

Wing Hong Felix KWOK

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AFFILIATION

Section de mathématiques, Université de Genève

EDUCATION

2002 – 2007

Ph.D., Scientific Computing/Computational Mathematics
Stanford University

Dissertation: “Scalable Linear and Nonlinear Algorithms for Multiphase Flow in Porous Media”

Advisor: Prof. Hamdi Tchelepi

Relevant Courses: Numerical Linear Algebra, Eigenvalue Computation, Applied PDEs (full-year), Numerical PDEs (full-year), Finite Element Analysis (full-year), Parallel Methods in Numerical Analysis, Reservoir Simulation

2000 – 2002

B.Sc., Joint Honours in Mathematics and Computer Science
McGill University

First Class Honours, Dean’s Honour List

1998 – 2002

B.Eng., Computer Engineering
McGill University

Great Distinction, Dean’s Honour List

1996 – 1998

Diplôme d’études collégiales, Pure and Applied Sciences
Marianopolis College, Montreal, Quebec

RESEARCH INTERESTS

General

Scientific computing, numerical methods for nonlinear PDEs, numerical linear algebra, parallel computing, large-scale simulation, applications in physics and engineering.

Specific Interests

Efficient solution of large nonlinear systems arising from the discretization of PDEs. Iterative methods for solving the associated sparse linear systems. Parallel computing and domain decomposition: optimized Schwarz methods, algebraic formulations. Preconditioning techniques and multiscale methods. Applications in computational fluid dynamics, reservoir simulation and structural mechanics.

RESEARCH EXPERIENCE

- 2011 – present Researcher (with tenure), Section de mathématiques
Université de Genève, Geneva, Switzerland
Course lecturer and research in numerical analysis and scientific computing, with emphasis in domain decomposition methods.
- 2010 – 2011 Maître Assistant, Section de mathématiques
Université de Genève, Geneva, Switzerland
Course lecturer and research in numerical analysis and scientific computing, with emphasis in domain decomposition methods.
- 2008 – 2010 Postdoctoral Research Assistant, Section de mathématiques
Université de Genève, Geneva, Switzerland
Research in domain decomposition methods, under the supervision of Prof. M. Gander.
- Summer 2004 &
Summer 2005 Research Intern, Department of Mathematical Sciences
IBM T.J. Watson Research Center, Yorktown Heights, NY, USA
Development of general-purpose iterative linear solvers for the Watson Sparse Matrix Package under the supervision of Dr. Anshul Gupta. Installation and testing of HPC packages under the AIX environment.

TEACHING EXPERIENCE

- Autumn 2011
(Full year) Analyse numérique, Université de Genève
Instructor
2nd year undergraduate course, Enrolment: 40 (approx.)
- Autumn 2010
(Full year) Analyse numérique, Université de Genève
Instructor
2nd year undergraduate course, Enrolment: 40 (approx.)
- Winter 2010 Mathématiques pour informaticiens, Université de Genève
Instructor
1st year course for Computer Science students, Enrolment: 20 (approx.)
- Winter 2008–
Autumn 2010 Analyse numérique, Université de Genève
Teaching Assistant (Instructors: Prof. M. J. Gander/Dr. S. Loisel)
2nd year undergraduate course, Enrolment: 40 (approx.)
- Winter 2004 CS137 Introduction to Scientific Computing, Stanford University
Teaching Assistant (Instructor: Prof. G. Golub)
1st year graduate course, Enrolment: 30 (approx.)
- Autumn 2003 CS237A Numerical Linear Algebra, Stanford University
Teaching Assistant (Instructor: Prof. G. Golub)
1st year graduate course, Enrolment: 40 (approx.)

AWARDS AND HONOURS

- 2010 NSERC Postdoctoral Fellowship (awarded CA \$40 000/year, declined)
Government of Canada
- 2004 – 2007 NSERC Postgraduate Scholarship (Doctoral, CA \$21 000/year)
Government of Canada
- 2002 – 2004 FCAR Masters Research Scholarship (CA \$15 000/year)
Government of Quebec (Canada)
- 2002 Canada Governor General's Silver Medal
Awarded to the undergraduate who achieved the highest academic standing upon graduation from a bachelor degree program (two per year at McGill)
- 2002 Charles Michael Morssen Gold Medal for Exceptional Engineering Promise
Faculty of Engineering, McGill University
- 2002 Edward Rosenthal Memorial Prize (CA \$750)
Department of Mathematics, McGill University

PROFESSIONAL ACTIVITIES

- University Service* Webmaster for ddm.org, the official page of Domain Decomposition Methods (2011 – present)
Student Officer, SIAM Stanford Student Chapter (2003 – 2006)
Student Consultant for C^2 Project, ICME, Stanford University (2006)
- Computer Skills* Languages: C/C++, Java, Fortran, Maple, Matlab, HTML, LaTeX
Platforms: Windows, Unix/Linux
- Professional Societies* Society for Industrial and Applied Mathematics
Canadian Applied and Industrial Mathematics Society

PERSONAL INFORMATION

- Citizenship* Canadian
- Languages* English, French, Chinese

REFERENCES

Available upon request.

