Curriculum Vitae
Sébastien Loisel

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Education
Ph.D. Mathematics, McGill University, 2005.
M.Sc. Mathematics, McGill University, 2001, Dean's Honour List.
B.Sc. Mathematics & Computer Science (Honours,) McGill University, 1997.

Work Experience

Lecturer, Heriot-Watt University (August 2010 to present)
I am a lecturer at Heriot-Watt University. My research interests are numerical analysis and functional analysis.

Maître Assistant, Université de Genève (September 2009-July 2010)
I taught numerical analysis. My research focused on domain decomposition.

Postdoctoral Fellow, McGill University (June & July 2009)
I completed a short postdoc with Yoshio Takane at McGill University. We worked on low rank approximations in statistics.

Assistant Professor (Research), Temple University (2006-2009)
My current research is on domain decomposition methods and we are investigating certain algebraic and analytic formulations of additive and multiplicative Schwarz preconditioners with Robin boundary conditions.

Postdoctoral fellow, University of Geneva (2005-2006)
After I completed my Ph.D. (my last year was at the University of Geneva), I did a one-year postdoc with Martin Gander, also in Geneva.

McGill University (1998-2005)
Teaching and research assistant.

Amazon.com (summer 2003)
I worked on the "Available to Promise" (A.T.P.) problem. Given an order (say, a client purchases Harry Potter and Joy of Sets on the web site) one needs to assign each item to a warehouse and ship it such that delivery dates and other constraints are satisfied while the cost to amazon.com (which includes shipping, variable per-factory costs and some other intangible costs) are minimized. This is a combinatorial optimization problem, we cast it as the set partitioning problem, which is NP-complete.

Freelance web development (2002-2003).
I developed a web application for real estate companies. We sold this application to several

branches of the Exit Realty real estate company. The purpose was to list available houses to potential customers and allow them to request details, make offers and so on. The application also included an administrative web interface for managing the realty database and changing the web sites' appearances.

NVidia Corporation (2000 and 2001)
Graphics chip development and testing.

Sun Microsystems (summer 1999)
MPEG 4 Systems layer implementation.

SGI (summers 1996, 1997, 1998)
Bug hunting, driver programming, build master, OpenGL stream capture and replay.

Hôtel-Dieu de Lévis (summers 1993 and 1994)
A pair of business applications written in C++ for 286 computers and DOS.

Outstanding Achievements

SIAM 100 digit challenge, first in the world
In 2002, I was part of the McGill team who solved the Society for Industrial and Applied Mathematics 100 digit challenge. We finished first. The goal was to find the solutions to 10 problems in numerical computing, including optimization problems. We provided 10 digits or more for each question, yielding a perfect score.

ACM Computer Programming Championship
17th in the world, February 17th 1998.
1st in regional finals, November 1st 1997.
1st in regional preliminaries, October 1997.

Mathematics
In 1994, I ranked third in the province of Québec at the AMQ mathematics competition.

Scholarship
My Ph.D. was financed by the Canadian Foundation for Climate & Atmospheric Sciences (CFCAS.)

Peer-Reviewed Publications

[17] S. W. Drury and S. Loisel, Sharp condition number estimates for the symmetric 2-Lagrange multiplier method. Submitted (8 pages). Preprint available on request.

[16] S. Loisel, Condition number estimates and weak scaling for 2-level 2-Lagrange multiplier methods for general domains and cross points. Submitted (17 pages). Preprint available on request.

[15] S. Loisel, Condition number estimates for the nonoverlapping optimized Schwarz method and the 2-Lagrange multiplier method for general domains and cross points. Submitted. preprint available online.

[14] M. J. Gander, S. Loisel and D. B. Szyld, An optimal block iterative method and preconditioner for banded matrices with applications to PDEs on irregular domain. Submitted.

[13] S. Loisel and Y. Takane, Minimum Polynomial Extrapolation in MATLAB and in R. Submitted (3 pages). Preprint available on request.

[12] S. Loisel and Y. Takane, Generalized GIPSCAL Re-revisited: A fast convergent algorithm with acceleration by the minimum polynomial extrapolation. Advances in data analysis and classifications 5 pp. 57--75 (2011) DOI: 10.1007/s11634-010-0083-2.

