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Curriculum Vitae

Mark Steven Gockenbach
Department of Mathematical Sciences
501 Ewing Hall
University of Delaware
Newark, DE 19716
msgocken@udel.edu

Personal data: Born: 10 March 1963
Citizenship: U. S.

Current position:
    Professor and Chair
    Department of Mathematical Sciences
    University of Delaware, Newark, DE

Research interests:
    Inverse problems in partial differential equations
    Numerical methods and software for large-scale optimization problems

Education:
    PhD, MA Computational & Applied Mathematics, Rice University, 1994
    ABD Mathematics, University of Illinois, 1990
    MS Mathematics, Illinois State University, 1987
    BS Mathematics/Computer Science, University of Illinois, 1985, *magna cum laude*

Professional Experience:
    Chair, Department of Mathematical Sciences, University of Delaware, 2020–
    Chair, Department of Mathematical Sciences, Michigan Technological University, 2007–2020
    Interim Chair, Department of Mathematical Sciences, Michigan Technological University, 2006–2007
    Professor of Mathematical Sciences, Michigan Technological University, 2006–
    Interim Chair, Department of Mathematical Sciences, Michigan Technological University, Spring 2004
    Associate Professor of Mathematical Sciences, Michigan Technological University, 2001–2006
    Assistant Professor of Mathematical Sciences, Michigan Technological University, 1998–2001
    Visiting Assistant Professor, Department of Computational and Applied Mathematics, and
        Associate Director, The Rice Inversion Project, Rice University, Houston, TX 1998-1999
    Assistant Professor of Mathematics, University of Michigan, Ann Arbor, MI 1995-1998
    Postdoctoral fellow, Center for Research on Parallel Computation, Rice University, 1994-1995
    Research Assistant, Computational & Applied Mathematics, Rice University, 1992-1994
    Visiting Lecturer of Mathematics, ITM/MUCIA–Indiana University
        Cooperative Program in Malaysia, 1990-1992
    Teaching Assistant / Teaching Fellow, University of Illinois, Urbana, IL 1987-1990
    Teaching Assistant, Illinois State University, Normal, IL 1985-1987

Recent professional activities:

1. Volunteer lecturer, International Mathematical Union's Commission on Developing Countries, 2016. Gave course on Numerical Optimization at the Royal University of Phnom Penh, Cambodia.

2. Volunteer lecturer, International Mathematical Union's Commission on Developing Countries, 2013, 2015. Gave course on Ordinary Differential Equations at the Royal University of Phnom Penh, Cambodia.

3. Co-organizer, Institute for Mathematics and its Applications Workshop, *Careers and Opportunities in Industry for Mathematical Scientists*, 20–22 April 2015.

4. Member, Advisory Board, NSF-funded *Progress through Calculus* project (David Bressoud, PI), January 2015–present.

Refereed Publications:

1. DANIEL K. CRANE, MARK S. GOCKENBACH, *The singular value expansion for arbitrary bounded linear operators*, Mathematics 2020, 8, 1346.

2. DANIEL K. CRANE, MARK S. GOCKENBACH, MATTHEW J. ROBERTS *Approximating the singular value expansion of a compact operator*, SIAM Journal on Numerical Analysis, 58(2) (2020), 1295–1318.

3. MARK S. GOCKENBACH, MATTHEW J. ROBERTS *Approximating the generalized singular value expansion*, SIAM Journal on Numerical Analysis 56(5) (2018), 2776-2795.

4. MARK S. GOCKENBACH, ELAHEH GORGIN *On the convergence of a heuristic parameter choice rule for Tikhonov regularization*, SIAM Journal on Scientific Computing 40(4) (2018), A2694–A2719.

5. MOHAMMAD F. AL-JAMAL, A. K. ALOMARI, AND MARK S. GOCKENBACH *Smoothing via elliptic operators with application to edge detection*, Inverse Problems in Science and Engineering 26(5)(2018), 657–676.

6. MARK S. GOCKENBACH *Generalizing the GSVD*, SIAM Journal on Numerical Analysis 54(4) (2016), 2517–2540.

7. MARK S. GOCKENBACH, BAASANSUREN JADAMBA, AKHTAR A. KHAN, CHRISTIANE TAMMER, AND BRIAN WINKLER *Proximal Methods for the Elastography Inverse Problem of Tumor Identification Using an Equation Error Approach*, in *Advances in Variational and Hemivariational Inequalities: Theory, Numerical Analysis, and Applications*, Han et al., editors, Springer, 2015.

