAA 2006*, page 235, ACM Press, 2006.

[27] **X. Li** and ***M. Moreno Maza***. Efficient implementation of polynomial arithmetic in a multiple-level programming environment. In proc. *ICMS 2006*, pages 12–23, Springer, 2006.

[28] 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.

[29] **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.

[30] 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.

[31] **C. Chen**, F. Lemaire, O. Golubitsky, ***M. Moreno Maza*** and **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.

[32] F. Lemaire, ***M. Moreno Maza***, **W. Pan** and **Y. Xie**. When does $\langle T \rangle$ equal Sat(T)? In proc. ISSAC 2008, pages 207-214, ACM Press, New York, NY, USA, 2008.

[33] **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.

[34] **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.

[35] **X. Li**, ***M. Moreno Maza***, **W. Pan** Computations modulo regular chains. In *Proc. of ISSAC 2009*, ACM Press, pp 239–246, 2009.

[36] ***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.

[37] ***M. Moreno Maza***, Y. Xie. FFT-based Dense Polynomial Arithmetic on Multi-cores. Presented at *High Performance Computing Symposium (HPCS) 2009*. (Accepted in the HPCS 2009 post-conference proceedings), 22 pages, 2009.

[38] 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.

[39] **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.

[40] 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.

3.2.3 Papers submitted to category I vehicles

Journal articles:

[41] **C. Chen**, F. Lemaire, **L. Liyun**, ***M. Moreno Maza***, **W. Pan** and **Y. Xie**. Computing with Constructible Sets in MAPLE. Submitted to *J. of Symbolic Computation*.

[42] **X. Li**, ***M. Moreno Maza***, **W. Pan** GCD Computations modulo regular chains. Submitted to *J. of Symbolic Computation*.

[43] **C. Chen**, J.H. Davenport, J.P. May, ***M. Moreno Maza***, B. Xia and **R. Xiao**. Triangular decomposition of semi-algebraic systems. Submitted to *J. of Symbolic Computation*.

Conference articles:

[43] **C. Chen**, J.H. Davenport, ***M. Moreno Maza***, B. Xia and **R. Xiao**. Computing with Semi-Algebraic Sets Represented by Triangular Decomposition Submitted to *ISSAC 2011*.

[44] **C. Chen** and ***M. Moreno Maza*** Algorithms for Computing Triangular Decompositions of Polynomial Systems Submitted to *ISSAC 2011*.

[45] ***M. Moreno Maza*** and **W. Pan** Solving Bivariate Polynomial Systems on a GPU Submitted to *ISSAC 2011*.

3.2.4 Manuscripts in progress to category I vehicles

Book in progress:

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

3.3 Category II vehicles

3.3.1 Description of category II vehicles

Proceedings papers are listed here. The corresponding conferences 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

3.3.2 Papers published in category II vehicles

Conference articles:

[47] **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.

[48] ***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.

[49] ***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.

[50] 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.

[51] **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.

[52] ***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.

[53] **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.

[54] **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.

[55] ***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.

[56] ***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.

[57] **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.

[58] **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.

[59] **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.

[60] **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.

[61] **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.

[62] **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.

[63] 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.

[64] **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.

[65] 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.

3.4 Category III vehicles

3.4.1 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 Applicaciones	EACA	Wide readership
maple Summer Conference		Appropriateness to the audience

3.4.2 Papers published in category III vehicles

Conference articles:

[56] 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.

[57] **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.

[**58**] **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. Long version of [**34**].

[**59**] 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.

[**60**] **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.

[**61**] ***M. Moreno Maza and*** **Y. Xie**. Parallelization of triangular decompositions. In proc. *AGGM'06*, pages 96-100, Universidad de Barcelona, 2006.

[**62**] 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.

[**63**] **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.

[**64**] 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.

[**65**] **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.

Technical Report:

[**66**] 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.

3.5 Software packages

My software contributions have been presented in Sections 1.6.2 and 2.2. Most of them are accessible from the following URLs or shipped within MAPLE.

[**67**] The Computational Mathematics Group. *The BasicMath library in* ALDOR. NAG, Oxford, UK, 1998.

