

**CURRICULUM VITAE**  
**George Labahn**

May 13, 2013

RANK

Professor

STATUS

Tenured

HOME ADDRESS

250 Shakespeare Drive  
Waterloo, Ontario  
Canada N2N 2A1

WORK ADDRESS

Cheriton School of Computer Science  
University of Waterloo  
Waterloo, Ontario  
Canada N2L 3G1  
Telephone (519) 888-4667

EMPLOYMENT HISTORY

2000-present	Professor (Full)	Computer Science	University of Waterloo
2008-2011	Associate Dean, Graduate Studies and Research	Faculty of Math	University of Waterloo
2008-2011	Co-Director, Management Program	Computer and Financial	University of Waterloo
2006-2006	Interim Director	Computer Science	University of Waterloo
2005-2007	Associate Director	Computer Science	University of Waterloo
1999-2002	Associate Dean, Graduate Studies and Research	Faculty of Math	University of Waterloo
1997-1999	Associate Chair, Graduate Studies	Computer Science	University of Waterloo
1994-2000	Associate Professor	Computer Science	University of Waterloo
1988-1994	Assistant Professor	Computer Science	University of Waterloo
1985-1988	Instructor	Computing Science	University of Alberta

## ADVANCED DEGREES RECEIVED

Ph.D.	Univ. of Alberta	Computing Science	1988
M.Sc.	Univ. of Alberta	Computing Science	1986

## DISSERTATION TITLE

Padé Forms and Inverses of Hankel Matrices

## PROFESSIONAL INTERESTS

Multi-dimensional Algebraic Computation  
Symbolic Manipulation  
Analysis of Algorithms  
User Interface of Computer Algebra Systems

## PROFESSIONAL ORGANIZATIONS

Association for Computing Machinery (ACM)  
Special Interest Group on Symbolic & Algebraic Manipulation (SIGSAM)  
Society for Industrial and Applied Mathematics (SIAM)  
American Mathematical Society (AMS)

## PROFESSIONAL ACTIVITIES

Member, ICR (Institute for Computer Research),  
1988 - present

Member, ICR Board of Directors,  
1993 - 1995

## SERVICE FOR JOURNALS AND CONFERENCES

Editor for the following journals:

Journal of Symbolic Computation (JSC) (2003 - present)  
Transactions of Mathematical Software (TOMS) (1996 - 2007)

Local Arrangements Co-Chair: ISSAC'07 (Waterloo)

General Chair: ISSAC'05 (Beijing)

Tutorial Chair: ISSAC'99 (Vancouver), Poster Chair: ISSAC'98 (Rostock)

Program Committee: ISSAC'97 (Maui), ISSAC'07 (Waterloo)

Member, ISSAC Steering Committee  
1999 - 2002

Grant Funding Panels : National Science Foundation (NSF) (Five times)

Committee of Visitors (COV) : National Science Foundation (NSF)

Referee for the following journals:

Constructive Approximation  
Journal of Computational and Applied Math  
Journal of Computational Finance  
Journal of Symbolic Computation  
Linear Algebra and its Applications  
Numerical Algorithms  
SIAM Journal of Scientific and Statistical Computation  
Journal for Computational and Graphical Statistics  
SIAM Journal of Matrix Analysis and Applications  
Journal of Pure and Applied Algebra  
Journal of Reliable Computing

Referee for the following research proposals:

NSERC operating grants, 1995 - present  
Academic Development Fund, University of Western Ontario  
Austrian Research Council for Engineering Sciences  
Belgium Research Council for Engineering Sciences  
Swedish Research Council for Engineering Sciences

Book Reviewer for the following journals:

Mathematics of Computation

ADMINISTRATIVE COMMITTEES

Chair: School Advisory Committee Appointments (SACA) (CS hiring committee)

2003 - 2005

Promotions and Tenure Committee,

2004 - 2005

UW Board of Governors ,

2004 - 2005

UW Senate ,

2000 - 2005

Dean of Graduate Studies Selection Committee,

2003

Provost Selection Committee,

2001

Computer Science Hiring Committee (SACA),

2000 - 2002

Senate Graduate Committee,

1998 - 2002

Math Faculty Graduate Committee,

1998 - 2002

Computer Science Graduate Committee,

1996 - 2000

Computing In Math Committee,

1994 - 1995

Graduate Student Advisor (University of Waterloo),

1991 - 1994

Chair: Ph.D. Comprehensive Committee (University of Waterloo),

1993 - 1995

Ph.D. Comprehensive Committee (University of Waterloo),

1992 - 1993

Chair: Long Term Committee to evaluate First Year Courses, (University of Waterloo),

1992 - 1994  
 ICR Operations Committee (University of Waterloo),  
 1993 - 1995  
 Faculty Affairs Committee (University of Waterloo),  
 1989 - 1991

POST DOCTORAL STUDENT SUPERVISION

Name		Project Title	Current Position
A. Novicin <sup>2</sup>	2011-12	Symbolic Linear Algebra	
C. Pernet <sup>2</sup>	2006-07	Symbolic Linear Algebra	Asst Prof Grenoble
J. May <sup>1</sup>	2004-06	Symbolic-Numeric Arith- metic	MapleSoft Inc
P. Giorgi <sup>2</sup>	2004-05	Symbolic Linear Algebra	Assistant Professor at Montpellier
Z. Li	2001-04	Differential Algebra	Assoc Prof, Academia Sinica
W-s. Lee <sup>1</sup>	2001-03	Symbolic-Numeric Arith.	Post Doc at Antwerp
C.P. Jeannerod	2001-02	Symbolic-Numeric Arith.	Researcher at INRIA
L. Rebillard	1999-01	Orthogonal Series	France Gaz
E. Hubert	1997-98	Partial Differential Eqns	Researcher at INRIA
M. Rybowicz <sup>3</sup>	1996-98	Algebraic Numbers	Assoc. Prof, (Limoges, Fr)
E. Cheb-Terrab <sup>3</sup>	1996-97	Partial Differential Eqns	Researcher, Waterloo Maple
M. Mohrenschildt	1994-96	Piecewise Functions	Assoc. Prof. (Software Eng.), McMaster Univ.
F. Boulier	1995-96	Differential Gröbner Bases	Asst. Prof. (C.S.), Univ. Lille (France)
J. Lang	1993-94	Partial Differential Eqns	Research in Motion
M. Mutrie	1992-93	Elliptic Integration	Research Assoc. (Systems Design Engineering), Univ. Waterloo

<sup>1</sup>Jointly supervised with M.W. Giesbrecht.