8. E. CROSSEN, M. S. GOCKENBACH, B. JADAMBA, A. A. KHAN, B. WINKLER *An equation error approach for the elasticity imaging inverse problem for predicting tumor location*, Computers and Mathematics with Applications 67(1) (2014), 122–135.

9. M. S. GOCKENBACH, C. LIU *Local convergence of Newton's method in the classical calculus of variations*, Optimization (2013) http://dx.doi.org/10.1080/02331934.2013.811664 (24 pp).

10. M. F. AL-JAMAL, M. S. GOCKENBACH *Stability and error estimates for an equation error method for elliptic equations*, Inverse Problems 28 (2012) 095006 (15pp).

11. M. S. GOCKENBACH, BAASANSUREN JADAMBA, AKHTAR A. KHAN *A Comparative Numerical Study of Optimization Approaches for Elliptic Inverse Problems*, JMI International Journal of Mathematical Sciences, 1(1), 35–56, 2010.

12. M. S. GOCKENBACH, K. K. SCHMIDTKE *Newton's law of heating and the heat equation*, Involve, 2(4), 419–437, 2009.

13. M. S. GOCKENBACH, A. A. KHAN *An abstract framework for elliptic inverse problems. Part 2: An augmented Lagrangian approach*, Mathematics and Mechanics of Solids, 14, 517–539, 2009.

14. M. S. GOCKENBACH *Numerical analysis of elliptic inverse problems with interior data*, Journal of Physics: Conference Series 124 012026, 2008.

15. M. S. GOCKENBACH, B. JADAMBA, A. A. KHAN *Equation error approach for elliptic inverse problems with an application to the identification of Lamé parameters*, Inverse Problems in Science and Engineering, 16(3), 349–367, 2008.

16. M. S. GOCKENBACH *The output least-squares approach to estimating Lamé moduli*, Inverse Problems 23, 2437–2455, 2007.

17. M. S. GOCKENBACH, A. A. KHAN *An abstract framework for elliptic inverse problems. Part 1: An output least-squares approach*, Mathematics and Mechanics of Solids, 12(3), 259–276, 2007.

18. M. S. GOCKENBACH, B. JADAMBA, A. A. KHAN *Numerical estimation of discontinuous coefficients by the method of equation error*, International Journal of Mathematics and Computer Science, 1(3), 343–359, 2006.

19. M. S. GOCKENBACH, A.A. KHAN, *A convex objective functional for elliptic inverse problems*, in *Mathematical Models and Methods for Real World Systems*, K.M. Furuti, M.Z. Nashed, A.H. Siddiqi, editors, Chapman & Hall/CRC, 389–419, 2006.

20. M. S. GOCKENBACH, A.A. KHAN, *Identification of Lamé parameters in linear elasticity: A fixed point approach*, Journal of Industrial and Management Optimization, 1(4), 487–497, 2005.

21. M. S. GOCKENBACH, W. W. SYMES, *Adaptive Simulation, the Adjoint State Method, and Optimization*, in *PDE-Constrained Optimization* (Volume 30, Lecture Notes in Computational Science and Engineering), L. T. Biegler, O. Ghattas, M. Heinkenschloss, B. van Bloemen Wanders, editors, Springer-Verlag, 2003.

22. MARK S. GOCKENBACH, DANIEL R. REYNOLDS, PENG SHEN, WILLIAM W. SYMES *Efficient and Automatic Implementation of the Adjoint State Method*, ACM Transactions on Mathematical Software, 28(1), 22-44, 2002.

23. J. CHEN, M. S. GOCKENBACH *A variational method for recovering planar Lamé moduli*, Mathematics and Mechanics of Solids 7(2), 191–202, 2002.

24. M. S. GOCKENBACH, D. R. REYNOLDS, W. W. SYMES *Automatic Differentiation and the Adjoint State Method*, *Automatic Differentiation 2000: From Simulation to Optimization*, George Corliss, Christèle Faure, Andreas Griewank, Laurent Hascoët, Uwe Naumann, editors, Springer-Verlag, 2002.

25. M. S. GOCKENBACH *A Primer on Differentiation*, Optimization and Engineering 2, 75–129, 2001.

26. M. S. GOCKENBACH, M. J. PETRO, W. W. SYMES *C++ classes for linking optimization with complex simulations*, ACM Transactions on Mathematical Software 25, no. 2, 191–212, 1999.