List of Publications for FELIX KWOK

PUBLICATIONS

Refereed Journal Publications

1. FELIX KWOK and HAMDI TCHELEPI, *Potential-based reduced Newton algorithm for non-linear multiphase flow in porous media*, J. Comput. Phys., 227 (2007), pp. 706–727.
2. FELIX KWOK and HAMDI TCHELEPI, *Convergence of implicit monotone schemes with applications in multiphase flow in porous media*, SIAM J. Numer. Anal., 46 (2008), pp. 2662–2687.
3. FELIX KWOK, *Optimized additive Schwarz with Harmonic Extension as a discretization of continuous parallel Schwarz methods*, SIAM J. Numer. Anal., 49 (2011), pp. 1289–1316.
4. MARTIN J. GANDER and FELIX KWOK, *Chladni figures and the Tacoma bridge: motivating PDE eigenvalue problems via vibrating plates*, accepted for publication in SIAM Review.
5. MARTIN J. GANDER and FELIX KWOK, *Best Robin parameters for optimized Schwarz methods at cross points*, submitted to SIAM Journal on Scientific Computing, June 2011.
6. FELIX KWOK, *Accuracy and Stability of a predictor-corrector Crank-Nicolson method with many subdomains*, submitted to SIAM Journal on Numerical Analysis, February 2012.

Refereed Conference Proceedings

7. MARTIN J. GANDER and FELIX KWOK, *Optimal interface conditions for an arbitrary decomposition into subdomains*. In Domain Decomposition in Science and Engineering XIX, Lecture Notes in Computational Science and Engineering 78, pp. 101–108, Springer-Verlag, 2010.
8. FELIX KWOK, *Is Additive Schwarz with Harmonic Extension just Lions' method in disguise?* In Domain Decomposition in Science and Engineering XIX, Lecture Notes in Computational Science and Engineering 78, pp. 439–446, Springer-Verlag, 2010.
9. MARTIN J. GANDER and FELIX KWOK, *On the applicability of Lions' energy in the analysis of discrete optimized Schwarz methods with cross points*, submitted to the Proceedings of the 20th International Conference on Domain Decomposition Methods, San Diego CA, February 2011.

Miscellaneous

10. FELIX KWOK, *Scalable Linear and Nonlinear Algorithms for Multiphase Flow in Porous Media*, PhD Thesis, Stanford University, Stanford, CA, Dec. 2007.
11. PIERRE DE LA HARPE and FELIX KWOK, *Prix Nobel de chimie, quasi-cristaux, périodicité et pavages*, Images des Mathématiques, CNRS, 2011. (Online article for general public)

Preprints (available upon request)

12. FELIX KWOK and HAMDI TCHELEPI, *A potentially-ordered preconditioner for multicomponent multiphase flow in porous media*.
13. FELIX KWOK, *A note on optimal Robin parameters for two-subdomain problems*.

CONFERENCE POSTERS

14. “A domain decomposition method that converges in two iterations for any subdomain decomposition and PDE”, High Performance Computing and Emerging Architectures, IMA, University of Minnesota, January 2011. (with Martin J. Gander, Contributed)
15. “Optimized Schwarz method for problems with cross points.” Schweizer Numerik Kolloquium, ETH Zürich, April 2010. (Contributed)
16. “Ordering-based approaches for improving solver efficiency in reservoir simulation.” Colloque Numérique Suisse, Université de Fribourg, April 2008. (Contributed)
17. “Combining direct and iterative methods to solve partitioned linear systems.” Bay Area Scientific Computing Day, University of San Francisco, March 2005. (Contributed)

TALKS AT CONFERENCES AND WORKSHOPS

Invited talks

1. “What makes block Jacobi slow, and how low-rank changes can help”, PRECOND 2011, Bordeaux, France, May 2011.
2. “Potential ordering methods for nonlinear solution of three-phase flow in porous media”, Conference on Challenges of Porous Media, Kaiserslautern, Germany, March 2009.