<sup>1</sup>Jointly supervised with M.W. Giesbrecht and A. Storjohann.

<sup>1</sup>Jointly supervised with K.O. Geddes.

## GRADUATE STUDENT SUPERVISION

### PHD STUDENTS

*Current:(5)*

Reinhold Burger - 2001 to present

Wei Zhou - 2002 to present

David Tausky - 2004 to present

Scott Maclean - 2009 to present

R. Jason Peasgood - 2010 to present

*Past:(5)*

Johannes Middeke - completed in 2011

A computational view on normal forms of matrices of Ore polynomials

Johannes Kepler Universitat, Linz

(c-supervise with Franz Winkler)

Wai man Ng - completed in 2011

Energy Shaping for systems with two degrees of underactuation

(co-supervise with Dong Eui Chang)

Amelie Belanger - completed in 2008

Numerical Methods for long-term impulse control problems in finance

(co-supervise with Peter Forsyth)

Shannon Kennedy - completed in 2007

Thesis Title: Hedging Contingent Claims in Markets with Jumps

(co-supervise with Peter Forsyth)

Howard Cheng - completed in 2003

Thesis Title: Algorithms for Normal Forms for Matrices of Polynomials  
and Ore Polynomials

### MASTERS STUDENTS

*Current:(3)*

Mark Prosser - 2011 to present

Zhe Wang - 2011 to present (co-supervise with Peter Forsyth)

Ming Ma - 2011 to present (co-supervise with Peter Forsyth)

*Past:(25)*

Daniel Ivan - completed in 2012 (co-supervise with Rahim Moosa)

Essay Title : Existentially Closed Hasse Fields

Josh Babbin - completed in 2011 (co-supervise with Peter Forsyth)

Essay Title : Numerical Comparisons of Iterative Methods for Pricing American Options Under Regime Switching

David Fagnan - completed in 2011 (co-supervise with Peter Forsyth)

Thesis Title: Computational Methods for Maximum Drawdown Options under Jump-Diffusion

Chris Morley - completed in 2011 (co-supervise with Peter Forsyth)

Thesis Title: Pricing CPPI Capital Guarantees : A Lagrangian Framework

Durgesh Saraph - completed in 2010 (co-supervise with Peter Forsyth)

R. Jason Peasgood - completed in 2009

Scott Maclean - completed in 2009

Thesis Title: Theory and practice in mathematical data corpus creation

Jon Aquan-Asee - completed in 2009 (co-supervise with Peter Forsyth)

Essay Title : Boundary Conditions For Mean-Reverting Square Root Process

Ian Rutherford - completed in 2005

Thesis Title: Structural Analysis for Pen-Based Math Input Systems

Justin Wozniak - completed in 2003

Thesis Title: A Control Systems package for Maple

Reinhold Burger - completed in 2001

Thesis Title: Exact Solutions of Linear Differential Equations with Doubly-Periodic Coefficients

Cathy Schnider - completed in 2001

Thesis Title: MathML - From Computer Algebra Systems to the Web and back

Yann d'Halluin - completed in 2000

Thesis Title: Pricing Callable Bonds using PDEs

(co-supervise with Peter Forsyth)

Katherina Von Bulow - completed in 2000

Thesis Title: Equivalence Methods for Second Order Linear Differential Equations

Cassidy Gentle - completed in 1999

Thesis Title: Computing Greatest Common Divisors of Polynomial Matrices

Coralee Allaby - completed in 1999

Essay Title: Pseudo-Analytic Solutions for Pricing European and Parisian Options

Qingwei Liu - completed in 1999

Essay Title: A Study of Graph Partitioning Algorithms

Ha Le - completed in 1999

Thesis Title: Client-Server Communication Standards for Mathematical Computation

Enrico Au Yeung - completed in 1996

Essay Title: Clustering Algorithms for Radial Basis Functions in Neural Networks

Geck Hong - completed in 1996

Essay Title: Gröbner Walk

Wolfgang Heidrich - completed in 1996

Thesis Title: Spline Extensions for the MAPLE Plot System

Lee Qiao - completed in 1995

Thesis Title: Performance Visualization Tools for Parallelizing Computer Algebra Algorithms

Hoan Pham - completed in 1995

Essay Title: Symbolic computation and Error-Correcting Codes

A. Storjohann- completed in 1994

Thesis Title: Computation of Hermite and Smith Matrix Normal Forms of Matrices

T. Tyhurst - completed in 1992

Thesis Title: Mathematical Output Presentation in User Interfaces for Computer Algebra Systems

## COMPREHENSIVE AND THESIS EXAMINATION COMMITTEES

### *External Ph.D Thesis Examiner:*

Pratibha, "Maple Tools for Hydrodynamic Interaction Problems",  
Ph.D, Dept of Applied Math, University Of Western Ontario. (1995)

Xianping Liu, "Symbolic Tools for the Analysis of Nonlinear Dynamical Systems",

Ph.D, Dept of Applied Math, University Of Western Ontario. (1999)

Yang Zhang, "",

Ph.D, Dept of Applied Math, University Of Western Ontario. (2004)