27. M. S. GOCKENBACH, A. J. KEARSLEY *Optimal Signal Sets for Non-Gaussian Detectors*, SIAM Journal on Optimization 9, no. 2, 316–326, 1999.

28. S. J. COX, M. S. GOCKENBACH *Recovering Planar Lamé Moduli From a Single Traction Experiment*, Mathematics and Mechanics of Solids 2, no. 3, 297–306, 1997.

29. M. S. GOCKENBACH, W. W. SYMES *Duality for inverse problems in wave propagation*, in *Large-Scale Optimization with Applications, Part I*, Biegler et al., eds., Springer, 1997.

30. M. S. GOCKENBACH, A. J. KEARSLEY, W. W. SYMES *An infeasible point method for minimizing the Lennard-Jones potential*, Computational Optimization and Applications 8, no. 3, 273–286, 1997.

31. M. S. GOCKENBACH, W. W. SYMES *The Hilbert Class Library: a library of C++ classes for large-scale optimization and inversion*, Computers and Mathematics with Applications 32, no. 6, 1–13, 1996.

32. M. S. GOCKENBACH, W. W. SYMES, R. A. TAPIA *The dual regularization approach to seismic velocity inversion*, Inverse Problems 11, no. 3, 501–531, 1995.

Books:

1. MARK S. GOCKENBACH *Linear Inverse Problems and Tikhonov Regularization*, Volume 32, Carus Mathematical Monographs, Mathematical Association of America, 2016.

2. MARK S. GOCKENBACH *Finite-Dimensional Linear Algebra*, CRC Press, 2010.

3. MARK S. GOCKENBACH *Partial Differential Equations: Analytical and Numerical Methods*, Second Edition, the Society for Industrial and Applied Mathematics, 2010.

   - International edition published by Universities Press, 2017.

4. MARK S. GOCKENBACH *Understanding and Implementing the Finite Element Method*, the Society for Industrial and Applied Mathematics, 2006.

5. MARK S. GOCKENBACH *Partial Differential Equations: Analytical and Numerical Methods*, the Society for Industrial and Applied Mathematics, 2002.

Software:

1. M. S. GOCKENBACH AND W. W. SYMES, "The Hilbert Class Library, Version 1.0" (HCL1.0), 2000. Available under the GNU public library license at

   http://www.trip.caam.rice.edu/txt/hcldoc/html/index.html.

Other publications:

1. MARK S. GOCKENBACH *Mathematics: An unparalled combination of beauty, transcendence, and utility*, in *Mathematics for the Curious: Why Study Mathematics?*, Curious Academic Publishing, 2015.

2. M. S. GOCKENBACH *Understanding code generated by TAMC*, Technical Report 00-30, Department of Computational & Applied Mathematics, Rice University (2000).

3. M. S. GOCKENBACH *An Overview of HCL1.0*, Technical Report TR 99-25, Department Computational & Applied Mathematics, Rice University (1999).

4. M. S. GOCKENBACH *Implementing Functionals in HCL*, Technical Report TR 99-24, Department Computational & Applied Mathematics, Rice University (1999).

5. M. S. GOCKENBACH *Implementing Nonlinear Operators in HCL*, Technical Report TR 99-22, Department Computational & Applied Mathematics, Rice University (1999).

6. M. S. GOCKENBACH, W. W. SYMES *Coherent Noise Suppression in Velocity Inversion*, Technical Report TR 99-08, Department Computational & Applied Mathematics, Rice University (1999).

7. M. S. GOCKENBACH, W. W. SYMES *Coherent Noise Suppression in Velocity Inversion* Expanded Abstract, Proc. 69th Annual International Meeting, Society of Exploration Geophysicists, Tulsa, 1999.

8. M. S. GOCKENBACH, W. W. SYMES *The Hilbert Class Library: a library of C++ classes for large-scale optimization and inversion*, Proceedings of the Fourth Annual Object-Oriented Numerics Conference, 1996.

9. M. S. GOCKENBACH, W. W. SYMES *Waveform inversion for velocity: where have all the minima gone?*, Expanded Abstract, Proc. 65th Annual International Meeting, Society of Exploration Geophysicists, Tulsa, 1995.

