Alan Demlow

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Education

B.A. in Mathematics and Chemistry	Spring Arbor University, May 1996 Minor Subject: German
Ph.D. in Mathematics	Cornell University, August 2002 Committee: L.B. Wahlbin (chair), A.H. Schatz, S. Vavasis Minor Subject: Scientific Computation

Experience

Visiting Assistant Professor of Mathematics	Cornell University, August 2002–August 2003
NSF Postdoctoral Fellow and Guest Scientist	University of Freiburg, Germany, July 2003–June 2006
Research Associate	University of Freiburg, Germany, March 2004–February 2006
Assistant Professor of Mathematics	University of Kentucky, July 2006–June 2011.
Associate Professor of Mathematics	University of Kentucky, July 2011–August 2014.
Associate Professor of Mathematics	Texas A&M University, July 2014-August 2017.
Professor of Mathematics	Texas A&M University, September 2017–present.

Fellowships and Awards

NSF Graduate Research Fellowship	Spring 1997
Battig Graduate Prize for excellence and promise in mathematics, Cornell University Department of Mathematics	August 2000
NSF Mathematical Sciences Postdoctoral Research Fellowship	February 2003
Simons Fellow in Mathematics	December 2011

Funding

External grants and awards:

National Science Foundation grant DMS-0303378 "Postdoctoral Research Fellowship," July 2003–June 2007, $108,000.

National Science Foundation grant DMS-0713770 "Adaptive FEM for controlling pointwise errors and level sets," July 2007–June 2010, $112,787.

National Science Foundation grant DMS-1016094 "Adaptive FEM for elliptic and parabolic problems," September 2010–August 2014, $152,361.

Simons Foundation award 228205 "Finite element and discrete exterior calculus" (through the Simons Fellows program), August 2012–July 2013, $55,264.

National Science Foundation grant DMS-1318652 "Problems in mathematical foundations of adaptive finite element methods," September 2013–August 2016, $179,995. Transferred to Texas A&M as DMS-1518925, September 2014-August 2016 (no-cost extension through August 2017).

National Science Foundation grant DMS-1720369 "Topics in mathematical theory of adaptive finite element methods," September 2017-August 2020, $180,193.

Research Interests

Numerical analysis of partial differential equations
Mathematical theory of finite element methods for elliptic and parabolic equations
Fine properties of finite element methods
A posteriori error analysis and adaptive mesh refinement
Mixed finite element methods and finite element exterior calculus
Surface finite element methods

Publications and Preprints

Refereed journal articles (denotes a graduate advisee coauthor):*

1. Demlow, A. *Suboptimal and optimal convergence in mixed finite element methods.* SIAM J. Numer. Anal. **39** (2002), no. 6, 1938–1953.
2. Demlow, A. *Piecewise linear finite element methods are not localized.* Math. Comp. **73** (2004), no. 247, 1195–1201.
3. Demlow, A. *Localized pointwise error estimates for mixed finite element methods.* Math. Comp. **73** (2004), no. 248, 1623–1653.
4. Demlow, A. *Localized pointwise a posteriori estimates for gradients of piecewise linear finite element approximations to second-order quasilinear elliptic problems.* SIAM J. Numer. Anal. **44** (2006), no. 2, 494–514.
5. Demlow, A. *Local a posteriori estimates for pointwise gradient errors in finite element methods for elliptic problems.* Math. Comp. **76** (2007), no. 257, 19–42.
6. Demlow, A. and Dziuk, G. *An adaptive finite element method for the Laplace-Beltrami operator on implicitly defined surfaces.* SIAM J. Numer. Anal. **45** (2007), no. 1, 421–442.
7. Demlow, A. *Sharply localized pointwise and W_∞^{-1} estimates for finite element methods for quasilinear problems.* Math. Comp. **76** (2007), 1725–1741.
8. Demlow, A. *Higher-order finite element methods and pointwise error estimates for elliptic problems on surfaces.* SIAM J. Numer. Anal. **47** (2009), no. 2, 805–827.
9. Demlow, A., Lakkis, O., and Makridakis, C. *A posteriori error estimates in the maximum norm for parabolic problems.* SIAM J. Numer. Anal. **47** (2009), no. 3, 2157–2176.
10. Demlow, A., and Makridakis, C. *Sharply local pointwise a posteriori error estimates for parabolic problems.* Math. Comp. **79** (2010), 1233–1262.
11. Demlow, A., Guzmán, J., and Schatz, A.H. *Local energy estimates for the finite element method on sharply varying grids.* Math. Comp. **80** (2011), 1–9.
12. Demlow, A. *Convergence of an adaptive finite element method for controlling local energy errors.* SIAM J. Numer. Anal. **48** (2010), 470–497.
13. Demlow, A., and Stevenson, R.P. *Convergence and quasi-optimality of an adaptive finite element method for controlling L_2 errors.* Numer. Math. **117** (2011), 185–218.
14. Demlow, A., Leykekhman, D., Schatz, A.H., and Wahlbin, L.B. *Best approximation property in the W_∞^1 norm on graded meshes.* Math. Comp., published electronically September 29, 2011.
15. Demlow, A., and Olshanskii, M. *An adaptive surface finite element method based on volume meshes.* SIAM J. Numer. Anal. **50** (2012), 1624–1647.