TEACHING (last 12 years)

University of Waterloo

2010 Fall	CS370 Introduction to Scientific Computation	150 students (two sections)
2010 Winter	CS370 Introduction to Scientific Computation	81 students
2009 Winter	CS370 Introduction to Scientific Computation	85 students
2008 Winter	CS370 Introduction to Scientific Computation	105 students (two sections)
2007 Spring	CS878 Advanced Computer Algebra	10 students
2007 Winter	CS370 Introduction to Scientific Computation	25 students
2006 Winter	CS370 Introduction to Scientific Computation	85 students
2005 Winter	CS371 Introduction to Numeric Computation	32students
2005 Winter	CS370 Introduction to Scientific Computation	85 students
2004 Winter	CS487/687 Intro. to Symbolic Computation	13 students
2004 Winter	CS371 Introduction to Numeric Computation	36 students
2002 Winter	CS370 Introduction to Scientific Computation	90 students
2000 Fall	CS370 Introduction to Scientific Computation	110 students
1999 Fall	CS370 Introduction to Scientific Computation	70 students
1999 Winter	CS134 Principles of Computer Science	100 students
1998 Winter	CS787 Seminar in Symbolic Computation	10 students
1998 Winter	CS487/687 Intro. to Symbolic Computation	20 students
1997 Summer	CS134 Principles of Computer Science	185 students
1997 Winter	CS487/687 Intro. to Symbolic Computation	38 students

## RESEARCH FUNDING

NSERC Individual Operating Grant	2010-2014	\$51,000 / yr
	2006-2010	\$49,000 / yr
	2001-2005	\$46,000 / yr
	1999-2001	\$43,890 / yr
	1998-1999	\$41,800 / yr
	1997-1998	\$38,000 / yr
	1994-1997	\$21,000 / yr
	1992-1994	\$15,000 / yr
	1989-1992	\$15,000 / yr
Co-Principal Investigator MITACS Grant Mathematics of Computer Algebra and Analysis (with M. Monagan (co-PI) and 12 others)	Apr 09-Mar 11	\$227,000/yr
Principal Investigator NSERC/Scotiabank Industrial Chair (with D. Berry and K. Czarnecki)	2008-2012	\$491,885/yr
Co-Principal Investigator Tata Consulting Services, India Portfolio Optimization with Liquidity Risk (with Peter Forsyth)	2008	\$25,000
Co-Principal Investigator MITACS Grant Mathematics of Computer Algebra and Analysis (with M. Monagan (co-PI) and 12 others)	Apr 07-Mar 09	\$254,000/yr
Co-Principal Investigator MITACS Grant Mathematics of Computer Algebra and Analysis (with M. Monagan (co-PI) and 12 others)	Apr 05-Mar 07	\$262,000/yr
Co-Principal Investigator NSERC SYNERGY Award University/Industry award (with K.O. Geddes, M. Giesbrecht, A. Storjohann (UW), R. Corless, D. Jeffrey, S. Watt (UWO) M. Monagan (SFU))	Oct 04	\$25,000
Principal Investigator NSERC Equipment Grant Equipment for Symbolic Computation Lab (with K.O. Geddes, M. Giesbrecht and A. Storjohann)	Apr 04-Mar 05	\$23,600
MITACS Grant Mathematics of Computer Algebra and Analysis (with K. O. Geddes, M. Giesbrecht and A. Storjohann)	Apr 03-Mar 05	\$126,000/yr

Principal Investigator MICROSOFT INDUSTRIAL GRANT Pen-based Mathematics for PC Tablets (with S. Watt and M. Giesbrecht)	Apr 04-Mar 07	\$252,000/yr
Principal Investigator Bell University Labs Grant Improvements for Symbolic Computation Lab (with K.O. Geddes, M. Giesbrecht and A. Storjohann)	Oct 02	\$42,000
Principal Investigator Bell University Labs Grant Improvements for Symbolic Computation Lab (with K.O. Geddes, M. Giesbrecht and A. Storjohann)	Oct 01	\$12,500
NSERC CRD Grant An Integrated Symbolic-Numeric Scientific Computing Environment (with K. O. Geddes, J. Shallit, S.M. Watt and R. Corless)	Feb 99-Feb 03	\$526,500/yr
Ontario Research Center for Computer Algebra ORDCF Grant (with S.M. Watt, R.M. Corless, K.O. Geddes, D.J. Jeffrey, M.W. Giesbrecht)	Feb 99-Feb 03	\$385,000/yr
Principal Investigator NSERC Equipment Grant Comp. Support for Symbolic Computation Group (with K. O. Geddes and J. Shallit)	Apr 99-Mar 00	\$34,041
NSERC CRD Grant Symbolic and Numeric Algorithms for Mathematical Computation (with K. O. Geddes, J. Shallit, and R. Corless)	Jul 94-June 98	\$181,120 first \$224,894/yr
Waterloo Maple Software Grant Symbolic and Numeric Algorithms for Mathematical Computation (with K. O. Geddes, J. Shallit, and R. Corless)	May 94-Apr 98	\$200,000/yr

Principal Investigator NSERC Equipment Grant Comp. Support for Symb. Comp. and Data Struc. Groups (with K. O. Geddes, I. Munro, E. Chan, G. Weddell, F. Tompa and J. Shallit)	Apr 93-Mar 94	\$67,601
ITRC Grant Symbolic and Numeric Analysis of Differential Equations (with K.O. Geddes and J.O. Shallit)	Apr 93-Mar 95	\$127,000
ITRC Grant Enhanced Mathematical Library Functions in Maple (with K.O. Geddes and J.O. Shallit)	Apr 91-Mar 93 Apr 90-Mar 91	\$120,000 \$110,000
Mathematical Tools for Science and Engineering Problem Solving via Maple (with G.H. Gonnet and K.O. Geddes)	Jul 89-Mar 90 Jan 88-Jun 89	\$80,000 \$170,000
ICR Infrastructure (NSERC Infrastructure - with 80 other members of ICR. I. Blake Principal Investigator)	1992-1995 1989-1992	\$352,000 per \$400,000 per
University of Waterloo Interim Grant	1988-1989	\$3,500