10. R. J. VERSTEEG, M. S. GOCKENBACH, M. KERN, W. W. SYMES *Shot level parallelization of a seismic inversion code using PVM*, Expanded Abstract, Proc. 64th Annual International Meeting, Society of Exploration Geophysicists, Tulsa, 1994.

11. **PhD Thesis** *An Abstract Analysis of Differential Semblance Optimization* (under direction of William W. Symes and Richard A. Tapia); Available as Technical Report TR 94-18, Department Computational & Applied Mathematics, Rice University (1994).

Funding:

1. M. S. GOCKENBACH, Principal Investigator; JIGUANG SUN, ALLAN STRUTHERS, BENJAMIN ONG, Co-PIs, Institute for Mathematics and its Applications, *Finite Element Methods for Eigenvalue Problems* (workshop grant), $15,000, August 2016.

2. M. S. GOCKENBACH, Principal Investigator, The Rice Inversion Project (TRIP) grant, *Optimization, Adaptive Simulation, and Parallelism*, $30,000, 9/2000-8/2001.

3. M. S. GOCKENBACH, Principal Investigator, National Science Foundation grant, *Large-Scale Optimization: Matrix-Free Algorithms, Data Parallelism, and Applications in Seismic Inversion* (DMS-9973308), $82,908, 9/1999-8/2002.

Awards:

1. Department of Mathematical Sciences award for outstanding teaching (senior level), Michigan Technological University, 2005-2006.

2. Department of Mathematical Sciences award for outstanding teaching (senior level), Michigan Technological University, 2004-2005.

3. Department of Mathematical Sciences award for outstanding research (junior level), Michigan Technological University, 1999-2000.

4. Department of Mathematical Sciences award for outstanding teaching (junior level), Michigan Technological University, 1999-2000.

5. Department of Mathematics award for outstanding teaching, University of Illinois, Urbana, IL 1989

6. Finalist for University-wide teaching award, University of Illinois, Urbana, IL 1990

Graduate students

1. PhD: Daniel K. Crane, *The Singular Value Expansion for Compact and Non-compact Operators*, Department of Mathematical Sciences, Michigan Technological University, 2020.

2. PhD: Matthew J. Roberts, *Approximation of the Generalized Singular Value Expansion*, Department of Mathematical Sciences, Michigan Technological University, 2019.

3. PhD: Elaheh Gorgin, *Heuristic Methods for Tikhonov Regularization*, Department of Mathematical Sciences, Michigan Technological University, 2015.

4. PhD: Mohammad F. Al-Jamal, *Numerical Solutions of Elliptic Inverse Problems Via the Equation Error Method*, Department of Mathematical Sciences, Michigan Technological University, 2012.

5. PhD: Chang Liu, *Problems in the Classical Calculus of Variations*, Department of Mathematical Sciences, Michigan Technological University, 2011.

6. PhD: Anatoli Andreev, *Comparison of Numerical Methods for Elliptic Inverse Problems*, Department of Mathematical Sciences, Michigan Technological University, 2006.

7. PhD: Akhtar Khan, *Numerical Methods for Elliptic Inverse Problems with Interior Data*, Department of Mathematical Sciences, Michigan Technological University, 2005.

8. MS: Erin Thomas, *A Comparison of p and h convergence for Finite Element Methods*, Department of Mathematical Sciences, Michigan Technological University, 2003.

9. MS: Fei Wang, *Distributed Classes for Optimization Software: A Client/Server Approach*, Department of Mathematical Sciences, Michigan Technological University, 2001.

10. MS: Jun Chen, *A Variational Method for Recovering Planar Lamé Moduli*, Department of Mathematical Sciences, Michigan Technological University, 2000.

Other graduate committees:

1. Member, MS committee for David Torrey, *A Parallel Algorithm for Solving Integer Linear Programs*, 2011. Department of Mechanical Engineering-Engineering Mechanics, Michigan Technological University, 2007.

2. Member, MS committee for Mike Graziano, *Reducing Crane Payload Swing Using a Rider Block Tagline Control System*, Department of Mechanical Engineering-Engineering Mechanics, Michigan Technological University, 2007.

3. Member, PhD committee for Adeeb Talafha, *Inverse Scattering Analysis of Multi-Soliton Solutions of the Three-Wave Interaction of Long Rectangular Pulses*, Department of Mathematical Sciences, Michigan Technological University, 2006.

