

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

Professor  
School of Computer Science  
University of Waterloo

Director, Symbolic Computation Group

Employment history

2008-present	Co-Director,	Computer and Financial Management Program	University of Waterloo
2008-present	Associate Dean, Graduate Studies	Faculty of Math	University of Waterloo
2000-present	Professor (Full)	Computer Science	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

Advanced Degrees

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

PhD Thesis

Padé Forms and Inverses of Hankel Matrices

## Journal Editorships

Editor for the following journals:

Journal of Symbolic Computation (JSC) (2003 - present)

Transactions of Mathematical Software (TOMS) (1996 - 2007)

## Conferences and Granting Panels

Program Committee: ISSAC'07 (Waterloo)

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

General Co-Chair: ISSAC'05 (Beijing)

General Chair: MOCAA'04 (Waterloo)

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

Program Committee: ISSAC'97 (Maui)

Member, ISSAC Steering Committee: 1999 - 2002

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

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

## Publications

### Papers in Refereed Journals

1. 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.
2. W. Zhou and G. Labahn, Efficient Computation of Order Bases, To appear in *Journal of Symbolic Computation*, 2011. 23 pages.
3. S. Maclean, G. Labahn, E. Lank, M. Marzouk and D. Tausky, Grammar-based techniques for creating ground-truthed sketch corpora, To appear in *International Journal of Document Analysis and Recognition*, 2010. 20 pages
4. 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.
5. M. Giesbrecht, G. Labahn and W-s Lee, Symbolic-numeric Sparse Interpolation of Multivariate Polynomials, *Journal of Symbolic Computation* 44(8) (2009) 943-959.
6. P. Forsyth and G. Labahn, Numerical Methods for Controlled Hamilton-Jacobi-Bellman PDEs in Finance, *Journal of Computational Finance* (2008) **11**(2) 1-44.
7. B. Beckermann, G. Golub and G. Labahn, On the numerical condition of a generalized Hankel eigenvalue problem, *Numerische Mathematik* **106**(1) (2007) 41-68
8. H. Cheng and G. Labahn, Output-sensitive Modular Algorithms for Polynomial Matrix Normal Forms, *Journal of Symbolic Computation*, **42**(7) (2007) 733-750.
9. B. Beckermann, G. Labahn and G. Villard, Normal Forms for General Polynomial Matrices, *Journal of Symbolic Computation*, **41**(6) (2006) 708-737.

10. 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.
11. 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.
12. 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.
13. 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.
14. 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.
15. B. Beckermann and G. Labahn, Effective Computation of Rational Approximants and Interpolants. *Reliable Computing* **6** (2000) 365-390.
16. B. Beckermann and G. Labahn, When are two numerical polynomials relatively prime? *J. of Symbolic Computation* **26** (1998) 677-689.
17. 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.
18. B. Beckermann and G. Labahn, Recursiveness in Matrix Rational Interpolation Problems, *J. of Computational and Applied Math* **77** (1997) 5-34.
19. 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.
20. 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.

21. 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.
22. 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.
23. 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.
24. 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.
25. G. Labahn and T. Shalom, Inversion of Toeplitz Structured Matrices using only Standard Equations, *Linear Algebra and its Applications* **207** (1994) 49-70.
26. G. Labahn, Inversion Components for Block Hankel-like Matrices, *Linear Algebra and its Applications* **177** (1992) 7-48.
27. 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
28. G. Labahn and T. Shalom, Inversion of Toeplitz Matrices with only Two Standard Equations, *Linear Algebra and its Applications* **175** (1992) 143-158.
29. S. Cabay and G. Labahn, A Superfast Algorithm for Multi-dimensional Padé Approximation, *Numerical Algorithms* **2** (1992) 201-224.
30. 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.
31. G. Labahn, D.K. Choi and S. Cabay, *Inverses of Block Hankel and Block Toeplitz Matrices*, *SIAM J. of Computing* **19** (1990) 98-123.

32. 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.
33. 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, Efficient Computation of Order Bases, *Proceedings of ISSAC'09*, Seoul, Korea, ACM Press, (2009) 375-382.
2. B. Beckermann and G. Labahn, Fraction-Free Computation of Simultaneous Padé Approximants, *Proceedings of ISSAC'09*, Seoul, Korea, ACM Press, (2009) 15-22.
3. S. MacLean, D. Tausky, G. Labahn, E. Lank and M. Marzouk, Tools for the efficient generation of hand-drawn corpora based on context-free grammars, *Proceedings of the Eurographics Symposium on Sketch-Based Interfaces and Modeling (SBIM 2009)*. (2009) 125-132
4. H. Cheng and G. Labahn, On Computing Polynomial GCDs in Alternate Bases, *Proceedings of ISSAC'06*, Genoa, Italy, ACM Press, (2006).
5. M. Giesbrecht, G. Labahn and W-s Lee, Symbolic-numeric Sparse Interpolation of Multivariate Polynomials, *Proceedings of ISSAC'06*, Genoa, Italy, ACM Press, (2006).
6. 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)
7. 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.
8. 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.