## PUBLICATIONS

### **Books**

1. M.B. Monagan, K.O. Geddes, K.M. Heal, G. Labahn, S. Vorketter, J. McCarron, P DeMarco, "The Maple Introductory Programming Guide", Springer-Verlag, (2003), 370 pages.
2. M.B. Monagan, K.O. Geddes, K.M. Heal, G. Labahn, S. Vorketter, J. McCarron, P DeMarco, "The Maple Advanced Programming Guide", Springer-Verlag, (2003), 430 pages.
3. K.O. Geddes, S.R. Czapor and G. Labahn, "Algorithms for Computer Algebra", Kluwer Academic Publishers, (1992), 585 pages.

## Papers in Refereed Journals

1. Y. Huang, P. Forsyth and G. Labahn, Inexact Arithmetic Considerations for Direct Control and Penalty Methods: American Options under Jump Diffusion To appear in *Applied Numerical Mathematics* ( 29 pages)
2. W. Ng, D.E. Chang and G. Labahn, Energy Shaping for Systems with Two Degrees of Underactuation and More than Three Degrees of Freedom, To appear in *SIAM Journal on Control and Optimization* (2012) (25 pages)
3. S. Maclean and G. Labahn, A new approach for recognizing handwritten mathematics using relational grammars and fuzzy sets, To appear in *International Journal of Document Analysis and Recognition* (2012) 27 pages
4. M. Barkatou, C. El Bacha, G. Labahn and E. Pflügel, On Simultaneous Row and Column Reduction of Higher-Order Linear Differential Systems, To appear in *Journal of Symbolic Computation*, 2011. 25 pages.
5. Y. Huang, P. Forsyth and G. Labahn, Combined Fixed Point and Policy Iteration for Hamilton-Jacobi-Bellman Equations in Finance, *SIAM Journal of Numerical Analysis* 50(4) (2012) 1861-1882.
6. Y. Huang, P. Forsyth and G. Labahn, Iterative methods for the solution of a singular control formulation of a GMWB pricing problem, *Numerische Mathematik* 122(1) (2012) 133-167.
7. W. Zhou and G. Labahn, Efficient Computation of Order Bases, *Journal of Symbolic Computation*, 47(7) (2012) 793-819
8. Y. Huang, P.A. Forsyth and G. Labahn, Methods for pricing American options under regime switching, *SIAM Journal on Scientific Computing*, 33(5) (2011) 2144-2168.
9. S. Maclean, G. Labahn, E. Lank, M. Marzouk and D. Tausky, Grammar-based techniques for creating ground-truthed sketch corpora, *International Journal of Document Analysis and Recognition*, 14(1) (2011) 65-74.

10. A.C. Belanger, P.A. Forsyth and G. Labahn, Valuing the Guaranteed Minimum Death Benefit Clause with Partial Withdrawals, *Applied Mathematical Finance*, 16(6) (2009) 451-496.
11. M. Giesbrecht, G. Labahn and W-s Lee, Symbolic-numeric Sparse Interpolation of Multivariate Polynomials, *Journal of Symbolic Computation* 44(8) (2009) 943-959.
12. P. Forsyth and G. Labahn, Numerical Methods for Controlled Hamilton-Jacobi-Bellman PDEs in Finance, *Journal of Computational Finance* (2008) **11**(2) 1-44.
13. B. Beckermann, G. Golub and G. Labahn, On the numerical condition of a generalized Hankel eigenvalue problem, *Numerische Mathematik* **106**(1) (2007) 41-68
14. H. Cheng and G. Labahn, Output-sensitive Modular Algorithms for Polynomial Matrix Normal Forms, *Journal of Symbolic Computation*, **42**(7) (2007) 733-750.
15. B. Beckermann, G. Labahn and G. Villard, Normal Forms for General Polynomial Matrices, *Journal of Symbolic Computation*, **41**(6) (2006) 708-737.
16. B. Beckermann, H. Cheng and G. Labahn, Fraction-free Row Reduction of Matrices of Ore Polynomials, *Journal of Symbolic Computation* **41**(5) (2006) 513-543.
17. Y. d'Halluin, P.A. Forsyth and G. Labahn, A Semi-Lagrangian approach for American Asian Options under jump diffusion, *SIAM Journal of Scientific Computation* **27** (2005) 315-345.
18. Y. d'Halluin, P.A. Forsyth and G. Labahn, A penalty method for American options with jump diffusion processes, *Numerische Mathematik*, **97**(2) (2004) 321-352.
19. Y. d'Halluin, P.A. Forsyth, K.R. Vetzal and G. Labahn, A Numerical PDE Approach for Pricing Callable Bonds. *Applied Mathematical Finance* **8** (2001) 49-77.