4. Member, PhD committee for Sahar Alqaraleh, *Variational principles for linear and nonlinear mixtures: New derivations and application to bilinear materials and yield behavior*, Department of Mathematical Sciences, Michigan Technological University, 2006.

5. Member, PhD committee for Yong Sun, *Optimization of die geometry for polymer extrusion*, Department of Mechanical Engineering-Engineering Mechanics, Michigan Technological University, 2006.

6. Member, MS committee for Yongliang Jin, *Direct method to determine the optimal riprap size for erosion protection in rivers*, Department of Civil and Environmental Engineering, Michigan Technological University, 2006.

7. Member, MS committee for Albert Suckow, *Unstructured surface mesh generation through point cloud interpolation*, Department of Mechanical Engineering-Engineering Mechanics, Michigan Technological University, 2005.

8. Member, MS committee for Rajeev Kulkarni, *Dynamic Wireless Resource Allocation in Multi-vendor Environments: Performance Analysis in Code Division Multiple Access (CDMA) Systems*, Department of Electrical and Computer Engineering, Michigan Technological University, 2005.

9. Member, MS committee for Ajit Vaze, *Octree Decomposition-Recomposition Approach to Rapid Manufacturing*, Department of Mechanical Engineering-Engineering Mechanics, Michigan Technological University, 2005.

10. Member, MS committee for Justin Priestman, Department of Mathematical Sciences, Michigan Technological University, 2005.

11. Member, MS committee for Ravi Shrestha, *Direct solution to the normal depth*, Department of Civil and Environmental Engineering, Michigan Technological University, 2005.

12. Member, MS committee for Seetha Manickam, *Security enhancements at MAC level for emergency applications*, Department of Electrical and Computer Engineering, Michigan Technological University, 2005.

13. Member, MS committee for Ganesh Krishnakumar, *New transmit schemes and simplified receivers for MIMO wireless communication systems*, Department of Electrical and Computer Engineering, Michigan Technological University, 2005.

14. Member, MS committee for Srinivas Kuppa, Department of Mathematical Sciences, Michigan Technological University, 2004.

15. Member, MS committee for Srinivas Kuppa, *Abstract State Machines: A Formal Approach to Software Documentation*, Department of Computer Science, Michigan Technological University, 2003.

16. Member, MS committee for Charlie Kiilunen, Department of Mechanical Engineering-Engineering Mechanics, Michigan Technological University, 2003.

17. Member, MS committee for James Sheldon, *Orientation Determination from Optical Scattering Patterns Generated by Ellipsoids of Revolution*, Department of Mathematical Sciences, Michigan Technological University, 2003.

18. Member, MS committee for Kimberly Lauinger, *Computing Transverse t-Designs*, Department of Mathematical Sciences, Michigan Technological University, 2003.

19. Member, MS committee for John Casserino, Department of Humanities, Michigan Technological University, 2003.

20. Member, MS committee for William R. Case, Department of Mathematical Sciences, Michigan Technological University, 2003.

21. Member, MS committee for Jer Hong Chong, *Dynamic behavior of spacecraft formation flying using Coulomb forces*, Department of Mechanical Engineering-Engineering Mechanics, Michigan Technological University, 2002.

22. Member, MS committee for Anastasia Minaeva, *Seismic Attributes and Synthetic Seismograms, Wamsutter Field, WY*, Department of Geological Engineering and Sciences, Michigan Technological University, 2001.

23. Member, MS committee for Matthias Schabus, *Damping of Multiple Constrained Layers*, Department of Mechanical Engineering and Engineering Mechanics, Michigan Technological University, 2001.

24. Member, MS committee for Markus Buehler, *Homogenization of Smart Material Cells for Topological Optimization*, Department of Mechanical Engineering and Engineering Mechanics, Michigan Technological University, 2001.

25. Member, MS committee for Rochelle Fischer, *A Polling Scheme Using an Automated Meter Reading System for Identifying System Conditions*, Department of Electrical and Computer Engineering, Michigan Technological University, 2000.

26. Member, PhD committee for Chih-jen Lin, *Studies in Large-Scale Optimization*, Department of Industrial and Operations Engineering, University of Michigan, 1998.

27. Member, PhD committee for Barton Yeary, (*Coupled Nonlinear Schrödinger Equations*), Department of Mathematics, University of Michigan, 1997.

