Curriculum Vitae

Scott MacLachlan

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Education:

2000 - 2004: Ph.D. Applied Mathematics, University of Colorado at Boulder
Thesis title: *Improving robustness in multiscale methods*
Advisor: Prof. Stephen F. McCormick
Chancellor's Fellowship holder, 2000-2002
Exam Areas: Applied Analysis, Numerical Analysis, and Partial Differential Equations

1996 - 2000: B.S. (Hon) Computer Science and Mathematics, University of British Columbia
Awarded Governor General's Silver Medal in Science, Harry Logan Memorial Scholarship
Named Wesbrook Scholar in 1999 & 2000, and Science Scholar in 1998, 1999, & 2000
Ranked first in UBC Faculty of Science class of May 2000, with 94.4% overall average

Research Experience:

Fall 2007 - Present:	Assistant Professor, Department of Mathematics, Tufts University. On leave, September - December, 2007.
Fall 2006 - Present:	EC-Fellow, Delft Institute of Applied Mathematics, Technical University of Delft, Advisor: Cornelis W. Oosterlee
January 2007 - Present:	Scientific Staff Member, Scientific Computing and Control Theory, Centrum voor Wiskunde en Informatica, Amsterdam
Fall 2005 - Summer 2006:	Postdoctoral Associate, Computer Science and Engineering, University of Minnesota, Advisor: Yousef Saad
Fall 2004 - Summer 2005:	Research Associate, Applied Mathematics, University of Colorado at Boulder, Advisors: Stephen F. McCormick and Thomas A. Manteuffel
Fall 2002 - Summer 2004:	Research Assistant, Applied Mathematics, University of Colorado at Boulder, Advisors: Stephen F. McCormick and Thomas A. Manteuffel
Summer 2001, 2002, 2003:	Graduate Research Assistant, Mathematical Modeling and Analysis, Los Alamos National Laboratory, Advisor: J. David Moulton
Summer 2000:	Research Assistant, Computer Science, University of British Columbia, Advisor: James Varah
Summer 1999:	Research Assistant, Mathematics, University of British Columbia, Advisors: Richard Froese and Anthony Peirce

Research Funding:

Fall 2006 - Summer 2008:	Marie Curie International Incoming Fellowship, European Community Funding of €151,521.94 for project: "Novel algebraic multigrid solver for real-life industrial applications"

Research Interests:

Field of study: Scientific computation and computational applied mathematics, with an emphasis on multiscale numerical analysis and efficient numerical techniques for the solution of partial differential equations.

Ongoing Research:

Advanced multigrid solvers for heterogeneous hyperbolic models
Algebraic multigrid techniques for lattice quantum chromodynamics
Multiscale model-order reduction, with application to flows in porous media
Theory for multigrid methods and its practical implications

Future Directions: Scientific and engineering applications continue to motivate improved approaches and algorithms to enable relevant simulations. My focus will be on development, analysis, and application of advanced multigrid and multiscale algorithms to enable these simulations to answer both practical and fundamental questions about the world around us.

Publications:

1. *Computing continuous velocity fields in heterogeneous porous media*, E.T. Coon, S.P. MacLachlan, and J.D. Moulton, in preparation, 2007.
2. *Practical aspects of theoretical bounds for algebraic multigrid performance*, S. MacLachlan and L. Olson, in preparation, 2007.
3. *General strategies for modification of threshold-based incomplete factorizations*, S. MacLachlan and Y. Saad, in preparation, 2007.
4. *Algebraic multigrid solvers for complex-valued matrices*, S.P. MacLachlan and C.W. Oosterlee, SIAM J. Sci. Comp., to appear, 2007. Also available as Delft Institute for Applied Mathematics Report 07-08, Delft University of Technology, ISSN 1389-6520, 2007.
5. *Greedy coarsening strategies for non-symmetric problems*, S. MacLachlan and Y. Saad, SIAM J. Sci. Comp., 29:2115-2143, 2007. Also available as University of Minnesota Supercomputing Institute Research Report UMSI 2006/58.
6. *A greedy strategy for coarse-grid selection*, S. MacLachlan and Y. Saad, SIAM J. Sci. Comp., 29:1825-1853, 2007. Also available as University of Minnesota Supercomputing Institute Research Report UMSI 2006/17.
7. *Adaptive smoothed aggregation in Lattice QCD*, J. Brannick, M. Brezina, D. Keyes, O. Livne, I. Livshits, S. MacLachlan, T. Manteuffel, S. McCormick, J. Ruge, and L. Zikatanov, pages 505-512 in Domain Decomposition Methods in Science and Engineering XVI, Lecture Notes in Computational Science and Engineering, Springer, 2007.
8. *Adaptive reduction-based AMG*, S. MacLachlan, T. Manteuffel, and S. McCormick, Numerical Linear Algebra with Applications, 13:599-620, 2006.
9. *An energy-based AMG coarsening strategy*, J. Brannick, M. Brezina, S. MacLachlan, T. Manteuffel, S. McCormick, and J. Ruge, Numerical Linear Algebra with Applications, 13:133-148, 2006.
10. *Multilevel upscaling through variational coarsening*, S.P. MacLachlan and J.D. Moulton, Water Resources Research, 42, 2006.
11. *Adaptive algebraic multigrid*, M. Brezina, R. Falgout, S. MacLachlan, T. Manteuffel, S. McCormick, and J. Ruge, SIAM J. Sci. Comp., 27:1261-1286, 2006.
12. *Adaptive smoothed aggregation multigrid*, M. Brezina, R. Falgout, S. MacLachlan, T. Manteuffel, S. McCormick, and J. Ruge, SIAM Review, 47:317-346, 2005.
13. *Improving robustness in multiscale methods*, S. MacLachlan, PhD Thesis, July 2004.
14. *Adaptive smoothed aggregation (αSA)*, M. Brezina, R. Falgout, S. MacLachlan, T. Manteuffel, S. McCormick, and J. Ruge, SIAM J. Sci. Comp., 25:1896-1920, 2004.