20. B. Beckermann and G. Labahn, Fraction-free Computation of Matrix Rational Interpolants and Matrix GCD's. *SIAM J. Matrix Analysis and Applications*. **22**(1) (2000) 114-144.
21. B. Beckermann and G. Labahn, Effective Computation of Rational Approximants and Interpolants. *Reliable Computing* **6** (2000) 365-390.
22. B. Beckermann and G. Labahn, When are two numerical polynomials relatively prime? *J. of Symbolic Computation* **26** (1998) 677-689.
23. B. Beckermann and G. Labahn, A fast and numerically stable Euclidean-like algorithm for detecting relatively prime numerical polynomials. *J. of Symbolic Computation* **26** (1998) 691-714.
24. B. Beckermann and G. Labahn, Recursiveness in Matrix Rational Interpolation Problems, *J. of Computational and Applied Math* **77** (1997) 5-34.
25. S. Cabay, A.R. Jones and G. Labahn, Algorithm 766: Experiments with a Weakly Stable Algorithm for Computing Padé-Hermite and Simultaneous Padé Approximants, *ACM Trans. of Mathematical Software (TOMS)* **23**(1) (1997) 91-110.
26. A. Storjohann and G. Labahn, A Fast Las Vegas Algorithm for Computing the Smith Normal Form of a Polynomial Matrix, *Linear Algebra and its Applications* **253** (1997) 155-173.
27. S. Cabay, A.R. Jones and G. Labahn, Computation of Numerical Padé-Hermite and Simultaneous Padé Systems I: Near Inversion of Generalized Sylvester Matrices, *SIAM J. Matrix Analysis and Applications* **17** (1996) 247-267.
28. S. Cabay, A.R. Jones and G. Labahn, Computation of Numerical Padé-Hermite and Simultaneous Padé Systems II: A Weakly-Stable Algorithm, *SIAM J. Matrix Analysis and Applications* **17** (1996) 268-297.
29. G. Labahn, B. Beckermann and S. Cabay, Inversion of Mosaic Hankel Matrices via Matrix Polynomial Systems, *Linear Algebra and its Applications* **221** (1995) 253-280.

30. B. Beckermann and G. Labahn, A uniform approach for the fast computation of Matrix-type Padé approximants, *SIAM J. Matrix Analysis and Applications* **15** (1994) 804-823.
31. G. Labahn and T. Shalom, Inversion of Toeplitz Structured Matrices using only Standard Equations, *Linear Algebra and its Applications* **207** (1994) 49-70.
32. G. Labahn, Inversion Components for Block Hankel-like Matrices, *Linear Algebra and its Applications* **177** (1992) 7-48.
33. B. Beckermann and G. Labahn, A uniform approach for Hermite Padé and simultaneous Padé Approximants and their Matrix-type generalizations, *Numerical Algorithms* **3** (1992) 45-54
34. G. Labahn and T. Shalom, Inversion of Toeplitz Matrices with only Two Standard Equations, *Linear Algebra and its Applications* **175** (1992) 143-158.
35. S. Cabay and G. Labahn, A Superfast Algorithm for Multi-dimensional Padé Approximation, *Numerical Algorithms* **2** (1992) 201-224.
36. S. Cabay, G. Labahn and B. Beckermann, On the Theory and Computation of Non-perfect Padé-Hermite Approximants, *J. of Computational and Applied Math* **39** (1992) 295-313.
37. G. Labahn, D.K. Choi and S. Cabay, *Inverses of Block Hankel and Block Toeplitz Matrices*, *SIAM J. of Computing* **19** (1990) 98-123.
38. T.C. Scott, R.A. Moore, G.J. Fee, M.B. Monagan, G. Labahn and K.O. Geddes, Perturbative Solutions of Quantum Mechanical Problems by Symbolic Computation: A Review, *International J. of Modern Phys. C* **1** (1990) 53-76.
39. G. Labahn and S. Cabay, Matrix Padé Fractions and their Computation, *SIAM J. of Computing* **18** (1989) 639-657.

## Papers in Refereed Conference Proceedings

1. W. Zhou and G. Labahn, Computing Column Bases for Polynomial Bases, *Proceedings of ISSAC'13*, Boston, USA, June 26-29, (2013).
2. E. Hubert and G. Labahn, Rational invariants of scalings from Hermite normal forms, *Proceedings of ISSAC'12*, Grenoble, France, July 22-25, (2012) 219-226.
3. W. Zhou, G. Labahn and A. Storjohann, Computing Minimal Nullspace Bases, *Proceedings of ISSAC'12*, Grenoble, France, July 22-25, (2012) 366-373.
4. W. Zhou and G. Labahn, Efficient Computation of Order Bases, *Proceedings of ISSAC'09*, Seoul, Korea, ACM Press, (2009) 375-382.
5. B. Beckermann and G. Labahn, Fraction-Free Computation of Simultaneous Padé Approximants, *Proceedings of ISSAC'09*, Seoul, Korea, ACM Press, (2009) 15-22.
6. G. Labahn, E. Lank, M. Marzouk, A. Bunt, S. MacLean and D. Tausky, MathBrush: A Case Study for Pen-based Interactive Mathematics, Proc. of the 5th Eurographics Symposium on Sketch-Based Interfaces and Modelling (SBIM 2008). (2008)
7. D. Tausky, G. Labahn, E. Lank and M. Marzouk, Managing Ambiguity in Mathematical Matrices, Proc. of the 4th Eurographics Symposium on Sketch-Based Interfaces and Modelling (SBIM 2007). (2007) 115-122.
8. H. Cheng and G. Labahn, On Computing Polynomial GCDs in Alternate Bases, *Proceedings of ISSAC'06*, Genoa, Italy, ACM Press, (2006) 47-54.
9. M. Giesbrecht, G. Labahn and W-s Lee, Symbolic-numeric Sparse Interpolation of Multivariate Polynomials, *Proceedings of ISSAC'06*, Genoa, Italy, ACM Press, (2006) 116-123.
10. M. Giesbrecht, G. Labahn and Y. Zhang, Computing Valuation Popov Forms, *Proceedings of CASA'2005*, Lecture Notes on Computer Science 3516, Springer-Verlag, (2005) 619-626.

