Lucas Charles WILCOX

PERSONAL DATA

PLACE AND DATE OF BIRTH:	Englewood, Colorado, USA — October 28, 1978
HOME ADDRESS:	513 East 46th Street, Austin, Texas 78751, USA
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EDUCATION

MAY 2006 | Doctor of Philosophy in APPLIED MATHEMATICS, **Brown University**, Providence, Rhode Island and Providence Plantations
Thesis: *High-Order Accurate Methods for Solving the Time-Harmonic Maxwell's Equations*
Adviser: Jan S. HESTHAVEN

MAY 2002 | Master of Science in APPLIED MATHEMATICS, **Brown University**, Providence, Rhode Island and Providence Plantations

MAY 2001 | Bachelor of Science in MATHEMATICAL AND COMPUTER SCIENCES, **Colorado School of Mines**, Golden, Colorado
Major: Mathematical and Computer Sciences
Area of Special Interest: Engineering Physics
Graduated with high scholastic honors
Graduated top student in the Mathematical and Computer Sciences Department

MAY 1997 | High school diploma **Columbine High School**, Littleton, Colorado
Graduated as Valedictorian

WORK EXPERIENCE

PRESENT
SEP 2008 | Research Associate at INSTITUTE FOR COMPUTATIONAL ENGINEERING AND SCIENCES, UNIVERSITY OF TEXAS AT AUSTIN, Austin, Texas
Advised by Omar GHATTAS. Topics researched include large scale uncertainty quantification, and scalable algorithms for parallel high performance computing. Developed a adaptive high-order parallel discontinuous Galerkin library. Co-advised several Ph.D. students.

AUG 2008
AUG 2006 | ICES Postdoctoral Fellow at INSTITUTE FOR COMPUTATIONAL ENGINEERING AND SCIENCES, UNIVERSITY OF TEXAS AT AUSTIN, Austin, Texas
Advised by Omar GHATTAS. Organized a weekly reading group studying uncertainty quantification and propagation. Topics researched include large scale uncertainty quantification, and scalable algorithms for parallel high performance computing. Developed an open-source parallel high-order nodal discontinuous Galerkin library being considered for use by Exxon. Co-advised several Ph.D. students.

AUG 2006
MAY 2006 | Postdoctoral Researcher at BROWN UNIVERSITY, Providence, Rhode Island and Providence Plantations

Advised by Jan S. HESTHAVEN. Researched uncertainty propagation via stochastic collocation in full-vectorial Maxwell's discontinuous Galerkin equation solvers.

SEP 2005 – MAY 2005 | Research Assistant at COMPUTER SCIENCE RESEARCH INSTITUTE, SANDIA NATIONAL LABORATORIES, Albuquerque, New Mexico

Advised by S. Scott COLLIS and Bart G. VAN BLOEMEN WAANDERS. Integrated the Trilinos numerical solvers into an existing discontinuous Galerkin framework Sledge++. Added three dimensional support to Sledge++. Studied the use of adjoint based error estimation and *h*- and *p*-refinement in solving partial differential equations numerically.

MAY 2005 – JAN 2005 | Teaching Assistant at DIVISION OF APPLIED MATHEMATICS, BROWN UNIVERSITY, Providence, Rhode Island and Providence Plantations

Lead a weekly recitation section covering topics in a second course in elementary differential equations. Topics covered include systems of differential equations, nonlinear ordinary differential equations and partial differential equations.

DEC 2004 – MAY 2004 | Research Assistant at DIVISION OF APPLIED MATHEMATICS, BROWN UNIVERSITY, Providence, Rhode Island and Providence Plantations

Advised by Jan S. HESTHAVEN and Tim WARBURTON. Helped develop a high-order discontinuous Galerkin framework Sledge++ for solving partial differential equations.

SEP 2004 – MAY 2004 | Research Assistant at COMPUTER SCIENCE RESEARCH INSTITUTE, SANDIA NATIONAL LABORATORIES, Albuquerque, New Mexico

Advised by S. Scott COLLIS and Bart G. VAN BLOEMEN WAANDERS. Studied the use of adjoint based error estimation and *h*- and *p*-refinement in solving partial differential equations numerically.