16. Demlow, A. and Georgoulis, E. *Pointwise a posteriori error control for discontinuous Galerkin methods for elliptic problems.* SIAM J. Numer. Anal. **50** (2012), 2159–2181.
17. Demlow, A., and Larsson, S. *Local pointwise a posteriori gradient error bounds for the Stokes equation.* Math. Comp. **82** (2013), 625–649.
18. Demlow, A. and Hirani, A.N. *A posteriori error estimates for finite element exterior calculus: The de Rham complex.* Found. Comput. Math. **14** (2014), 1337–1371.
19. Camacho, F.* and Demlow, A. *L_2 and pointwise a posteriori error estimates for FEM for elliptic PDEs on surfaces.* IMA J. Numer. Anal. **35** (2015), 1199–1227.
20. Demlow, A. and Kopteva, N. *Maximum-norm a posteriori error estimates for singularly perturbed elliptic reaction-diffusion problems.* Numer. Math. **133** (2016), pp. 707–742.
21. Cockburn, B. and Demlow, A. *Hybridizable discontinuous Galerkin methods and mixed finite element methods for elliptic problems on surfaces.* Math. Comp. **85** (2016), 2609–2638.
22. Demlow, A. *Quasi-optimality of adaptive finite element methods for controlling local energy errors.* Numer. Math. **134** (2016), pp. 27–60.
23. Bonito, A. and Demlow, A. *Convergence and optimality of higher-order adaptive finite element methods for eigenvalue clusters.* SIAM J. Numer. Anal. **54** (2016), pp. 2379–2388.
24. Demlow, A. *Convergence and quasi-optimality of adaptive finite element methods for harmonic forms.* Numer. Math. **136** (2017), pp. 941–971.
25. Bonito, A., Demlow, A., and Owen, J*. *A priori error estimates for finite element approximations to eigenvalues and eigenfunctions of the Laplace-Beltrami operator.* SIAM J. Numer. Anal., to appear.

Preprints/articles submitted:

26. Bonito, A., and Demlow, A. *A posteriori error estimates for the Laplace-Beltrami operator on C^2 surfaces.* Submitted.

Research Lectures and Conferences

Invited talks:

1. Workshop "Mixed Finite Element Methods and Applications," Oberwolfach, Germany, February 2001.
2. Cornell University Analysis Seminar, April 2001.
3. Joint ÖMG/DMV meeting, Vienna, Austria, September 2001.
4. Institut für Angewandte Mathematik, Freiburg, Germany, September 2002.
5. Numerical analysis seminar, University of Maryland–College Park, March 2003.
6. Applied and numerical analysis seminar, University of Crete, Greece, October 2004.
7. Applied mathematics seminar, University of Milan, Italy, February 2005.
8. Departmental seminar, University of Sussex, UK, February 2006.
9. Applied math seminar, University of Zürich, Switzerland, May 2006.
10. Computational and applied mathematics seminar, Chalmers University of Technology, Gothenburg, Sweden, May 2006.
11. Computational and applied mathematics colloquium, Pennsylvania State University, October 2006.
12. Altoona-Penn State working seminar on PDEs and their applications, Pennsylvania State University, October 2006.