11. G. Labahn and Ziming Li, Hyperexponential Solutions of Finite-rank Ideals in Uncoupled Ore Algebras, *Proceedings of ISSAC'04*, Santander, Spain, ACM Press, (2004) 213-220.
12. R. Burger, G. Labahn and M. van Hoeij, Closed form solutions of linear odes having elliptic functions as coefficients, *Proceedings of ISSAC'04*, Santander, Spain, ACM Press, (2004) 58-64.
13. M. Giesbrecht, G. Labahn and W-s Lee, Symbolic-Numeric Sparse Polynomial Interpolation in Chebyshev Basis and Trigonometric Interpolation, *Proceedings of Computer Algebra in Scientific Computing (CASC 2004)*, St. Petersburg, Russia, (2004)
14. C.P. Jeannerod and G. Labahn, The SNAP Package for Arithmetic with Numeric Polynomials, *Proceedings of International Congress of Mathematical Software 2002*, Beijing, China, (2002) 61-71.
15. B. Beckermann, H. Cheng and G. Labahn, Fraction-free Row Reduction of Matrices of Skew Polynomials, *Proceedings of ISSAC'02*, Lille, France, ACM Press, (2002) 8-15.
16. H. Cheng and G. Labahn, Computing all Factorizations in  $Z_N[x]$ , *Proceedings of ISSAC'01*, London, Canada, ACM Press, (2001) 64-71.
17. B. Beckermann, G. Labahn and G. Villard, Shifted Normal Forms of Polynomial Matrices, *Proceedings of ISSAC'99*, Vancouver, ACM Press, (1999) 189-196.
18. B. Beckermann, S. Cabay and G. Labahn, Fraction-free Computation of Matrix Padé Systems, *Proceedings of ISSAC'97*, Maui, ACM Press, (1997) 125-132.
19. D.J. Jeffrey, G. Labahn, M. von Mohrenschildt and A.D. Rich, Integration of the signum, piecewise and related functions, *Proceedings of ISSAC'97*, Maui, ACM Press, (1997) 324-330.
20. W. Heidrich, R. Bartels and G. Labahn, Fitting Uncertain Data with NURBS, *Proceedings of Curves and Surfaces*, Chamonix, France, (1997)
21. A. Storjohann and G. Labahn, Asymptotically Fast Computation of the Hermite Normal Form of an Integer Matrix, *Proceedings of ISSAC'96*, Zürich, ACM Press, (1996) 259-266.

22. K.O. Geddes and G. Labahn, Symbolic and Numeric Integration in Maple, *Proceedings of the First Asian Technology Conference in Mathematics*, Singapore, (1995) 377-386.
23. K.O. Geddes and G. Labahn, The Maple Computer Algebra System, *Proceedings of the First Asian Technology Conference in Mathematics*, Singapore, (1995) 367-376.
24. A. Storjohann and G. Labahn, Preconditioning of Rectangular Polynomial Matrices for Efficient Hermite Normal Form computation, *Proceedings of ISSAC'95*, Montreal, ACM Press, (1995) 119-125.
25. M. Van Barel, B. Beckermann, A. Bultheel and G. Labahn, Matrix Rational Interpolation with Pole Information, *Nonlinear Numerical Methods and Rational Approximation*, (A. Cuyts ed.), Antwerp, Kluwer Academic Publishers, (1994) 137-148.
26. S. Cabay and G. Labahn, A Fast, Reliable Algorithm for Calculating Padé-Hermite Forms, *Proceedings of ISSAC'89*, (G.H. Gonnet ed.), Portland, ACM Press, (1989) 95-100.
27. G. Labahn and S. Cabay, Matrix Padé Fractions, Proceedings of EUROCAL'87, (J. Davenport ed.), Leipzig, *Lecture Notes in Computer Science*, Springer-Verlag, (1989) 438-449.

#### **Invited Papers in Conference Proceedings**

1. H. Cheng and G. Labahn, Modular Computation for Matrices of Ore Polynomials, Proceedings of WSPC (In Honor of 60-th birthday of Sergei Abramov), 43-66 (2007)

#### **Invited Papers in Conference Proceedings**

1. S. Cabay and G. Labahn, Fast, Numerically Stable Inversion of Mosaic Hankel Matrices, *Systems and Networks: Mathematical Theory and Applications, Volume II: Invited and Contributed Papers*, (U. Helmke, R. Mennicken and J. Saurer, ed.) Akademie Verlag (1994) 625-630.

#### **Papers in Refereed Workshop Proceedings**

1. S. MacLean, and G. Labahn, Elastic matching in linear time and constant space  $i/A_i$ , *Proceedings of Ninth IAPR International Workshop on Document Analysis Systems DAS 2010*, (Short paper), (2010) 551-554
2. G. Labahn, E. Lank, S. Maclean, M. Marzouk and D. Tausky, MathBrush: A System for Doing Math on Pen-Based Devices, *Proceedings of The Eighth IAPR Workshop on Document Analysis Systems DAS 2008*, September 16-19, Nara, Japan (2008) 599-606.
3. G. Labahn, S. Maclean, M. Marzouk, I. Rutherford and D. Tausky, A preliminary report on the MathBrush pen-math system, *Proc. of Maple Conference 2006*, (2006) 162-178.
4. G. Labahn and T. Humphries, Symbolic Integration of Jacobian Elliptic Functions in Maple, *Proc. of Maple Conference 2005*, (2005) 331-339

#### **Other Publications (Lightly Refereed)**

1. M. Giesbrecht, G. Labahn and W-s Lee, Symbolic-Numeric Sparse Polynomial Interpolation of Multivariate Polynomials, *Proc. 9th Rhine Workshop on Computer Algebra* (2004).
2. G. Labahn, Solving Linear Differential Equations in Maple, *MapleTech*, 2 (1995) 20-28.