9. 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.
10. 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.
11. H. Cheng and G. Labahn, Computing all Factorizations in  $Z_N[x]$ , *Proceedings of ISSAC'01*, London, Canada, ACM Press, (2001) 64-71.
12. B. Beckermann, G. Labahn and G. Villard, Shifted Normal Forms of Polynomial Matrices, *Proceedings of ISSAC'99*, Vancouver, ACM Press, (1999) 189-196.
13. B. Beckermann, S. Cabay and G. Labahn, Fraction-free Computation of Matrix Padé Systems, *Proceedings of ISSAC'97*, Maui, ACM Press, (1997) 125-132.
14. 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.
15. W. Heidrich, R. Bartels and G. Labahn, Fitting Uncertain Data with NURBS, *Proceedings of Curves and Surfaces*, Chamonix, France, (1997)
16. 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.
17. 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.
18. K.O. Geddes and G. Labahn, The Maple Computer Algebra System, *Proceedings of the First Asian Technology Conference in Mathematics*, Singapore, (1995) 367-376.
19. 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.

20. 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.
21. 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.
22. 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.

#### Papers in Refereed Workshop Proceedings

1. G. Labahn, E. Lank, S. MacLean, M. Marzouk and D. Tausky, MathBrush: A System for Doing Math on Pen-Based Devices, Proc. of The Eighth IAPR Workshop on Document Analysis Systems DAS 2008, September 16-19, Nara, Japan (2008) 599-606.
2. 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 Workshop on Sketch-Based Interfaces and Modelling (SBIM 2008). (2008)
3. D. Tausky, G. Labahn, E. Lank and M. Marzouk, Managing Ambiguity in Mathematical Matrices, Proc. of the 4th Eurographics Workshop on Sketch-Based Interfaces and Modelling (SBIM 2007). (2007) 115-122.
4. 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.
5. G. Labahn and T. Humphries, Symbolic Integration of Jacobian Elliptic Functions in Maple, Proc. of Maple Conference 2005, (2005) 331-339

#### 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.

## Other Publications

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.

## Book Reports

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

## Software

1. Symbolic integration of Erf, Si, Ci and Fresnel Functions (2008)
2. Symbolic integration of Elliptic Functions (2004)
3. Solving linear odes having doubly-periodic coefficients (2002-2004)
4. The MatrixPolynomialAlgebra package (2002)
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. Matrix similarity in Maple (1994)
15. Frobenius and Jordan Normal Forms in Maple (1992-1995)
16. Indefinite Integration of Bessel Functions in Maple (1993)
17. Extensions of Risch Algorithm for functions defined by integrals in Maple (1992)
18. Implementation of bivariate modular gcd algorithm in Maple (1991)
19. Computation of the Matrix Exponential in Maple (1989)

Current PhD students

- R. Jason Peasgood - 2010 to present
- Scott MacLean - 2009 to present
- Daniel Ivan - 2006 to present
- David Tausky - 2004 to present
- Wei Zhou - 2002 to present
- Reinhold Burger - 2001 to present

Current MMath students

- C. Morley - 2008 to present
- D. Saraph - 2009 to present
- D. Fagnan - 2009 to present

Previous students (23)

Research Funding (last 8 years)

NSERC Individual Operating Grant	2010-2014	\$51,000/yr
NSERC Individual Operating Grant	2006-2010	\$49,000/yr
NSERC Individual Operating Grant	2001-2005	\$46,000/yr

NSERC SYNERGY Award University/Industry award (with K.O. Geddes, M. Giesbrecht, A. Storjohann, S. Watt, R. Corless, D. Jeffrey, M. Monagan)	Oct 04	\$25,000
NSERC Equipment Grant Equipment for Symbolic Computation Lab (with K.O. Geddes, M. Giesbrecht and A. Storjohann)	Apr 04-Mar 05	\$23,600
NSERC/Scotiabank Industrial Chair (with D. Berry and K. Czarnecki)	2008-2012	\$491,885/yr
MITACS Grant Mathematics of Computer Algebra and Analysis (with M. Monagan and 12 others)	Apr 09-Mar 11	\$227,000/yr
MITACS Grant Mathematics of Computer Algebra and Analysis (with M. Monagan and 12 others)	Apr 07-Mar 09	\$254,000/yr
MITACS Grant Mathematics of Computer Algebra and Analysis (with M. Monagan and 12 others)	Apr 05-Mar 07	\$254,000/yr
MITACS Grant Mathematics of Computer Algebra and Analysis (with M. Monagan and 12 others)	Apr 03-Mar 05	\$252,000/yr
Tata Consulting Services, India Portfoilo Optimization with Liquidity Risk (with Peter Forsyth)	2008	\$25,000
MICROSOFT INDUSTRIAL Grant Pen-based Mathematics for PC Tablets (with S. Watt and M. Giesbrecht)	Apr 04-Mar 07	\$252,000/yr