SEP 2003 – MAY 2003 | Research Assistant at BELL LABORATORIES, LUCENT TECHNOLOGIES, Murray Hill, New Jersey

Advised by Dan FUCHS, Ronen RAPAPORT, and Gang CHEN. Used the multilayer boundary variation method to investigate periodic roughness Bragg reflectors.

MAY 2004 – SEP 2001 | NSF VIGRE Graduate Student at DIVISION OF APPLIED MATHEMATICS, BROWN UNIVERSITY, Providence, Rhode Island and Providence Plantations

Researched Boundary variation methods for multilayer optical gratings. Investigated preconditioning for discontinuous Galerkin methods for the time-harmonic Maxwell's equations.

AUG 2001 – SEP 2000 | Research Assistant at DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES, COLORADO SCHOOL OF MINES, Golden, Colorado

Advised by William NAVIDI and Tracy CAMP. Worked on research in the area of location based routing in mobile ad hoc networks. Added routing functionality to the Berkeley NS2 simulator, which is written in C++/TCL.

AUG 2000 – MAY 2000 | Programmer at QWEST ADVANCED TECHNOLOGIES INC., Boulder, Colorado

Advised by Andy PAI. Programmed in JAVA adding functionality to a large mailbox provisioning system. Designed and implemented a graphical user interface to maintain business rules in a user permission database table.

AUG 1999 – JUN 1999 | Programmer at INTESSERA TECHNOLOGIES GROUP, Denver, Colorado

Scripted 4Test quality assurance automated test scripts.

AUG 1999 – JUN 1999 | Linear Programming Consultant at KN ENERGY, Lakewood, Colorado
Simulated work environment for the Colorado School of Mines field session. Mathematically modeled the North American natural gas market. Included linear programming and scripting in AMPL.

AUG 1998 – MAY 1998 | Programmer at INTESSERA TECHNOLOGIES GROUP, Denver, Colorado
Included Perl scripting and work in Remedy, a help desk management system.

RESEARCH

Topics of Interest

Field of study: Generally classified as scientific computation with an emphasis on the numerical solution of partial differential equations using high-order methods.

Keywords: Discontinuous Galerkin, Spectral Elements, Finite Elements, Finite Volume, Finite Difference, Adaptive Mesh Refinement, Boundary Perturbations, Iterative Methods, Preconditioning, Adjoint Equations, Error Estimation, Inverse Problems, Uncertainty Propagation and Estimation, Large-Scale Parallel Computing, Maxwell's Equations, Electromagnetic Scattering, Mantle Convection, Seismic Waves, Ice Sheets

Synopsis: In the ***past***, wireless ad hoc network routing protocols, and the use of location information with wireless ad hoc networks constituted the focus of undergraduate research. Graduate research began with extending a boundary perturbation method for diffraction optics to handle multiple material layers. This solver was used alongside an analytical method to investigate grating depth effects in grating coupled waveguide sensors. Later ventures included the study of high-order *hp*-adaptive discontinuous Galerkin methods for solving the time-harmonic Maxwell's equations. Adjoint based error estimates were used to drive the adaptation of the computational mesh. ***Current*** avenues of research include developing methods for large-scale uncertainty quantification for inverse problems involving pdes, the development of local time-stepping methods for discontinuous Galerkin methods and the development of parallel adaptive finite element and discontinuous Galerkin frameworks for applications in Earth Sciences. ***Future*** interests include developing and extending scalable high-order accurate methods for geosicence applications. This extension includes integrating uncertainty quantification and propagation into these numerical methods for solving pdes and further algorithmic developments of the numerical solvers themselves.

Ph.D. Thesis

2006 L. C. Wilcox. *High-Order Accurate Methods for Solving the Time-Harmonic Maxwell's Equations*. Ph.D. in Applied Mathematics, Brown University, Division of Applied Mathematics, Brown University, 182 George Street, Providence, RI 02912, 2006.