28. Member, PhD committee for David Stuenkel, (*Measurement of Dose Equivalent Rate in Mixed Fast Neutron-Gamma Ray Fields using a Liquid Scintillator*), Department of Nuclear Engineering, University of Michigan, 1997.

Presentations:

1. Department of Mathematical Sciences, University of Delaware, 12 April 2020, *The Galerkin method for estimating the singular values and singular vectors of a compact operator.*

2. Millican Colloquium, Department of Mathematics, University of North Texas, 18 March 2018, *Inverse problems and singular value expansions.*

3. Department of Mathematical Sciences, Clemson University, 6 November 2017, *Singular values of matrices and operators.*

4. Applied Math Seminar, Department of Mathematical Sciences, Michigan Technological University, 2 March 2017, *Choosing the parameter in Tikhonov regularization.*

5. Seminar, Department of Mathematics, Royal University of Phnom Penh, 16 June 2016, *Inverse problems and the singular value expansion.*

6. Applied Math Seminar, Department of Mathematical Sciences, Michigan Technological University, 15 March 2016, *Computing the generalized singular value expansion.*

7. Seminar, Department of Mathematics, Royal University of Phnom Penh, 25 June 2015, *Newton's method and the classical calculus of variations.*

8. Applied Math Seminar, Department of Mathematical Sciences, Michigan Technological University, 25 September 2014, *A generalized singular value expansion for general linear operators.*

9. Applied Math Seminar, Department of Mathematical Sciences, Michigan Technological University, 18 September 2014, *A singular value expansion for general (noncompact) linear operators.*

10. Colloqium, Department of Mathematics and Statistics, Winona State University, 2 April 2013. *Newton's method and the classical calculus of variations.*

11. Eastern Sectional Meeting of the American Mathematical Society, Rochester, NY, 22 September 2012. *Multiplicative regularization for linear inverse problems.*

12. Colloquium, School of Mathematical Sciences, Rochester Institute of Technology, 12 May 2011. *Numerical Analysis of Elliptic Inverse Problems.*

13. Presentation, Math Society of Michigan Tech, 17 March 2011. *A Miscellany of Pi.*

14. Conference on Applied Inverse Problems 2007: Theoretical and Computational Aspects, Vancouver, Canada, 27 June 2007. *Numerical Analysis of Elliptic Inverse Problems.*

15. Colloquium, Department of Mathematical Sciences, Michigan Technological University, 12 February 2007. *Numerical analysis of elliptic inverse problems.*

16. Computational Science and Engineering Seminar, Michigan Technological University, 17 February 2006. *Computational issues in elliptic inverse problems.*

17. Colloquium, Department of Mathematical Sciences, Michigan Technological University, 6 February 2006. *Inverse Problems in Elasticity.*

18. SIAM Great Lakes Section, Spring Meeting 2004 (NUMPDES: Numerical Solution of PDEs), 24 April 2004. Invited talk: *Elliptic inverse problems with interior data.*

19. St. Norbert College, Math Club, 11 February 2004. Talked about graduate school and the graduate program at Michigan Tech.

20. Michigan Undergraduate Mathematics Conference, 25 October 2003. *The graduate program at Michigan Tech.*

21. IMA Workshop: Optimization in Simulation Based Models, 16 January 2003. *The Standard Vector Library.*

22. Colloquium, Department of Mathematics, Taylor University, 31 October 2002. *Boundary Control of the 1D Heat Equation.*

23. Colloquium, Department of Mathematics and Computer Science, Hillsdale College, 30 October 2002. *Boundary Control of the 1D Heat Equation.*

24. Colloquium, Department of Mathematics and Computer Science, Alma College, 29 October 2002. *Boundary Control of the 1D Heat Equation.*

25. Applied Math Seminar, Department of Mathematical Sciences, Michigan Technological University, 17 April 2001. *Adaptive Simulation, the Adjoint State Method, and Optimization.*

26. First Sandia Workshop on Large-Scale PDE-Constrained Optimization, Santa Fe, NM, 6 April 2001. *Adaptive Simulation, the Adjoint State Method, and Optimization.*

27. The Rice Inversion Project Annual Meeting, Houston, Texas, 10 November 2000. *TRIP Projects at Michigan Tech.*

28. Argonne National Laboratory, working group on "Next Generation Optimization Software", 16 October 2000. *An Overview of the Hilbert Class Library.*