Minisymposium talks

3. “Accuracy and stability of a predictor-corrector Crank-Nicolson method with many subdomains”, International Conference on Scientific Computation and Differential Equations (SciCADE), Toronto, Canada, July 2011.
4. “Optimized Schwarz methods for problems with cross points.” MS19 (Schwarz Methods: Analysis and Applications), 20th International Conference on Domain Decomposition Methods, San Diego, California, USA, February 2011.
5. “Algebraic vs. continuous formulations of domain decomposition methods.” MS-DD (Parallelizing your differential equation solver: a tutorial introduction to domain decomposition methods), 31st Annual Meeting of the Canadian Applied and Industrial Mathematics Society, St. John’s, NL, July 2010.
6. “Optimal interface conditions for an arbitrary decomposition into subdomains.” MS1 (Continuous and Discrete Optimized Schwarz Methods), 19th International Conference on Domain Decomposition Methods, Zhangjiajie, China, August 2009.
7. “Ordering-based approaches for improving solver efficiency in reservoir simulation.” MS18 (Computational Methods for Transport in Porous Media), SIAM Annual Meeting, San Diego, CA, July 2008.
8. “Multistage preconditioning for coupled unstructured reservoir models and multisegment wells.” MS111 (Iterative Solvers for Subsurface Simulations), SIAM Annual Meeting, San Diego, CA, July 2008.
9. “Combining direct and iterative methods to solve partitioned linear systems.” MS 29 (Hybrid Direct/Iterative Techniques for the Solution of Large Linear Systems), SIAM Conference on Parallel Processing, San Francisco, CA, February 2004.

Contributed talks

10. “Chladni Figures and the Tacoma Bridge: Motivating PDE Eigenvalue Problems via Vibrating Plates”, Swiss Numerics Colloquium, Lugano, Switzerland, May 2011.
11. “Potential ordering methods for nonlinear solution of three-phase flow in porous media”, International Conference on Nonlinearities and Upscaling in Porous Media, Stuttgart, Germany, October 2009.
12. “Is the additive Schwarz method with Harmonic Extension just Parallel Schwarz in disguise?” 19th International Conference on Domain Decomposition Methods, Zhangjiajie, China, August 2009.
13. “An algebraic optimized Schwarz method that converges in finitely many steps.” Schweizer Numerik Kolloquium, Basel, Switzerland, April 2009.
14. “An algebraic optimized Schwarz method that converges in finitely many steps.” OPTPDE 2008, Warsaw, Poland, December 2008.
15. “Potential-based reduced Newton method for nonlinear multiphase flow in porous media.” American Physical Society Annual March Meeting, Denver, CO, March 2007.
16. “Combining direct and iterative methods to solve partitioned linear systems.” Workshop on Model Reduction Problems and Matrix Methods, PIMS, Banff, Alta., April 2004.

TALKS AT UNIVERSITIES AND RESEARCH INSTITUTIONS

17. Mathematical Colloquium, Universität Bern, April 2011.
18. Numerical Analysis Seminar, École Polytechnique Fédérale de Lausanne, September 2010.
19. Séminaire d’analyse appliquée, Université Paris XIII, April 2010.
20. CRM/McGill Applied Mathematics Seminar, McGill University, January 2010.
21. Seminar on Numerical Methods, Laboratoire J.-L. Lions, Université Paris VI, June 2009.
22. Séminaire EDP et Analyse Numérique, Université Laboratoire J. A. Dieudonné, Université Nice Sophia–Antipolis, December 2008.
23. Séminaire d’analyse appliquée, Université Paris XIII, November 2008.
24. Séminaire d’analyse numérique, Université de Genève, October 2008.
25. Seminar für Analysis und Numerik, Universität Basel, September 2008.
26. Séminaire d’analyse numérique, Université de Genève, February 2008.
27. CRM/McGill Applied Mathematics Seminar, McGill University, January 2008.
28. Department of Mathematical Sciences, IBM T.J. Watson Research Center, Yorktown Heights, NY, January 2008.
29. 24th SUPRI-B Reservoir Simulation Industrial Affiliates Meeting, Stanford University, May 2007.

30. 23rd SUPRI-B Reservoir Simulation Industrial Affiliates Meeting, Stanford University, May 2006.
31. 22nd SUPRI-B Reservoir Simulation Industrial Affiliates Meeting, Stanford University, May 2005.
32. Department of Mathematical Sciences, IBM T.J. Watson Research Center, Yorktown Heights, NY, September 2005.
33. Scientific Computing/Computational Math Seminar, Stanford University, April 2004.