Journal Articles

2009 C. Burstedde, O. Ghattas, G. Stadler, T. Tu, and L. C. Wilcox. Parallel scalable adjoint-based adaptive solution of variable-viscosity Stokes flow problems. *Computer Methods in Applied Mechanics and Engineering*, 198(21-26):1691–1700, 2009. Advances in Simulation-Based Engineering Sciences - Honoring J. Tinsley Oden.

2007 C. Chauviere, J. S. Hesthaven, and L. C. Wilcox. Efficient computation of RCS from scatterers of uncertain shapes. *IEEE Transactions on Antennas and Propagation*, 55(5):1437–1448, May 2007.

2005 R. Horvath, L. C. Wilcox, H. C. Pedersen, N. Skivesen, J. S. Hesthaven, and P. M. Johansen. Analytical and numerical study on grating depth effects in grating coupled waveguide sensors. *Applied Physics B: Lasers and Optics*, 81:65–73, 2005.

2004 L. C. Wilcox, P. G. Dinesen, and J. S. Hesthaven. Fast and accurate boundary variation method for multilayered diffraction optics. *Journal of the Optical Society of America A*, 21(5):757–769, May 2004.

Conference Proceedings

2009 C. Burstedde, M. Burtscher, O. Ghattas, G. Stadler, T. Tu, and L. C. Wilcox. ALPS: A framework for parallel adaptive PDE solution. In *Journal of Physics: Conference Series*, volume 180, page 012009, 2009.

2008 C. Burstedde, O. Ghattas, M. Gurnis, G. Stadler, E. Tan, T. Tu, L. C. Wilcox, and S. Zhong. Scalable adaptive mantle convection simulation on petascale supercomputers. In *SC '08: Proceedings of the 2008 ACM/IEEE conference on Supercomputing*, pages 1–15, Piscataway, NJ, USA, 2008.

J. S. Hesthaven, T. Warburton, C. Chauviere, and L. Wilcox. High-order discontinuous Galerkin methods for computational electromagnetics and uncertainty quantification. In *Proceedings of 7th International Conference on Scientific Computing in Electrical Engineering (SCEE 2008)*, Hensinki University of Technology, Hensinki, Finland, October 2008.

C. Burstedde, O. Ghattas, G. Stadler, T. Tu, and L. C. Wilcox. Towards adaptive mesh PDE simulations on petascale computers. In *TeraGrid'08*, Las Vegas, NV, 2008.

2007 C. Chauviere, J. S. Hesthaven, L. Lurati, and L. C. Wilcox. DG-FEM for CEM with uncertainty. In *Proceedings of 23rd International Review of Progress in Applied Computational Electromagnetics*, Verona, Italy, March 2007.

J. S. Hesthaven, L. N. Olson, and L. C. Wilcox. Developments in overlapping Schwarz preconditioning of high-order nodal discontinuous Galerkin discretizations. In *Domain decomposition methods in science and engineering XVI*, volume 55 of *Lecture Notes in Computational Science and Engineering*, pages 325–332. Springer, Berlin, 2007.

2002 T. Camp, J. Boleng, and L. Wilcox. Location information services in mobile ad hoc networks. In *Proceedings of the IEEE International Conference on Communications (ICC 2002)*, pages 3318–3324, New York City, NY, 2002.

T. Camp, J. Boleng, B. Williams, L. Wilcox, and W. Navidi. Performance evaluation of two location based routing protocols. In *Proceedings of the IEEE 21st Annual Joint Conference of the IEEE Computer and Communications Societies (INFOCOM 2002)*, pages 1678–1687, New York City, NY, 2002.

2001 J. Boleng, B. Williams, T. Camp, L. Wilcox, and W. Navidi. Performance of location-based routing protocols for an ad hoc network. In *Proceedings of the 11th Local and Metropolitan Area Networks Workshop (LANMAN 2001)*, pages 98–101, Boulder, CO, March 2001.