`http://www.nag.co.uk/projects/FRISCO.html`

[**68**] 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`

[69] 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`

[70] *Aldor version 1.0.1.* University of Western Ontario, Canada, 2002.
`http://www.aldor.org`

[71] *Aldor version 1.0.2.* University of Western Ontario, Canada, 2004.
`http://www.aldor.org`

[72] *Aldor version 1.0.3.* University of Western Ontario, Canada, 2004.
`http://www.aldor.org`

[73] *Aldor version 1.1.0.* University of Western Ontario, Canada, 2007.
`http://www.aldor.org`

[74] F. Lemaire, ***M. Moreno Maza*** and **Y. Xie**. The `RegularChains` library. In *Maple 10*, Maplesoft, Canada, 2005.
`http://www.maplesoft.com/`

[75] F. Lemaire, ***M. Moreno Maza***, É. Schost, **W. Wu** and **Y. Xie**. Modular algorithms for the `RegularChains` library. In *Maple 11*, Maplesoft, Canada, 2007.
`http://www.maplesoft.com/`

[76] **C. Chen**, F. Lemaire, **L. Li**, ***M. Moreno Maza***, **W. Pan** and **Y. Xie**. The `ConstructibleSetTools` and `ParametricSystemTools` modules of the `RegularChains` library. In *Maple 12*, Maplesoft, Canada, 2008.

[77] **X. Li**, ***M. Moreno Maza*** and **W. Pan**. The `Modpn` library. In *Maple 13*, Maplesoft, Canada, 2009.

[78] **X. Li**, ***M. Moreno Maza*** and **W. Pan**. The `FastArithmeticTools` module of the `RegularChains` library. In *Maple 13*, Maplesoft, Canada, 2009.

[79] **C. Chen**, F. Lemaire, ***M. Moreno Maza***, B. Xia, R. Xiao and **Y. Xie**. The `SemiAlgebraicSetTools` module of the `RegularChains` library. In *Maple 13*, Maplesoft, Canada, 2009.

[80] **C. Chen**, ***M. Moreno Maza***, and **W. Pan**. New decomposition algorithms for the `RegularChains` library. To appear in *Maple 14*, Maplesoft, Canada, 2010.

[81] **C. Chen**, F. Lemaire, ***M. Moreno Maza***, B. Xia, R. Xiao and **Y. Xie**. New features of the `SemiAlgebraicSetTools` module of the `RegularChains` library. To appear in *Maple 14*, Maplesoft, Canada, 2010.

4 Invited Talks and Posters

4.1 Invited talks at conferences and workshops

The list below includes only those invited talks at conferences and workshops and does not include invited talks at seminars, nor presentations of contributed papers. The slides of these talks are available from `http://www.csd.uwo.ca/~moreno`. The full title of the conferences and workshops are described in the table below.

Short name	**Conference or Workshop**
PoSSo	Polynomial System Solving, an Esprit Reactive LTR Scheme (ESPRIT) Basic Research contract with the Commission of the European Community
FRISCO	A Framework for Integrated Symbolic/Numeric Computation, a three-year project funded by the European Commission under ESPRIT
CoCoA	Computations in Commutative Algebra
ICIAM	International Congress on Industrial and Applied Mathematics
CATLAN	Workshop on Categorical Programming Languages with an Emphasis on Aldor
SCA	Symbolic Computational Algebra
ACA	International Conference on Applications of Computer Algebra
MOCCA	Mathematics of Computer Algebra and Analysis
MITACS	Mathematics of Information Technology and Complex Systems
CAIMS	Canadian Applied and Industrial Mathematics Society
ISSAC	International Symposium on Symbolic and Algebraic Computation
ICMS	International Congress on Mathematical Software
SHARCNET	Shared Hierarchical Academic Research Computing Network
MSRI	Mathematical Sciences Research Institute
SRATC	Symbolic Real Algebra and Trustworthy Computing

[82] *Computations of Gcd of Univariate Polynomials with Coefficients in a Tower of Simple Algebraic Extensions in AXIOM.* PoSSo Workshop, Paris, June 1995.

[83] *Triangular sets for solving algebraic systems: A comparison of 4 methods.* CoCoA Conference, Kent, England, July 1997.

[84] *Design of nonseparable bidimensional wavelets and filter banks using Gröbner bases techniques and triangular systems.* FRISCO Workshop, Nice, July 1997.

[85] *Aldor: an introduction.* FRISCO Workshop, Pisa, November 1997.

[86] *Quelques Experiences avec Aldor et BasicMath.* Séminaire Euclide (Workshop), University of Paris 6, Paris, November 1997.