#### **Invited and Other Talks**

1. "Normal Forms of Differential Polynomials", Workshop on Differential Operators, Linz, Austria, Feb 6, 2009.
2. "Popov Forms of Differential Polynomials", Foundations of Computational Mathematics (FoCM 2008), Hong Kong, June 25, 2008.
3. "Recent Advances in Order Bases", Conference in honour of Peter Borwein, Simon Fraser University, May 12, 2008.
4. "On the Numerical Condition of a Generalized Hankel Eigenvalue Problem", Waterloo Symposium in Honour of Gene Golub, Waterloo, Feb 29, 2008.

5. “Numerical conditioning of the generalized Hankel eigenvalue problem”, Canadian Math Society Meeting, December 9, 2007.
6. “Order Bases”, Plenary Talk for ECCAD 2007, April 24, 2007.
7. “Solving Linear ODEs having Elliptic Function Coefficients”, Computer Algebra Day, Center for Experimental and Computational Math, Simon Fraser University, July 26, 2004.
8. “Linear ODEs in Maple”, Université de Limoges, Limoges, France, Mar 28, 2003.
9. “Linear ODEs in Maple”, École Polytechnique, Paris, France, Mar 26, 2003.
10. “Research in Symbolic Computation”, Department of Computer Science, University of Alberta, Nov 8, 2002
11. “Fraction-free algorithms for Differential Polynomials”, Plenary Lecture, Symbolic Computation and Algorithms (SCA), University of Western Ontario, July 15, 2002
12. “Symbolic/Numeric Computation”, Tutorial for Symbolic Computation and Algorithms (SCA), University of Western Ontario, July 13, 2002
13. “Fast Kernel Computation for finding all factors modulo a power of a prime”, Université des Sciences et Technologies de Lille, France, Dec 13, 2001.
14. “Fast modular computation of GCDs where all primes are lucky”, Department of Mathematics and Statistics, Simon Fraser University, Feb 27, 2001.
15. “Fast modular computation of GCDs where all primes are lucky”, Department of Mathematics, University of Alberta, Feb 23, 2001.
16. “Unexpected Algorithms in the Maple Computer Algebra System”, Laboratoire d’Analyse Numérique et d’Optimisation, Université des Sciences et Technologies de Lille, France, May 4, 2000.

17. “General Matrix Normal Forms for Polynomial Matrices”, Laboratoire d’Analyse Numérique et d’Optimisation, Université des Sciences et Technologies de Lille, France, Apr 27, 2000.
18. “Effective Computation of Rational Approximants and Interpolants”, International Conference on Rational Approximation, (Plenary Talk), Antwerp, Belgium, June 10, 1999.
19. “Fraction-free Computation of Matrix Rational Interpolants”, Laboratoire d’Analyse Numérique et d’Optimisation, Université des Sciences et Technologies de Lille, France, June 5, 1998.
20. “When are two polynomials numerically prime?”, University of British Columbia, Jan. 24, 1998
21. “When are two polynomials numerically prime?”, Simon Fraser University, Jan. 23, 1998
22. “When are two polynomials numerically prime?”, University of Calgary, Dec. 10, 1997
23. “When are two polynomials numerically prime?”, University of Manitoba, Dec. 9, 1997
24. “When are two polynomials numerically prime?”, University of Western Ontario, Feb. 18, 1997
25. “Algebraic Algorithms for Matrix-like Padé Approximants” Université de Limoges, France, July 11, 1996
26. “Algebraic Algorithms for Matrix-like Padé Approximants” Institut National De Recherche en Informatique en Automatique (INRIA), France, June 10, 1996
27. “Current Mathematical Research on the Maple Computer Algebra System”, Université de Limoges, France, June 4, 1996
28. “Legendre Normal Form of Elliptic Integrals”, Université de Limoges, France, June 3, 1996

29. “Current Mathematical Research on the Maple Computer Algebra System”, Laboratoire d’Informatique Fondamentale de Lille, Université des Sciences et Technologies de Lille, France, March 21, 1996.
30. “Recursiveness in Matrix Rational Interpolation Problems”, Laboratoire d’Analyse Numérique et d’Optimisation, Université des Sciences et Technologies de Lille, France, March 14, 1996.
31. “The Maple Computer Algebra System”, AECL Symposium on Mathematical Science, Atomic Canada, Deep River, Ontario, Feb. 25, 1995.
32. “Numerical Padé-Hermite and Simultaneous Padé Systems”, Laboratoire d’Analyse Numérique et d’Optimisation, Université des Sciences et Technologies de Lille, France, April 7, 1994.
33. “Mathematical Algorithms of Computer Algebra”, Invited presentation for 25-th Anniversary Celebration of Department of Computer Science, University of Alberta, Oct 1, 1993.
34. “A Fast, Reliable and Stable Algorithm for the Inversion of Mosaic Hankel and Toeplitz Matrices”, International Symposium on the Mathematical Theory of Networks and Systems, Regensburg, Germany, Aug 6, 1993.
35. “Gcd Heuristics and Reduction of Elliptic Integrals to Normal Form in Maple”, Grupo de Matematica Aplicada, Universidade do Porto, Porto, Portugal, Feb. 12, 1993.
36. “The Maple Computer Algebra Project”, Institute für Angewandte Mathematik, Universität Hannover, Hannover, Germany, Feb. 10, 1993.
37. “Fast and Reliable Inversion of Hankel-like Matrices”, Institute für Angewandte Mathematik, Universität Hannover, Hannover, Germany, Feb. 5, 1993.
38. “Some applications of Maple”, Dept. of Mathematics, University of Alberta, Edmonton, Alberta, Nov. 24, 1992
39. “Algorithmic considerations in the Maple Computer Algebra system”, Dept. of Computer Science, University of Alberta, Edmonton, Alberta, Nov. 23, 1992

40. “Algorithmic considerations in the Maple Computer Algebra system”, Dept. of Computer Science, University of Calgary, Calgary, Alberta, Nov. 20, 1992
41. “A Fast, Reliable and Stable Algorithm for Inversion of Hankel-like Matrices”, Dept. of Computer Science, Stanford University, Stanford, California, Oct. 12, 1992.
42. “Symbolic Integration in Maple” Dept. of Math, University of Alberta, Edmonton, Alberta, Aug 21, 1991.
43. “The Maple Computer Algebra System” University of Kaiserslautern, Kaiserslautern, Germany, July 12, 1991.