Technical Reports

2004 B. G. van Bloemen Waanders, R. A. Bartlett, S. S. Collis, E. R. Keiter, C. C. Ober, T. M. Smith, V. Akcelik, O. Ghattas, J. C. Hill, M. Berggren, M. Heinkenschloss, and L. C. Wilcox. Sensitivity technologies for large scale simulation. Technical Report SAND2004-6574, Sandia National Laboratory, PO Box 5800, Albuquerque, NM 87185-5800, 2004.

Presentations

2009 *High-Order Accurate Solution of Acoustic-Elastic Interface Problems on Adapted Meshes Using a Discontinuous Galerkin Method*, Poster, 2009 American Geophysical Union Fall Meeting, DEC 2009, San Francisco, California.

Towards Deterministic and Statistical Full Waveform Inversion, Dix Seismo Lab Seminar, Seismological Laboratory, California Institute of Technology, DEC 2009, Pasadena, California.

Towards Deterministic and Statistical Full Waveform Inversion, Mechanical Engineering Seminar Series, Department of Mechanical Engineering, The University of Texas at San Antonio, NOV 2009, San Antonio, Texas.

Path to Fully-Implicit Parallel Adaptive Solution of Mantle Convection Problems, SIAM Annual Meeting, JUL 2009, Denver, Colorado.

mangll: A Scalable Adaptive High-Order Discretization Library, Poster, SIAM Conference on Computational Science and Engineering, MAR 2009, Miami, Florida.

2008 *Scalable Adaptive Mantle Convection Simulation on Petascale Supercomputers*, Colloquia, Department of Mathematics, Southern Methodist University, DEC 2008, Dallas, Texas.

Parallel Adaptive Mantle Convection Simulation, Poster, Center for Subsurface Modeling Affiliates Meeting, OCT 2008, Austin, Texas.

Parallel Adaptive Mantle Convection Simulation, Poster, CIG Workshop on Mathematical and Computational Issues in the Solid Earth Geosciences, SEP 2008, Santa Fe, New Mexico.

Parallel Adaptive Solution of Mantle Convection Problems, SIAM Annual Meeting, JUL 2008, San Diego, California.

Towards Adaptive Petascale Simulations of Geophysical Phenomena, Scientific Computing Seminar, Division of Applied Mathematics, Brown University, MAY 2008, Providence, Rhode Island and Providence Plantations.

Towards Petascale Simulations of Geophysical Phenomena, Colloquia, Department of Mathematics and Statistics, The University of New Mexico, FEB 2008, Albuquerque, New Mexico.

2007 *Occam meets Bayes: Bridging the Divide*, Poster, SIAM Conference on Computational Science and Engineering, FEB 2007, Costa Mesa, California.

2006 *hp-Adaptive Solutions of the Time-Harmonic Maxwell's Equations Using a Nodal Discontinuous Galerkin Method*, Institute for Computational Engineering and Sciences Seminar, University of Texas at Austin, OCT 2006, Austin, Texas.

Sledge++ — A Discontinuous Galerkin Finite Element Discretization Package, 7th World Congress on Computational Mechanics, JUL 2006, Los Angeles, California.

2005 *Implementation and examples using Sledge++ (a high-order nodal discontinuous Galerkin library)*, CAAM Graduate Seminar, Computational and Applied Mathematics, Rice University, NOV 2005, Houston, Texas.

Adjoint Based A Posteriori Error Analysis for a 3D High-Order Nodal Discontinuous Galerkin Method, Student Internship Symposium, AUG 2005, Albuquerque, New Mexico.

2004 *Adjoint Based A Posteriori Error Analysis Applied to a High-Order Nodal Discontinuous Galerkin Method*, Student Internship Symposium, AUG 2004, Albuquerque, New Mexico.

Scholarships and Fellowships

2006 *ICES Postdoctoral Fellowship*, 2006-09-01–2008-08-31.

2004 *CSRI Summer Student Fellowship*, 2004-05-28–2004-09-01.

2001 *NSF VIGRE Fellowship*, 2001-09-01–2004-05-27.

1997 *CSM Presidential Scholarship*, 1997-08-23–2001-05-13.