[87] *Using Aldor: Triangular Decompositions of Polynomial Systems and Applications.* FRISCO mini-symposium at ICIAM'99, Edinburgh, UK, 1999.

[88] *Sur les Chaînes régulières de polynômes.* Jounées Nationales du Calcul Formel, Aussois, France, Mai 2000.

[89] *Around the* StandardMath *Library.* CATLAN 01, London, Canada, July 2001.

[90] *On recent advances on regular chains.* SCA 2002, London, Canada, July 2002.

[91] *Dr. Modular or How I learned to stop worrying and love symbolics.* ACA 2003, North Carolina State University, USA, July 2003.

[92] *On Polynomial Gcds over Direct Products of Fields Given by Towers of Simple Extensions.* MOCCA Workshop, Waterloo, May 2004.

[93] *Debugging a high level language via a unified interpreter and compiler runtime environment.* ACA 2004, Univ. of Texas at Beaumont, USA, July 2004.

[94] *Solving systems of algebraic equations with* AXIOM. ACA 2004, Univ. of Texas at Beaumont, USA, July 2004.

[95] *On polynomial gcds over direct products of fields given by towers of simple extensions.* ACA 2004, Univ. of Texas at Beaumont, USA, July 2004.

[96] *Generic modular computations in* ALDOR. CATLAN 04, Univ. of Santander, Spain, July 2004.

[97] *On the complexity of the D5 Principle.* MOCCA Workshop, University of Calgary, May 2005.

[98] On the complexity of the D5 Principle. *Canadian Mathematical Society Meeting*, Waterloo, May, 2005.

[99] *Some recipes for handling large expressions in polynomial system solving.* ACA 2005, Univ. of Nara, Japan, August 2005.

[100] *Solving polynomial systems symbolically and in parallel.* MITACS - CAIMS Meeting, Toronto, Canada, June 18, 2006.

[101] *Bounds and algorithms in differential alegbra: The ordinary case.* Dagstuhl Seminar,Dagstuhl, Germany, July, 2006.

[102] *Triangular decompositions of polynomial systems: From theory to practice.* Tutorial lecture at ISSAC'06, Genoa, Italy, 9 July 2006.

[103] *AXIOM: generic, open, powerful.* International Congress on Mathematical Software (ICMS), Castro Urdiales, Spain, 2006.

[104] *Parallelization of triangular decompositions.* SHARCNET Fall Workshop 2006, Waterloo, Canada, November, 2006.

[105] *Component-level parallelization of triangular decompositions.* Interactive Parallel Computation in Support of Research in Algebra, Geometry and Number Theory. MSRI Workshop 2007, Berkeley, February 1, 2007.

[106] *On the verification of polynomial system solvers.* Fifth Asian Workshop on Foundations of Software, University of Xiamen, China, 2007.

[107] *Triangular decompositions of polynomial systems: from practice to high-performance* Canadian Mathematical Society Winter Meeting, London, Canada, December 10, 2007.

[108] *Triangular Decompositions of Polynomial Systems: From Practice to High-Performance* SRATC 2008, Shangai, 5 April 2008.

[109] *The* `modpn` *library: Bringing fast polynomial arithmetic into* MAPLE MOCCA Workshop, University of Western Ontario, 9 May 2008.

[110] *Triangular Decomposition of Polynomial Systems: Algorithmic Advances and Remaining Challenges*, ICMM'09, In honor of Prof. Wen-Tsen Wu, Beijing, China, May 13, 2009.

[111] *FFT-based Dense Polynomial Arithmetic on Multi-cores* ACA 2009, Montréal, 26 June 2009.

[112] *Differential Algebra, Regular Chains and Modeling*, ACA 2009, Montréal, 25 June 2009.

[113] *Coding Experiences with Parallel Symbolic Computation*, Maple Retreat, June 15, 2009.

[114] *Fundamental Algorithms and Implementation Techniques for Computing with Regular Chains*, SSSC'09, Chengdu, China, August 12, 2009.

[115] *Fundamental Algorithms and Implementation Techniques for Computing with Regular Chains.* Rikkyo University, Tokyo 11 Dec. 2009.

4.2 Refereed posters and software presentations

This is a selection of refereed posters, most of them are available from `http://www.csd.uwo.ca/~moreno`.

[121] **X. Dahan**, ***M. Moreno Maza***, É. Schost, **W. Wu** and **Y. Xie**. Equiprojectable decompositions of zero-dimensional varieties. Presented at the MITACS'05 Conference, Calgary, Canada, 2005.