### Technical Reports

1. G. Labahn and M. Mutrie, Elliptic Integration in Maple, *University of Waterloo Computer Science Department Research Report CS-97-04*, Jan. 1997 (22 pages)
2. G. Labahn, Inversion of Mosaic Hankel Matrices via the Unimodular Matrix Polynomials of Antoulas, *University of Waterloo Computer Science Department Research Report CS-93-04*, Jan. 1993 (22 pages)
3. G. Labahn et. al. (Symbolic Computation Group), “Maple V: A Sample Interactive Session.” *University of Waterloo Computer Science Department Research Report CS-91-51*, Oct. 1991 (26 pages).
4. G. Labahn, Inversion Algorithms for Rectangular-Block Hankel Matrices, *University of Waterloo Computer Science Department Research Report CS-90-52*, Dec. 1990 (25 pages).

### Book Reports

1. R. Zippel, “Effective Polynomial Computation”, *Mathematics of Computation*, 64, (1995) 1353-1354

### Other Conference Presentations

1. *MathBrush: An Experimental Pen-Based Math System*, Presentation at Dagstuhl, July 5, 2006.

2. *Properties of Sigma Bases*, Waterloo Workshop on Computer Algebra, Wilfred Laurier University, April 12, 2006
3. “The SNAP Package for Arithmetic of Numeric Polynomials”, International Conference on Mathematical Software (ICMS), Beijing, August 18, 2002
4. “Factorization modulo a power of a prime”, Congres International d’Algebre Lineaire et Arithmetique: Calcul Numerique, Symbolique et Parallele, Rabat, Morocco, May 31, 2001.
5. “A Boundary Value Problem Solver in Maple”, MATH 2000, McMaster University, Hamilton, June 13, 2000.
6. “A fast and numerically stable Euclidean-like algorithm for detecting relatively prime numerical polynomials”, SIAM Annual Meeting, Toronto, July 1998.
7. B. Beckermann and G. Labahn, “When are two polynomials numerically prime”, Workshop on Symbolic-Numeric Algorithms for Polynomials (SNAP), INRIA (Sofia-Antipolis), France, July 15 1996.
8. M. Van Barel, B. Beckermann, A. Bultheel and G. Labahn, “Matrix Rational Interpolation with Pole Information”, Conference on Nonlinear Numerical Methods and Rational Approximation, Antwerp, Belgium, Sept 7 1993.
9. B. Beckermann and G. Labahn, “Recursiveness in Matrix Rational Interpolation Problems and Vector M-Padé Approximation with Infinity”, Conference on Nonlinear Numerical Methods and Rational Approximation, Antwerp, Belgium, Sept 7 1993.
10. B. Beckermann and G. Labahn, “A uniform approach for Hermite Padé and simultaneous Padé Approximants and their Matrix-type generalizations”, International Congress of Extrapolation and Rational Interpolation, Jan. 13-17, Tenerife, Spain, 1992.
11. S. Cabay and G. Labahn, “A superfast algorithm for multi-dimensional Padé systems”, International Congress of Extrapolation and Rational Interpolation, Jan. 13-17, Tenerife, Spain, 1992.

12. G. Labahn and T. Shalom, “The inversion of Toeplitz matrices using only two standard equations”, 2nd NIU Conference on Numerical Linear Algebra, Northern Illinois Univ., May 5, 1991.

### **Workshop Presentations**

1. G. Labahn, “The Maple Computer Algebra System” , Workshop on Normal Forms and Homoclinic Chaos, Fields Institute, Waterloo, Ontario, Nov. 15, 1992

### SOFTWARE DEVELOPMENT SUMMARY

1. Integration of Elliptic Functions (2004)
2. Solving linear ODEs with doubly periodic coefficients (2003,2004)
3. The Matrix Polynomial Algebra package (2002)
4. The SNAP package in Maple (with C.P. Jennerod) (2001)
5. Special function solutions of higher order linear odes using the Meijer G ode (2000)
6. Solving linear differential equation using differential factorization (1999-2000)
7. Solution of linear differential equations via special functions (1996-2000)
8. Computation of indefinite Elliptic integrals (1996)
9. The *Plots* graphics package in Maple (1990-1995)
10. The *Plottools* graphics package in Maple (1995)
11. The *inttrans* package for computation of integral transforms in Maple (1992-1995)
12. Computation of definite Elliptic Integrals in Maple (1991-1996)
13. The linear ODE solver in Maple (1993-1998)

14. The *Mpade* package for matrix rational approximation (in Maple share library) (1993)
15. Matrix similarity in Maple (1994)
16. Frobenius and Jordan Normal Forms in Maple (1992-1995)
17. Indefinite Integration of Bessel Functions in Maple (1993)
18. Extensions of Risch Algorithm for functions defined by integrals in Maple (1992)
19. Implementation of bivariate modular gcd algorithm in Maple (1991)
20. Computation of the Matrix Exponential in Maple (1989)

#### MAPLE RELATED SERVICE

Director, Symbolic Computation Group, 1993 - present.

Associate Director, Symbolic Computation Group, 1990 - 1993.

#### MAPLE SUMMARY

Member: Maple Development Committee.(1991-1996)

(Three member committee with representatives from Waterloo Maple and academia that managed the development of the Maple computer algebra system)

Member: Maple Design Team. (1993-1996)

(Eight member committee with representatives from industry and academia that oversaw the design of the Maple computer algebra system)