[11] O. Dubois, S. Loisel, A. St-Cyr, and D. B. Szyld, The Optimized Schwarz Method with a Coarse Grid Correction. Submitted.

[10] S. Loisel, J. Côté, M. J. Gander, L. Laayouni, A. Qaddouri, Optimized Domain Decomposition Methods for the Spherical Laplacian. In SINUM 48, pp. 524--551 (2010).

[9] S. Loisel and D. B. Szyld, On the convergence of Algebraic Optimizable Schwarz Methods with applications to elliptic problems. Numerische Mathematik 4 pp. 697--728 (2009).

[8] S. Loisel, M. Takane, Fast Robust Generalized Method of Moments. Computational Statistics and Data Analysis 53 (2009), 3571--3579.

[7] S. Loisel and D. B. Szyld, On the convergence of Optimizable Schwarz Methods by way of Matrix Analysis. In Bercovier, M., Gander, M., Kornhuber, R., Widlund, O., Domain Decomposition Methods in Science and Engineering XVIII (2009), 363--370.

[6] S. Loisel and D. B. Szyld, A maximum principle for trace norms with an application to Optimizable Schwarz Methods. In Bercovier, M., Gander, M., Kornhuber, R., Widlund, O., Domain Decomposition Methods in Science and Engineering XVIII (2009), 193--200.

[5] S. Loisel, R. Nabben, D. B. Szyld, On Hybrid Multigrid-Schwarz algorithms. In Journal of Scientific Computing 36 pp. 165--176 (2008).

[4] A. Qaddouri, L. Laayouni, S. Loisel, J. Côté, M. J. Gander, Optimized Schwarz methods with an overset grid for the shallow-water equations: preliminary results. Applied Numerical Mathematics, Volume 58, Issue 4, April 2008, Pages 459--471.

[3] N. Bartholdi, J. Blanc, S. Loisel, Line and pseudo-line arrangements with maximal number of triangles. In Discrete and Computational Geometry - Twenty Years Later. 2007.

[2] S. Loisel, Optimal and optimized domain decomposition methods on the sphere. In Olof B. Widlund and David E. Keyes (editors), Domain Decomposition Methods in Science and Engineering XVI, Lecture Notes in Computational Science and Engineering, vol. 55, Springer, 2006, pp. 197-204.

[1] J. Côté, M. J. Gander, L. Laayouni, and S. Loisel, Comparison of the Dirichlet-Neumann and Optimal Schwarz Method on the Sphere. In R. Kornhuber, R. Hoppe, J. Priaux, O. Pironneau, O. B. Widlund, and J. Xu (editors), Domain Decomposition Methods in Science and Engineering,

Lecture Notes in Computational Science and Engineering, vol. 40, Springer, 2004, pp. 235-242.

Other publications

O1. S. Loisel, Optimal and optimized domain decomposition methods on the sphere. Ph.D. thesis, McGill university, 2005.

O2. S. Loisel, *Improving the performance of ATP,* 2003. Internal publication at Amazon.com. In this paper, I solved a variant of the NP-complete problem of set partitioning. Given an order, the task was to assign each item in the order to a warehouse, such that some constraints are satisfied and the cost to Amazon.com is minimized. The improvement on the algorithm they had previously been using will save the company two to four million dollars a year. Due to trade secrets, this paper can not be circulated outside of Amazon.com.

O3. S. Loisel, Polarization constants for symmetric multilinear forms. Master's thesis, McGill University, 2001. The thesis was awarded the Dean's Honour List.

O4. S. Loisel, Zed3D: a compact reference for 3d computer graphics programming. This document was published several times on compact discs about 3d programming, and was used by Professor Donald Anderson of UCSD for class notes in his graphics programming class.

Presentations

P1. S. Loisel, Graph Drawing and Related Topics. McGill University talk to the Society of Undergraduate Mathematics Students, 1998.

P2. S. Loisel, The Peter-Weyl Theorem and Harmonic Analysis. Institut de Sciences Mathématiques (ISM) student talk, McGill University, February 1999.

P3. Weekly reading seminars: "Domain Decomposition Methods for Partial Differential Equations" by Quarteroni and Valli (Oxford University Press, 1999). Weekly seminars at McGill University during the academic year 2002-2003.