29. AD2000: The 3rd International Conference on Automatic Differentiation: From Simulation to Optimization, Nice, France, 20 June 2000. *Automatic Differentiation and the Adjoint State Method.*

30. Applied Math Seminar, Department of Mathematical Sciences, Michigan Technological University, 4 April 2000. *Efficient and automatic implementation of the adjoint state method.*

31. NUMPDES 2000: the Third Forum on Numerics and Modeling for Partial Differential Equations, University of Michigan - Dearborn, 1 April 2000. *Efficient and Automatic Implementation of the Adjoint State Method.*

32. Department of Mathematics, Michigan State University, 29 March 2000. *Object-oriented programming for scientific computing: is it worth it?.*

33. "Emerging Computational Technologies", Department of Computational and Applied Mathematics, Rice University, April 9, 1999. *HCL: linking large-scale optimization with complex simulations.*

34. HSEMB 99 (Houston Society for Engineering in Medicine and Biology), Houston, February 12, 1999. *Material identification via biaxial testing.*

35. Department of Mathematics, Virginia Tech, February 11, 1998. *The Hilbert Class Library: Linking large-scale optimization with complex simulations.*

36. Department of Mathematical Sciences, Montana State University, February 6, 1998. *The Hilbert Class Library: Linking large-scale optimization with complex simulations.*

37. Department of Mathematics and Statistics, Calvin College, February 4, 1998. *The Hilbert Class Library: Linking large-scale optimization with complex simulations.*

38. Department of Mathematics, Whitman College, January 30, 1998. *The Hilbert Class Library: Linking large-scale optimization with complex simulations.*

39. Department of Mathematical Sciences, Michigan Technological University, January 26, 1998. *The Hilbert Class Library: Linking large-scale optimization with complex simulations.*

40. IBM Thomas J. Watson Research Center, August 19, 1997. *C++ classes for linking simulation and optimization.*

41. Fourth SIAM Conference on Mathematical and Computational Issues in the Geosciences, June 16–19, 1997, Albuquerque, NM. *The Hilbert Class Library: C++ classes for optimization.*

42. American Mathematical Society, Meeting of the Central Section, Detroit, Michigan, May 2–4, 1997. *Output Least-Squares Minimization for Recovering Elastic Moduli in an Isotropic Membrane.*

43. Mechanical Engineering Seminar, University of Michigan, April 23, 1997. *Object-Oriented Programming in the design of Mathematical Software: Why and How.*

44. American Mathematical Society, Meeting of the Western Section, Corvallis, Oregon, April 19–20, 1997. *Recovering spatially-varying Lamé parameters from a traction experiment.*

45. Applied Mathematics Seminar, University of Michigan, April 7, 1997. *Recovering spatially-varying Lamé parameters from a traction experiment.*

46. Workshop on object-oriented numerics and reproducible research in computational geophysics, Stanford University, June, 1996. Lectures on *The design and application of the Hilbert Class Library.*

47. The Fourth Annual Object-Oriented Numerics Conference, Mississippi State University, March 27–29, 1996. *The Hilbert Class Library: a library of abstract C++ classes for optimization and inversion.*

48. Applied Mathematics Seminar, University of Michigan, March 11, 1996. *Duality for inverse problems in wave propagation: a simple example.*

49. The Rice Inversion Project Annual Meeting, Houston, Texas, August, 1995. *Object-oriented design for inversion software: a proposal.*

50. The Rice Inversion Project Annual Meeting, Houston, Texas, August, 1995. *Duality for seismic velocity inversion.*

51. Third SIAM Conference on Mathematical and Computational Issues in the Geosciences,1995, San Antonio, Texas. Poster presentation on *The use of convex duality in seismic velocity inversion.*

52. Third SIAM Conference on Mathematical and Computational Issues in the Geosciences,1995, San Antonio, Texas. Poster presentation on *The dual regularization method for seismic velocity inversion.*

53. The Fifteenth International Symposium on Mathematical Programming, Ann Arbor, Michigan, August, 1994. Contributed presentation on *Seismic Velocity Inversion.*

54. The Rice Inversion Project Annual Meeting, Houston, Texas, July, 1994. *An Abstract Analysis of Differential Semblance Optimization.*

55. The Rice Inversion Project Annual Meeting, Houston, Texas, June, 1993. *Comparing objective functions for velocity inversion.*

Teaching experience:

1. Taught in The Merit Workshop at University of Illinois (improving Calculus achievement by underrepresented minority students)

2. Used *Calculus & Mathematica* (a reform Calculus curriculum)

3. Taught in University of Michigan Calculus Program (reform Calculus using Harvard Curriculum)

4. Taught undergraduate mathematics in Malaysia in ITM/MUCIA-Indiana University program

5. Taught graduate course in ordinary differential equations and numerical optimization at the Royal University of Phnom Penh (Cambodia), May 2013, June 2015, and June 2016 (volunteer lecturer for International Mathematical Union Commission on Developing Countries).