Selected Presentations:

September 6, 2007: Scientific Computing Group Seminar, University of Wuppertal
July 20, 2007: 6th International Congress on Industrial and Applied Mathematics
May 23, 2007: *Algebraic multigrid preconditioners for complex-valued matrices*
Minisymposium on Numerical Linear Algebra and Applications, CAIMS*SCMAI 2007, Banff, AB
May 16, 2007: Los Alamos National Laboratory SWG invited talk, Los Alamos, NM
April 26, 2007: *Multigrid solvers for quantum dynamics - a first look*
Computational Mathematics & Applications Seminar, Rutherford Appleton Laboratory, UK
March 22, 2007: Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO, USA
June 21, 2006: *Adaptive multigrid methods for heterogeneous problems*
DCSE Seminar, Technical University of Delft, the Netherlands
June 16, 2006: Sparse Days at CERFACS, Toulouse, France
April 24, 2006: *A Variational Approach to Upscaling Heterogeneous Media*
Math Seminar, Boise State University, Boise, ID
April 4, 2006: Copper Mountain Conference on Iterative Methods, Copper Mountain, CO
February 20, 2006: CSE/CS/Applied Math Seminar, Department of Computer Science, University of Illinois at Urbana-Champaign, Urbana, IL
May 5, 2005: Organizer and lecture, *Adaptive AMG*
Minisymposium on Recent Advances in Multilevel Methods, Seventh IMACS International Symposium on Iterative Methods in Scientific Computing, Toronto, ON
April 5, 2005: Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO
February 15, 2005: SIAM Conference on Computational Science and Engineering, Orlando, FL
September 22, 2004: Invited Lecture, *Creating Coarse-Scale models with Robust Multigrid Methods*
Third DOE Workshop on Multiscale Mathematics, Portland, OR
March 31, 2004: Copper Mountain Conference on Iterative Methods, Copper Mountain, CO
August 6, 2003: Invited Lecture, *Solving PDEs with Multigrid Methods*
PIMS Workshop on Numerical Linear Algebra and Applications, Vancouver, BC
June 20, 2003: SIAM Annual Meeting, Montreal, QC
April 24, 2003: SCV Seminar, University of British Columbia, Vancouver, BC
April 2, 2003: *Adapting Algebraic Multigrid*
Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO; Winner of Student Paper Competition
March 19, 2003: SIAM Conference on Mathematical and Computational Issues in the Geosciences, Austin, TX
March 28, 2002: Copper Mountain Conference on Iterative Methods, Copper Mountain, CO

Teaching Experience:

Spring 2007: Instructor for *Computational Science and Engineering*, Delft Centre for Computational Science and Engineering, TU Delft

- Masters-level course; lectured for 3 weeks on interative methods

Spring 2007: Guest lecturer for *Advanced Numerical Techniques for Fluid Flow and Structural Engineering* Faculty of Aerospace Engineering, TU Delft

- Masters-level course; two lectures on multigrid methods for structural dynamics

Spring 2005: Instructor for *Topics in Applied Mathematics: Multigrid Methods*, Applied Mathematics, University of Colorado at Boulder

- Advanced graduate level course introducing multigrid methodology

Fall 2002-Spring 2003: Lead Teaching Assistant, Applied Mathematics, University of Colorado at Boulder

- Responsible for coordination and training of departmental TAs

Fall 2002: Instructor for *Teaching and Learning Seminar*, Applied Mathematics, University of Colorado at Boulder

- Required graduate seminar on teaching techniques for first year TAs

Fall 2002: Instructor for *Calculus 1 Workgroup*, Applied Mathematics, University of Colorado at Boulder

- Optional Freshman course for additional help in first-semester calculus
- Course emphasis on group work and peer teaching

Summer 2001: Instructor for *Calculus 3*, Applied Mathematics, University of Colorado at Boulder

Spring 2000: Instructor for *Calculus 1*, Mathematics, University of British Columbia

Fall 1999: Teaching Assistant for *Intermediate Algorithm Design and Analysis*,Computer Science, University of British Columbia

- Led two weekly tutorials for third-year algorithms and data structures
- Received Department of Computer Science Terrific TA award for performance on student evaluations

Spring 1999: Teaching Assistant for *Calculus 2*, Mathematics, University of British Columbia

Service:

2003 - Present: Journal referee for Numerical Linear Algebra with Applications, SIAM Journal on Scientific Computing, Computer Methods in Applied Mechanics and Engineering, SIAM Journal on Numerical Analysis, Computing in Science & Engineering, Electronic Transactions on Numerical Analysis, Mathematics and Computers in Simulation, SIAM Journal on Matrix Analysis and Applications.

Fall 2003 - Summer 2004: Co-founder and co-president of University of Colorado at Boulder Graduate Chapter of SIAM

Summer 2002 - Spring 2003: Co-president of United Government of Graduate Students, University of Colorado at Boulder

Summer 2001 - Spring 2002: Vice-president of United Government of Graduate Students, University of Colorado at Boulder

Fall 1999 - Spring 2000: Student Senator, University of British Columbia

References:

Prof. Stephen F. McCormick
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