P4. S. Loisel, *Improving the performance of ATP,* 2003. Internal talk at Amazon.com.

P5. S. Loisel, Optimal and optimized domain decomposition methods on the sphere. Poster, McGill University, 2003.

P6. S. Loisel, Optimal domain decomposition methods on the sphere. McGill University talk to the Society of Undergraduate Mathematics Students, 2004.

P7. S. Loisel, Optimal domain decomposition methods on the sphere. University of Washington, Seattle. Numerical Analysis Reading Club, January 2004.

P8. S. Loisel, Optimal and optimized domain decomposition methods on the sphere. University of Geneva Numerical Analysis Seminar, December 2004.

P9. S. Loisel, Optimal and optimized domain decomposition methods on the sphere. Google, Mountain View, California, February 2005.

P10. S. Loisel, Optimal and optimized domain decomposition methods on the sphere. 16th International Conference on Domain Decomposition Methods, January 2005.

P11. S. Loisel, Optimal and optimized domain decomposition methods on the sphere. Yahoo Research, Pasadena, California, February 2005.

P12. N. Bartholdi, J. Blanc, S. Loisel, Line and pseudo-line arrangements with maximal number of triangles. University of Geneva Numerical Analysis Seminar, December 2005.

P13. University of Geneva Stochastic Differential Equations Seminar (organizer, 2006).

P14. S. Loisel, *L'espérence de la solution d'une équation différentielle stochastique par cubature*. (The expectation of a stochastic differential equation using cubature rules.) University of Geneva Numerical Analysis Seminar and University of Geneva Stochastic Differential Equations Seminar, May 2006.

P15. N. Bartholdi, J. Blanc, S. Loisel, Line and pseudo-line arrangements with maximal number of triangles. Temple University Discrete Geometry Seminar, October 2006.

P16. S. Loisel, A domain decomposition method that converges in two steps for three subdomains, Ninth Copper Mountain Conference on Iterative Methods, April 2006.

P17. S. Loisel, Optimized Domain Decomposition Methods, I. Applied Mathematics and Scientific Computing Seminar at Temple University, 25 October 2006.

P18. S. Loisel, Optimized Domain Decomposition Methods, II. Applied Mathematics and Scientific Computing Seminar at Temple University, 1 November 2006.

P19. S. Loisel, Optimized Schwarz Methods for the Spherical Laplacian with Corners. International Council for Industrial and Applied Mathematics (ICIAM) conference, July 2007, Zürich, Switzerland.

P20. S. Loisel, D. B. Szyld, On the convergence of Algebraic Optimizable Schwarz Methods with applications to elliptic problems. 18th International Conference on Domain Decomposition Methods, January 2008, Jerusalem, Israel.

P21. O. Dubois, S. Loisel, A. St-Cyr, and D. B. Szyld, The Optimized Schwarz Method with a Coarse Grid Correction. Poster session at Fast Algorithms for Scientific Computing A Symposium in Honor of Olof B. Widlund on the Occasion of His 70th Birthday, September 2008, New York City, USA.

P22. O. Dubois, S. Loisel, A. St-Cyr, and D. B. Szyld, The Optimized Schwarz Method with a Coarse Grid Correction. Poster session at the Applied Mathematics Principal Investigators Meeting (by invitation only), October 2008, Argonne, USA.

P23. S. Loisel, Optimized Schwarz Methods. Numerical analysis seminar, University of Geneva, Switzerland, September 2009.

P24. S. Loisel, Optimized Schwarz Methods. Interview talk at Heriot-Watt University, Scotland, September 2009.

P25. S. Loisel, Optimized Schwarz Methods. Interview talk at University of Uppsala, Sweden, September 2009.

P26. S. Loisel, Condition number estimates for the nonoverlapping optimized Schwarz method and the 2-Lagrange multiplier method for general domains and cross points. Swiss Numerics Colloquium, April 2010.

P27. S. Loisel, Condition number estimates for the nonoverlapping optimized Schwarz method and the 2-Lagrange multiplier method for general domains and cross points. Colloque d'analyse numérique, École Polytechnique Fédérale de Lausanne, April 2010.

P28. S. Loisel, Coarse grid correction, Canadian Applied and Industrial Mathematics Symposium, July 2010.