`http://www.csd.uwo.ca/~moreno/Publications/EPD-ISSAC-uwo-12-07.pdf.gz`

[122] **X. Dahan**, ***M. Moreno Maza***, É. Schost, **W. Wu** and **Y. Xie**. On the complexity of the D5 Principle. Presented at the ISSAC'05 Conference, Beijing, China, 2006.

`http://www.csd.uwo.ca/~moreno//Publications/D5Poster.pdf`
Best Poster Award at ISSAC'05.

[123] F. Lemaire and ***M. Moreno Maza*** and **Y. Xie**. The `RegularChains` library in `Maple 10`. Presented at the ISSAC'05 Conference, Beijing, China, 2006.

`http://www.csd.uwo.ca/~moreno//Publications/RC.ppt`

[124] **X. Dahan**, **X. Jin**, ***M. Moreno Maza*** and É Schost. Change of ordering for regular chains in positive dimension. Presented at the ISSAC'06 Conference, Genoa, Italy, 2006.

[125] ***M. Moreno Maza*** and **Y. Xie**. Parallelization of triangular decompositions. Presented at the ISSAC'06 Conference, Genoa, Italy, 2006.

[126] O. Golubitsky, M. Kondratieva, ***M. Moreno Maza*** and **A. Ovchinnikov**. Bounds for algorithms in differential algebra. Presented at the ISSAC'06 Conference, Genoa, Italy, 2006.

[127] **C. Chen**, ***M. Moreno Maza***, **W. Pan** and **Y. Xie**. On the verification of polynomial system solvers. Presented at the ISSAC'07 Conference, Waterloo, Canada, 2007.

[128] M. Giesbrecht, J. May, ***M. Moreno Maza***, D. Roche and **Y. Xie**. Automatic Variable Order Selection for Polynomial System Solving. In *Milestones in Computer Algebra 2008*, pages 207-209, Trinidad and Tobago, 2008.

[129] **C. Chen**, ***M. Moreno Maza***, **W. Pan** and **Y. Xie**. On the Verification of Polynomial System Solvers. In *Milestones in Computer Algebra 2008*, pages 209-210, Trinidad and Tobago, 2008.

[130] **C. Chen**, ***M. Moreno Maza***, B. Xia and L. Yang. Triangular Decompositions for Solving Parametric Polynomial Systems Changbo Chen, Marc Moreno Maza, Bican Xia and Lu Yang In *Milestones in Computer Algebra 2008*, pages 217-218, Trinidad and Tobago, 2008.

[131] **C. Chen**, **L. Li**, ***M. Moreno Maza***, **W. Pan** and **Y. Xie**. On the Representation of Constructible Sets. In proc. of *Second Congres France-Canada* amd *MITACS 2008 Conference* Université du Québec à Montréal, June 1-5, 2008.

[132] **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 *Second Congres France-Canada* amd *MITACS 2008 Conference* Université du Québec à Montréal, June 1-5, 2008.

[133] **C. Chen**, ***M. Moreno Maza***, B. Xia and L. Yang. Triangular Decompositions for Solving Parametric Polynomial Systems. In proc. of *Second Congres France-Canada* amd *MITACS 2008 Conference* Université du Québec à Montréal, June 1-5, 2008.

[134] **C. Chen**, **L. Li**, ***M. Moreno Maza***, **W. Pan** and **Y. Xie**. On the Representation of Constructible Sets. Presented at ISSAC 2008, Linz, Austria, Jluy 2008. Abstract published in ACM SIGSAM Bulletin Volume 42, Issue 3, Pages 162-163, 2008.

[135] M. Giesbrecht, J. May, ***M. Moreno Maza***, D. Roche and Y. Xie Automatic Variable Order Selection for Polynomial System Solving. Presented at ISSAC 2008, Linz, Austria, Jluy 2008. Abstract published in ACM SIGSAM Bulletin, Volume 42, Issue 3, Pages 83-83, 2008.

[136] **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. Refeered sofware presentation at ISSAC 2008, Linz, Austria, July 2008. Abstract published in ACM SIGSAM Bulletin, Volume 42, Issue 3, 2008.