13. Numerical Analysis Seminar, University of Maryland, February 2007.
14. Workshop "Adaptive Numerical Methods for PDEs," Oberwolfach, Germany, June 2007.
15. Computational and applied mathematics seminar, Chalmers University of Technology, Gothenburg, Sweden, June 2007.
16. Special session "Finite Element Methods and Applications", AMS Central meeting, Bloomington, IN, April 2008.
17. Applied and numerical analysis seminar, University of Crete, Greece, June 2008.
18. Computational and applied mathematics seminar, Chalmers University of Technology, Gothenburg, Sweden, June 2008.
19. Mini-symposium "Recent advances in a posteriori error estimation and adaptive methods", SIAM Annual Meeting, San Diego, July 2008.
20. Applied and computational mathematics seminar, University of Tennessee, September 2008.
21. Minisymposium "Error Control and Adaption in Evolution Problems", MAFELAP 2009, Brunel University, London, UK, June 2009.
22. REB60: Workshop on Adaptive and Multilevel Methods for Partial Differential Equations, University of California-San Diego, November 2009.
23. Numerical Analysis Seminar, Purdue University, January 2010.
24. Computational Science and Engineering Seminar, University of Illinois-Urbana Champaign, February 2010.
25. Applied Math Seminar, University of Minnesota, March 2010.
26. Scientific Computing Group Seminar, Brown University, April 2010.
27. Special session "Multilevel Mesh Adaptation and Beyond: Computational Methods for Solving Complex Systems", AMS Western Sectional Meeting, Las Vegas, NV, May 2011.
28. Special session "Recent Advances in Finite Element Methods", AMS Western Sectional Meeting, Las Vegas, NV, May 2011.
29. Numerical analysis seminar, University of Amsterdam, Netherlands, June 2011.
30. Computational and applied mathematics seminar, University of Leicester, United Kingdom, June 2011.
31. Computational and applied mathematics seminar, Chalmers University of Technology, Gothenburg, Sweden, June 2011.
32. Minisymposium "Discontinuous Galerkin method for PDEs", ICIAM, Vancouver, Canada, July 2011.
33. Workshop "Modern Techniques in the Numerical Solution of Partial Differential Equations", Heraklion, Greece, September 2011.
34. Workshop on Geometric Numerical Methods for PDE, University of California-San Diego, November 2011.
35. Minisymposium "Exploiting Geometry in the Development of Numerical Methods for Partial Differential Equations", SIAM Conference on Analysis of PDE, San Diego, November 2011.
36. Center for Nonlinear Analysis Seminar, Carnegie Mellon University, Pittsburgh, February 2012.
37. Numerical Analysis Seminar, Texas A&M University, March 2012
38. Workshop "UQ: Models with complex and uncertain domains", SAMSI, North Carolina, March 2012.

39. Minisymposium "Numerical Approximation of Viscous Flows", SIAM annual meeting, Minneapolis, July 2012.
40. Minisymposium "Numerical methods for surface PDEs", ECCOMAS 2012, Vienna, September 2012.
41. Numerical analysis seminar, University of Maryland–College Park, September 2012.
42. Applied math seminar, University of Minnesota, November 2012.
43. Numerical analysis and PDE seminar, University of Delaware, November 2012.
44. Minisymposium "Global and local error estimates for problems with singularities or low regularity", MAFELAP 2013, Brunel University, London, UK, June 2013.
45. Scientific Computing Seminar, University of Houston, November 2013.
46. Applied and Computational Mathematics Seminar, University of California-Irvine, January 2014.
47. Special Session "Discontinuous Galerkin Finite Element Methods for Partial Differential Equations", AMS Southeastern Sectional Meeting, Knoxville, TN, March 2014.
48. Durham Symposium "Building Bridges: Connections and Challenges in Modern Approaches to Numerical Partial Differential Equations", Durham, UK, July 2014.
49. IMA Workshop "Structure-preserving discretizations of partial differential equations", Minneapolis, October 2014.
50. Workshop "Multiresolution and Adaptivity in Numerical PDE's", Foundations of Computational Mathematics 2014, Montevideo, Uruguay, December 2014.
51. Minisymposium "Recent advances in a posteriori error estimations and adaptive methods", SIAM CSE 2015, Salt Lake City, March 2015.
52. Workshop "Advanced Numerical Methods in the Mathematical Sciences", Texas A&M University, May 2015.
53. Minisymposium "Recent advances in a posteriori error estimations and adaptive methods", ICIAM 2015, Beijing, China, August 2015.
54. Minisymposium "Recent advances in numerical approximation of singular solutions", ICIAM 2015, Beijing, China, August 2015.
55. Minisymposium "Adaptive finite element methods", ENUMATH 2015, Ankara, Turkey, September 2015.
56. Minisymposium "Advances in finite and boundary elements", WONAPDE 2016, Concepción, Chile, January 2016.
57. Minisymposium "Adaptivity in numerical PDE", WONAPDE 2016, Concepción, Chile, January 2016.
58. Oberwolfach Mini-Workshop "Mathematical Foundations of Isogeometric Analysis", Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany, February 2016.
59. Oberwolfach workshop "Self-adaptive numerical methods for computationally challenging problems", September 2016.
60. Oberwolfach workshop "Adaptive Algorithms", September 2016.
61. Computational and Applied Mathematics Colloquium, Pennsylvania State University, October 2016.
62. Special session "Recent Trends in Finite Element Methods", AMS Southeastern Sectional Meeting, March 2017.