6. Use of technology:

   (a) TI-82 Calculator and *Mathematica* for Calculus

   (b) *Matlab* for Numerical Analysis and Partial Differential Equations

   (c) *Maple* and *Mathematica* for Partial Differential Equations

7. Directed several "REUs" (Research Experience for Undergraduates) (summer 1994, summer 1997, 1997-98, spring 2006, spring 2008, summer 2011)

8. Courses taught:

   (a) Complex variables

   (b) History of Mathematics

   (c) Scientific Programming

   (d) Numerical Methods for PDEs

   (e) Numerical Optimization

   (f) Discrete Optimization

   (g) Ordinary Differential Equation and Dynamical Systems

   (h) Continuum Mechanics and Partial Differential Equations

   (i) Inverse Problems and Medical Imaging

   (j) Finite Element Methods for Elliptic BVP

   (k) Numerical Linear Algebra/Elliptic BVP

   (l) BVP in Partial Differential Equations

   (m) Introductory Numerical Analysis

   (n) Ordinary Differential Equations

   (o) Linear Algebra

   (p) Abstract Algebra

   (q) Calculus sequence

   (r) Trigonometry

   (s) Discrete Mathematics

Other professional activities:

1. Chair, Dean Review Committee, Michigan Technological University, Spring 2016.

2. Member, General Education Council, Michigan Technological University, Fall 2012–present.

3. Reviewed textbook proposal on differential equations for SIAM, 2015.

4. Reviewed textbook proposal on applied mathematics for SIAM, 2014.

5. Panelist, *Chairing the Academic Department: Advice and Perspectives from the Pros*, MAA MathFest, Portland, 8 August 2014.

6. Reviewed textbook proposal on computational differential equations for Springer, 2013.

7. Reviewed textbook proposal on computational differential equations for SIAM, 2012.

8. Reviewed book monograph proposal on numerical partial differential equations for SIAM, 2012.

9. Reviewed textbook on Green's functions for CRCPress, 2009.

10. Reviewed textbook on computational science and engineering for SIAM, 2008.

11. Reviewed textbook on numerical partial differential equations for CRC Press, 2008.

12. Reviewed book proposal on Matlab programming for Cambridge University Press, 2007.

13. Reviewed textbook on linear algebra for McGraw-Hill, 2007.

14. Chair, Dean Search Committee, College of Sciences and Arts, Michigan Technological University, 2007-08.

15. Reviewed textbook on numerical methods for differential equations for SIAM, 2006

16. Reviewed textbook on numerical methods for differential equations for Prentice-Hall, 2004

17. Reviewed textbook on numerical analysis for the Prentice-Hall, 2000.

18. Reviewed textbook on numerical methods for Wiley, 1999.

19. Participant, First Annual Los Alamos Computer Science Institute Symposium, Sante Fe, New Mexico, June 7-8, 1999.

20. Refereed papers for:

    (a) *Journal of Mathematical Analysis and Applications*
    (b) *ACM Transactions on Mathematical Software*
    (c) *Optimization and Engineering*
    (d) *Inverse Problems*
    (e) *Mathematics and Mechanics of Solids*
    (f) *Physics Letters A*
    (g) *SIAM Journal on Applied Mathematics*
    (h) *Journal of Optimization Theory and Applications*
    (i) *Mathematical Programming*
    (j) *Optimization*

21. Refereed grant proposals for the National Science Foundation, 1998, 1999, 2000.

22. Presented short course on *Object-oriented programming and C++* for the *Spend a Summer with a Scientist* program (promoting careers in mathematics and science for minority students) at Rice University, 1994.

23. Served as faculty mentor for a Malay instructor, ITM/MUCIA-Indiana University Cooperative Program in Malaysia, 1991–92.

24. Chair, Committee to recognize excellence in teaching, Department of Mathematics, University of Illinois, 1990.