P29. S. Loisel, All for one: Harnessing the power of a million computers, Heriot-Watt University Colloquium, October 2010.

P30. S. Loisel, Optimized domain decomposition methods that scale weakly, Oxford University, January 2011.

P31. S. Loisel, Absorbing boundary conditions for the micro element problems in the heterogeneous multiscale method, Variational Multiscale Methods, Strathclyde, June 2011.

P32. S. Loisel, Sharp performance estimates for optimized domain decomposition preconditioners, 24th biennial conference on numerical analysis, Strathclyde, June 2011.

Teaching Experience

Lecturer, Heriot-Watt University (2011-present)
Numerical Analysis B (Spring 2011). Approximation and Interpolation: 1 and 2D polynomial interpolation. Direct algorithms for the solution of linear systems: Gaussian elimination, LU, LLT and LDLT decomposition. Operation counts for these algorithms. Iterative algorithms for the solution of linear systems: Jacobi, Gauss-Seidel, SOR. Convergence analysis and operation counts. Iterative algorithms for eigenvalue problems: Power, inverse power and shifted inverse power methods. Convergence analysis and operation counts.

Maître Assistant, Université de Genève (2009-2010):
Analyse numérique (2009-2010). A full year-course. Floating point arithmetic, linear algebra, Gaussian elimination, LU decomposition, eigenvalues, QR decomposition, SVD, interpolation, integration, Runge-Kutta methods, multistep methods, order conditions, fast Fourier transform, splines, the Banach fixed point theorem, implementation in MATLAB and in MAPLE.

Research Assistant Professor, Temple University (2006-2009):
Numerical Partial Differential Equations (Spring 2009). Calculus of variation, existence and uniqueness of solutions, Dirichlet integral, the Galerkin method, Finite Elements, spectral elements, boundary elements, polynomial approximation in Sobolev spaces, Runge-Kutta methods, stability, finite difference methods, upwinding, the CFL condition, preconditioners,

additive Schwarz, multigrid, and implementation in MATLAB.
Calculus I (Fall 2008).
Probability and Statistics (Spring 2008).
Topics in Applied Mathematics: the Mathematics of Computer Graphics (Fall 2007). Fourier transforms, Hilbert spaces, splines, the rendering equation, Monte Carlo raytracing, radiosity, wavelet transforms, kinematics, differential-algebraic equations, geometric integration, control problems.
Topics in Numerical Analysis: the Finite Element Method (Spring 2007). Sobolev spaces, variational formulation, existence and uniqueness of solutions, trace theorems, elliptic regularity, Galerkin formulation and Céa's lemma, Bramble-Hilbert Lemma, piecewise polynomial basis functions, Schwarz iteration, multigrid.
Calculus II (Fall 2006).

Teaching Assistant, University of Geneva (2005-2006):
Introduction to computer science (*Introduction à l'informatique*) : a C++ course.
Selected topics in complex analysis (*Chapitre choisis d'analyse complexe*) : a senior year complex analysis course.
Real Analysis 3 (*Analyse Réelle 3*) : Lebesgue integration and elementary functional analysis. I only did the summer semester, which begins in March and ends in June.

Teaching Assistant, University of Geneva (2004-2005):
Real Analysis 2 (*Analyse Réelle 2*) : metric spaces, differential forms, ordinary differential equations.
Numerical Analysis (*Analyse Numérique*) : a full-year junior level course in Fortran that covers basic numerical analysis: Newton's iteration, splines, Runge-Kutta methods and some matrix algorithms.

Teaching Assistant, McGill University (2001-2002):
Calculus I
Analysis I: the first semester of real analysis. Numbers, limits, continuity.

Teaching Assistant, McGill University (2000-2001):
Calculus I and II.

Teaching Assistant, McGill University (1999-2000):
Calculus I and II

Teaching Assistant, McGill University (1998-1999):
Calculus I and II

Marker, McGill University (1998):
Dynamical Systems, Fractals and Chaos: an optional course on fractals and chaos. We looked at iterated function systems, Julia sets and divergence graphs.

References

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Yoshio Takane, Professor, McGill University. +1.514.398.6125
Daniel B. Szyld, Professor, Temple University. +1.215.204.7288
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