63. Stream "Numerical Solutions of Differential Equations", ECM2017 meeting, Hong Kong, May 2017.
64. Numerical analysis seminar, University of Oslo, Oslo, Norway, June 2017.
65. Workshop "Multiresolution and Adaptivity in Numerical PDEs", Foundations of Computational Mathematics 2017, Barcelona, Spain, July 2017.

Contributed talks:

1. Finite Element Circus and Rodeo talks: October 1999 (Cornell University), February 2000 (University of Texas-Austin), October 2000 (Rutgers University), April 2001 (University of Delaware), March 2002 (University of Maryland-College Park), April 2004 (University of Pittsburgh), November 2006 (Pennsylvania State University), April 2007 (University of Maryland), October 2007 (Cornell University), October 2008 (RPI), April 2009 (University of Delaware), October 2009 (University of Tennessee–Knoxville), April 2010 (Brown), November 2010 (Minneapolis), October 2011 (Connecticut), April 2012 (Rutgers), October 2012 (Pittsburgh), March 2014 (Wayne State), October 2014 (Minneapolis), February 2015 (Dallas).
2. European Finite Element Fair talks: June 2004 (Berlin, Germany), June 2005 (Pavia, Italy), June 2006 (Zürich, Switzerland), June 2008 (Göteborg, Sweden), June 2009 (Helsinki, Finland), June 2011 (Paris, France).
3. Equadiff 10, Prague, Czech Republic, August 2001.
4. Workshop on Reliable Methods of Mathematical Modeling, Zürich, Switzerland, July 2005.
5. Enumath 2005, Santiago de Compostela, Spain, July 2005.
6. MAFELAP 2006, Brunel University, London, UK, June 2006.
7. USNCCM9, San Francisco, CA, July 2007.
8. Workshop "Adaptive Finite Elements: Analysis and Application", Kirchzarten, Germany, September 2009.
9. Workshop "Numerical methods for PDE on surfaces", Freiburg, Germany, September 2009.
10. Conference CMAM-4, Bedlewo, Poland, June 2010.

Conference organization

1. Minisymposium "Mathematical aspects of finite element methods", MAFELAP 2009, Brunel University, London, UK, June 2009 (co-organized with D. Leykekhman).
2. Special session "Recent progress in numerical methods for PDE", Spring 2010 AMS Sectional Meeting, Lexington, KY, March 2010 (co-organized with X. Feng).
3. Minisymposium "Exploiting Geometry in the Development of Numerical Methods for Partial Differential Equations", SIAM Conference on Analysis of PDE, San Diego, November 2011 (co-organized with M. Holst).
4. CBMS conference "Finite Element Exterior Calculus", Brown University, June 2012 (co-organized with D. Leykekhman and PI/principal organizer J. Guzmán).
5. Minisymposium "Numerical methods for surface PDEs", ECCOMAS 2012, Vienna, September 2012 (co-organized with M. Olshaskii and A. Reusken).
6. Minisymposium "Global and local error estimates for problems with singularities or low regularity", MAFELAP 2013, Brunel University, London, UK, June 2013 (co-organized with D. Leykekhman).
7. Local organizer, Finite Element Rodeo, Texas A&M University, March 2016.

Professional Memberships

American Mathematical Society

Society for Industrial and Applied Mathematics

Refereeing and Editorial Activities

Associate Editor, SIAM Journal on Numerical Analysis, 2016–present.

Journal referee for SIAM Journal on Numerical Analysis, Mathematics of Computation, Communications in Numerical Methods in Engineering, Numerische Mathematik, Journal of Computational Mathematics, Communications in Computational Physics, Applied Mathematics and Computation, Journal of Mathematical Analysis and Applications, IMA Journal of Numerical Analysis, Foundations of Computational Mathematics, BIT-Numerical Mathematics, Journal of Mathematical Analysis and Applications, and Computational Methods in Applied Mathematics, SIAM Journal on Scientific Computing, and Journal of Scientific Computing.