[137] **X. Li**, ***M. Moreno Maza***, **R. Rasheed** and É. Schost. The `Modpn` library: bringing fast polynomial arithmetic into MAPLE. Refeered sofware presentation at ISSAC 2008, Linz, Austria, July 2008. Abstract published in ACM SIGSAM Bulletin, Volume 42, Issue 3, 2008.

[138] **C. Chen**, ***M. Moreno Maza***, B. Xia, L. Yang. Computing Cylindrical Algebraic Decomposition via Triangular Decomposition, MITACS Conference 2009.

[139] ***M. Moreno Maza***, Y. Xie. Balanced Dense Polynomial Multiplication on Multi-cores, MITACS Conference 2009.

[140] ***M. Moreno Maza***, Y. Xie. Balanced Dense Polynomial Multiplication on Multi-cores, ISSAC 2009, Seoul, Korea. **Best Poster Award at ISSAC'09.**

5 Teaching Material

The table below summarizes the courses I have taught at the University of Western Ontario during the last 5 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
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
CS652	Algorithms and Software for Symbolic Solvers for Polynomial Systems	Winter 2004
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

The courses CS424/CS556, CS874, AM583, CS652, CS867, CS855 and CS9624 are new courses that I have designed and for which I have produced the teaching materials. The course CS447/CS545 was an existing course. However, I have produced all the teaching materials that I have distributed to the CS447/CS54 Students. The teaching materials I have produced for CS424/CS556, CS874, AM583, CS652, CS867, CS855 and CS447/CS54 include slides, course notes, computer programs, projects, assignments, quizzes, exercises with solutions and exams. CS210 and CS211 were existing courses for which I generated computer programs, assignments, exercises with solutions and exams. More details follow.

- The courses AM583, CS874, and CS424 have several chapters in common. Together, they share 250 pages of course notes.
- The course notes of CS442/CS545 amounts to 215 pages with 62 figures.
- The course notes of CS867 and CS652 are part of a book which I am currently writing and which contains today 250 pages; it is available to the students taking these courses.
- CS855 has more than 200 slides.

- CS9624 has about 600 slides.
- The slides of CS211 were created by the previous instructor; however, I produced many exercises and programs illustrating the main contents in this course.

Except for CS867/CS652, all these teaching materials are available at the web sites listed in Sections 5.1 and 5.2

5.1 Undergraduate courses (cross-listed courses included)

- *CS211, Software Tools and Systems Programming.*
  `http://www.csd.uwo.ca/~moreno/cs211_moreno/index.html`
- *CS424, Foundations of Computer Algebra.*
  `http://www.csd.uwo.ca/~moreno/MainPages/CS424-2005.html/index.html`
- *CS447, Compiler Theory.*
  `http://www.csd.uwo.ca/~moreno/MainPages/CS447-2004.html/index.html`.

5.2 Graduate courses

- *CS9624 High Performance Computing with a Focus on Hardware Acceleration Technologies.*
  `http://www.csd.uwo.ca/~moreno/CS433b-CS9624b-0910.html`
- *CS855, Parallel Scientific Computing: Models, Algorithms and Implementation.*
  `http://www.csd.uwo.ca/~courses/CS855b/`
- *CS867, Algorithmic Properties of Polynomial Rings.*
  `http://www.csd.uwo.ca/~moreno/MainPages/CS867-2005.html/index.html`.
- *AM583, Advanced Computer Algebra: Modular Computations.*
  `http://www.csd.uwo.ca/~moreno/MainPages/AM583-2003.html/index.html`.
- *CS652, Algorithms and Software for Symbolic Solvers for Polynomial Systems.*
  `http://www.csd.uwo.ca/~moreno/MainPages/CS652-2004.html/index.html`.
- *CS874, Advanced Computer Algebra: Asymptotically Fast Methods for Exact Computations.*
  `http://www.csd.uwo.ca/~moreno/MainPages/CS874-2003.html/index.html`

6 Supervision of Students and PDFs

I have supervised the Master's theses listed in Section 6.1, the post-doctoral projects listed in Section 6.2 and the internships and undergraduate projects listed in Section 6.3.

6.1 Completed graduate students

1. Xin Li *Toward High-performance Polynomial System Solvers Based on Triangular Decompositions.* PhD thesis (co-supervised by S. M. Watt). UWO, started in September 2005, defended on April 21, 2009.

2. Yuzhen Xie *Fast algorithms, modular methods, parallel approaches and software engineering for solving polynomial systems symbolically.* PhD thesis (co-supervised by S. M. Watt). UWO, started in January 2003, defended on September 4, 2007.