Grants

2009 Omar GHATTAS, principle investigator, Donald D. BLANKENSHIP, Carsten BURSTEDDE, Charles S. JACKSON, Georg STADLER, and Lucas C. WILCOX, co-principle investigators, *Computational Science Research for Ice Sheet Modeling*, (approved, in process of being awarded), 2009-09-01–2012-08-31, $981,327.

Omar GHATTAS, principle investigator, Leszek DEMKOWICZ, J. Tinsley ODEN, and Lucas C. WILCOX, co-principle investigators, *Uncertainty Quantification for Large-Scale Inverse Scattering*, FA9550-09-1-0608, 2009-08-01–2012-07-31, $900,000.

2008 Omar GHATTAS, principle investigator, Carsten BURSTEDDE, Georg STADLER, and Lucas C. WILCOX, co-principle investigators, *an NSF LRAC allocation supporting our scalable adaptive Mantle convection research*, TG-MCA04N026, 2008-10-01–2009-09-30, 15,000,000 SUs.

Awards and Prizes

2008 *Finalist, 2008 Gordon Bell Prize* for the entry C. Burstedde, O. Ghattas, M. Gurnis, G. Stadler, E. Tan, T. Tu, L. C. Wilcox, and S. Zhong. Scalable adaptive mantle convection simulation on petascale supercomputers. In *SC '08: Proceedings of the 2008 ACM/IEEE conference on Supercomputing*, pages 1–15, Piscataway, NJ, USA, 2008.

TeraGrid Capability Computing Challenge Award for the entry C. Burstedde, O. Ghattas, G. Stadler, T. Tu, and L. C. Wilcox. Towards adaptive mesh PDE simulations on petascale computers. In *TeraGrid'08*, Las Vegas, NV, 2008.

Service

Mini-symposia Organized

2010 *Challenges in Parallel Adaptive Mesh Refinement* for SIAM Conference on Parallel Processing and Scientific Computing (PP10) (submitted).

Reviews

Referee for Applied Numerical Mathematics (1), Communications in Computational Physics (1), Computer Methods in Applied Mechanics and Engineering (1), IEEE International Parallel and Distributed Processing Symposium (IPDPS) (3), Journal of Computational and Applied Mathematics (1), Journal of Scientific Computing (2), SC07 (1), SIAM (1), SIAM Journal on Numerical Analysis (1), SIAM Journal on Scientific Computing (3), Springer (1), and TeraGrid'08 (4).

TEACHING

Courses

2006 Co-instructor, SPRING 2006, *Introduction to Computing Sciences*, (undergraduate), Division of Applied Mathematics, Brown University.

2005 Recitation Leader, SPRING 2005, *Introduction to Computing Sciences*, (undergraduate), Division of Applied Mathematics, Brown University.

Students Advised

2007 Co-adviser with Omar GHATTAS to James MARTIN, Ph.D. Student, 2007-09-01–PRESENT.

2006 Co-adviser with Omar GHATTAS to Jennifer WORTHEN, Ph.D. Student, 2006-09-01–PRESENT.

Co-adviser with Omar GHATTAS to H. Pearl FLATH, Ph.D. Student, 2006-09-01–PRESENT.

EXHIBITIONS

2008 *PROSPECT: Art that Renegotiates Standardized Locations in our Environment*, Creative Research Laboratory, Austin, Texas, 2008-11-22–2008-12-13.

CODES

2007 Co-developer of `ALPS Toolkit`, an MPI based framework for large-scale high-order *h*-adaptive finite element discretizations with applications in geosciences, 2007-06-06–PRESENT.

Lead developer of `pFudg`, an MPI based library for solving time-dependent hyperbolic partial differential equations using quadrature based discontinuous Galerkin methods, 2007-05-11–PRESENT.

2004 Co-developer of `Sledge++`, an object oriented C++ library for conforming and nonconforming *hp*-adaptive discontinuous Galerkin methods, 2004-12-15–2007-12-05.

PRIMARY REFERENCES

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University of Illinois at Urbana-Champaign
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Urbana, Illinois 61801
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