External and panel reviewer for NSF Division of Mathematical Sciences–Computational Mathematics.

External or panel reviewer for NSERC (Canada), FONDECYT (Chile), Austrian National Science Foundation.

Teaching Experience

University of Kentucky:

MA113 Calculus I, Spring 2009, Fall 2010, and Fall 2013.

MA114 Calculus II, Spring 2011.

MA213 Calculus III, Spring 2008 and Fall 2011.

MA214 Calculus IV (Ordinary Differential Equations), Fall 2006, Fall 2008, Fall 2010, Spring 2012, and Spring 2014.

MA321 Numerical Methods, Spring 2007 and Spring 2012.

MA483 Introduction to PDE, Spring 2008.

MA537 Introduction to Numerical Analysis, Spring 2009 and Spring 2011.

MA625 Numerical Methods for Differential Equations, Fall 2011.

MA721 Topics in numerical analysis (Finite element methods), Fall 2008.

Texas A&M University:

MATH308 (Differential Equations), Fall 2014 and Fall 2017 (2 sections).

MATH412 (Theory of Partial Differential Equations), Fall 2015.

MATH417 (Numerical Analysis), Spring 2017.

MATH442 (Mathematical Modeling), Spring 2018.

MATH610 (Numerical Partial Differential Equations), Spring 2015 and Spring 2017.

MATH663 (Seminar in Analysis), Spring 2016.

Educational Service Activities

University of Kentucky:

Course coordinator for MA214 Calculus IV, University of Kentucky, Fall 2006–Spring 2010.

Speaker at University of Kentucky graduate colloquium, Fall 2007, Fall 2009, and Fall 2010.

University of Kentucky Microteach session leader, August 2008 (part of training for incoming teaching assistants).

University of Kentucky Math Club speaker, Fall 2009.

Held Engineering PE exam review sessions, AY2009–10, 2010–11, 2011–12, and 2013–14 (twice each year).

Organized departmental Computational and Applied Math Seminar, 2009-10 and 2010-11.

Faculty advisor for University of Kentucky teams participating in the undergraduate Mathematical Contest in Modeling, 2011–2014 (6 teams total).

Course coordinator for MA213 Calculus III, University of Kentucky, 2011–12.

Course coordinator for MA214 Calculus IV, University of Kentucky, 2013–14.

Texas A&M University:

Texas A&M Math Department AMUSE seminar speaker, Spring 2015.

Faculty advisor for teams participating in the undergraduate Mathematical Contest in Modeling, 2016-18 (4 teams total).

Graduate advising

Ph.D. Advisees

Fernando Camacho; graduated 2014 (University of Kentucky).

Justin Owen; current (TAMU).

Ph.D. committees

Qualifying exam committee of Max Kennedy (Decision Science and Information Systems); 2010.

Ph.D. committee of Jun Geng (Chair: Z. Shen); graduated 2011.

Ph.D. committee of Jay Hineman (Chair: C. Wang); graduated 2012.

Ph.D. committee of Josh Strodtbeck (Mechanical Engineering); graduated 2012.

External Ph.D. committee member for Kaushik Kalyanaraman, University of Illinois Urbana-Champaign; graduated 2015.

Opponent for thesis defense of Martin Licht, University of Oslo (Norway), June 2017.

Masters' committees

Master's committee of Justin Taylor (Chair: Russell Brown); 2008.

Master's committee of Craig Hamilton (Chair: Jeff Ovall); 2012.

University Committee Service

University of Kentucky:

Undergraduate committee, University of Kentucky Department of Mathematics, 2007–08 and 2010–11.

Hiring committee, University of Kentucky Department of Mathematics, 2008–09.

Executive committee, University of Kentucky Department of Mathematics, 2008–09 and 2011–12.

Chair search committee, University of Kentucky Department of Mathematics, 2010–11.

Ad hoc committee on rules and procedures, University of Kentucky Department of Mathematics, 2010–11.

Calculus textbook committee, University of Kentucky Department of Mathematics, 2011–12.

Salary committee, University of Kentucky Department of Mathematics, 2011–12.

Texas A&M University:

Postdoc Committee, 2014–2016.

Executive committee, 2015–2017.

College of Science Strategic Planning Committee, 2017–present.

College of Science Dean Search Committee, Fall 2018.

Academic Civil Rights Investigative Committee, 2017-present.