3. Raqeeb Rasheed. *Modular Methods for Solving Nonlinear Polynomial Systems.* Master's thesis UWO, started in September 2006, defended on August 23, 2007.

4. Akpodigha Filatei. *Implementation of Fast Polynomial Arithmetic in Aldor.*, Master's thesis UWO, started in May 2005, defended on March 28, 2006.

5. 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.

6. 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.

6.2 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.

6.3 Completed internships

1. Undergraduate research assistant: Afsaneh Bakhtiari (Applied Mathematics Department). *Implementation of the Half-GCD Algorithms in Aldor.* UWO, May 2005 to May 2006.

2. Undergraduate research assistant: Steve Wilson (Mathematics Department). *Implementation of Multivariate Hensel lifting in Aldor.* UWO, Summer 2004.

3. Internship in *licence MIAGE-2* of Karim Zgoulli. *Automatisation du suivi de la production de l'entreprise OSYS.* Université de Lille 1, France, 2001.

4. Internship in *licence MIAGE-2* of Édith Deman. *Gestion informatique de la bibliothèque interne de l'entreprise UNIS.* Université de Lille 1, France, 2001.

5. Undergraduate project (CS 490 Y) of Wei Hu (co-supervised with Serge Mister). *Security Testing of Protocol Implementations.* UWO, September 2004 to March 2005.

6.4 Titles of theses in progress

1. Supervision of the PhD thesis of Wei Pan. *Towards practically efficient symbolic solvers for systems of differential equations.* UWO, started September 2006.

2. Supervision of the PhD thesis of Changbo Chen. *High-performance computer algebra support for dynamical systems.* UWO, started September 2006.

3. Supervision of the PhD thesis of Paul Vrbik, *Probabilistic Algorithms and Implementation Techniques for Triangular Decompositions of Polynomial Systems*, join-supervision with Éric Schost. UWO, started January 2009.

4. Supervision of the PhD Thesis of Sardar Anisul Haque. *Cache-oblivious Algorithms for Sparse Polynomial Arithmetic.* UWO, started January 2009.

5. Supervision of the Master Thesis of Liyun Li *Asymptotically Fast and Practically Efficient Algorithms for Computing Resultants and Sub-resultants.* UWO, started September 2008.

6.5 Supervision of post-doctoral fellows in progress

1. Supervision of the post-doctoral fellowship of Rong Xiao, *High Performance Real Solving Tools in Support of Industrial Applications.* UWO, started September 2009.

2. Supervision of the post-doctoral fellowship of Ekaterina Shemyakova, *Heuristical strategies for variable ordering section in solving large sparse polynomial systems.* UWO, started January 2010.

6.6 Theses for which I served as adviser or examiner

1. Examiner for the Master's thesis of Muhammad Chowdhury *Homotopy Techniques for Multiplication Modulo Triangular Sets* UWO, April 22, 2009.

2. 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.

3. Examiner for the Master's thesis of Ling Ding *High Performance Code Generation for Polynomials and Power Series.* UWO, April 20, 2009.

4. Examiner for the PhD thesis of Xiaofang Xie *On the Recognition of Handwritten Mathematical Symbols* UWO, December 14, 2007.

5. Examiner for the Master's thesis of Matthew Malefant *A Comparison of Two Families of Algorithms for Symbolic Polynomials* UWO, December 13, 2007.

6. Examiner for the PhD thesis of Azar Shakoori. *Polynomial Algebra by Values for Solving Bivariate Systems* UWO, December 11, 2007.

7. Examiner for the PhD thesis of Laurentiu Dragan. *On Measuring and Optimizing the Performance of Parametric Polymorphism.* UWO, September 4, 2007.

8. Examiner for the PhD thesis of Qing Zhao. *SC-Expressions in Object-Oriented Languages.* UWO, August 9, 2007.

9. Adviser (but not supervisor) for the PhD thesis of Wenyuan Wu. *Geometric Symbolic-numeric methods for differential and algebraic systems.* UWO, July 23, 2007.

10. Examiner for the PhD thesis of Wenqin Zhou. *Symbolic Computation Techniques for Solving Large Expression Problems from Mathematics and Engineering.* UWO, April 19, 2007.

11. Examiner for the Master's thesis of Heba Anbeer. *Complexity measures for biological strings* UWO, December 8, 2006.

12. Examiner for the Master's thesis of Songxin Liang. *Component-free vector algebra in Aldor* UWO, April 17, 2006.

13. Examiner for the PhD thesis of Elena Losseva. *Optimal Methods of Encoding Information for DNA Computing.* UWO, December 8, 2005.

14. Examiner for the Master's thesis of Nargol Rezvani. *Approximate Polynomials in Different Bases.* UWO, December 2, 2005.

15. Examiner for the PhD thesis of Cosmin Oancea. *Parametric Polymorphism for Software Component Architectures.* UWO, November 1, 2005.

16. 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.

17. Examiner for the PhD thesis of Juntao Ye. *Computational Aspects of the Dynamics of Cloth.* UWO, May 3, 2005.

18. Examiner for the Master's thesis of Ben Huang. *Network Performance Studies in High Performance Computing Environments.* UWO, March 3, 2005.

19. Examiner for the Master's thesis of Kevin Durdle. *Supporting Mathematical Handwriting Recognition through an Extended Digital Ink Framework.* UWO, December 13, 2004.

20. 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.

6.7 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	MITACS Award for Best Novel Use of
	& Wei Pan	Mathematics in Technology Transfer
2009	Anisul S. Haque	UWO Biocomputing Student Award
2010	Changbo Chen	UWO Graduate Thesis Award

7 Scholarly Activity

7.1 Organization of conferences and workshops

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 M^3 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.lifl.fr/issac2002/`

CATLAN' 02. Co-organizer with S.M. Watt *Workshop on Categorical Programming Languages.* Lille, France, 2002.
`http://www.lifl.fr/issac2002/`

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 Gonzàlez Vega (Universitad 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.

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-2009. Program Committee Member of the International Conference *Computer Algebra in Scientific Computing.*

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

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

Calculemus 2005. Program Committee Member of the *12th Symposium on the Integration of Symbolic Computation and Mechanized Reasoning.*
`http://imps.mcmaster.ca/calculemus-2005`

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

ISSAC 2005-2010. Article referee for the *International Symposium on Symbolic and Algebraic Computation.*

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

7.2 Invited Visits

These are visits, of at least two weeks, for which I received an honorarium covering my living and travel expenses.

Inviting Institution	**Time**	**Duration**
University of Santander	March 1998	2 weeks
Ontario Research Center for Computer Algebra (ORCCA, UWO)	Fall 2001	1 term
Chinese Academy of Sciences	May 2007	1 month
Peking University	May-June 2008	1 month
Chinese Academy of Sciences	May 2009	2 weeks
& Peking University	August 2009	2 weeks
Normal University of Chegdu	August 2009	2 weeks
Rykkyo Univerisity	December 2009	2 weeks
& Fukuoka University		

7.3 Participation in European research projects

FRISCO Project 1996-1999. Investigator and developer at NAG[1] for the European project FRISCO[2]

PoSSo Project 1992-1995. I was involved in the European project PoSSo[3] during my PhD Thesis.

[1]The Numerical Algorithms Group Ltd, Oxford, UK.
[2]A Framework for Integrated Symbolic Numeric Computation. Project ESPRIT No. 21024. `http://www.nag.co.uk/projects/FRISCO.html`.
[3]Polynomial System Solving. Project BRA 6846. `http://posso.dm.unipi.it/`

8 Research Funding

Start Date	End Date	Principal Investigator	Co-Investigators	Granting Agency	Grant Title	Total Amount	Amount/year for myself
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 Workshop	\$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 Institue	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

Notes:

Short name	**Full name or URL**
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

- In case of a grant held by several researchers, the percentage in square brackets represents my share of the total.

9 Administrative Work

9.1 Departmental activities

University	**Department**	**Description**	**Year**
UWO	Computer Science	Graduate awards committee chair	2006-2008
UWO	Computer Science	Awards committee chair	2006-2008
UWO	Computer Science	Graduate executive committee member	2004-2008
UWO	Computer Science	Undergraduate counselling and Appeals committee member	2003-2004 2003-2004
UWO	Computer Science	Colloquium committee member	2003-2006
UWO	Computer Science	Award committee member	2002-2006
Univ. of Paris 6	Computer Science	Development of new programs for undergraduate students under the direction of Michèle Soria	1995-1997

9.2 Extra-departmental activities

Instituton	**Description**	**Year**
SHARCNET	Member resource allocation committee	2007 & 2008