Curriculum Vitae

Kurt Bryan

e-mail: kurt.bryan@rose-hulman.edu

Department of Mathematics

www.rose-hulman.edu/~bryan

Rose-Hulman Institute of Technology

Ph: (812) 877-8485

Terre Haute, IN 47803

U.S. Citizen

EDUCATION

Ph.D. in Mathematics received May, 1990.
University of Washington, Seattle, Washington.

Doctoral research focused on inverse problems related to impedance imaging.

B.A. in Mathematics received May, 1984.
Reed College, Portland, Oregon.

Undergraduate research and thesis focused on techniques in the theory of transcendental numbers.

EMPLOYMENT

Professor of Mathematics, Rose-Hulman Institute of Technology, Terre Haute, IN, 8/05 to present (Assistant Professor 8/93 to 7/99, Associate Professor 8/99 to 7/05), Associate Department Head 7/17-present.

- Teaching and course development

    - Full-year introductory course in calculus, two-quarter sequence in differential equations, probability, statistics, many upper level courses in modeling, analysis (real, complex, vector, functional, harmonic), number theory, partial differential equations, discrete math, financial mathematics, numerical methods, image processing, and senior thesis advising.

    - Four years teaching experience in Rose-Hulman's nationally recognized Integrated First Year Curriculum in Science, Engineering, and Mathematics (IFYCSEM), an innovative full-year freshman course sequence that integrates traditionally distinct subjects such as physics, chemistry, mathematics, and computer science.

    - Developed or substantially revised many courses, including "Principles of Optimization" (with funding from the Lilly Endowment), "Mathematical Modeling" (with funding from the Foundation Coalition), "Calculus

of Variations" (to include modern topics such as optimal control and finite elements), "Partial Differential Equations," "Mathematical Methods in Image Processing," and a course on "Option and Derivative Pricing."

In many of these courses, including the introductory Calculus and DE sequence, I've made integral use of computer algebra software (Maple) and/or Matlab.

- Led research groups (2002 to 2012) and assumed directorship (2004 to 2009) of the Rose-Hulman summer REU program in mathematics, an NSF-funded program in which 8-11 students spend 8 weeks in the summer doing mathematical research with Rose-Hulman faculty. My research groups have produced ten Rose Math Dept. Technical reports (three published in professional journals, several appeared in the Rose Undergraduate Math Journal).

- Co-founder, organizer, frequent speaker in the weekly Rose Math Seminar, now in its 25th year. This weekly seminar was started with several other faculty members. I have given many of the lectures, and we have covered such topics as multigrid methods, wavelets, the algebraic structure of the Fourier transform, combinatorial optimization, image processing, RSA encryption, and inverse problems. We've had over 300 talks by external speakers, Rose faculty and students.

- Organized (in years 1998, 2009, 2011, 2018, 2019, 2020, with others) the annual Rose-Hulman Undergraduate Mathematics conference, a two-day event with 100 to 150 attendees, in which students from around the country present their mathematical research.

- With faculty member John Rickert, developed and taught "Jump Start" for five years, a one week summer program for incoming freshmen who need extra preparation in math, physics, and use of the computer.

- Taught three years in the "Fast Track" calculus program, a summer course for talented incoming freshmen. The course takes these students through the entire first-year calculus sequence in five weeks and makes extensive use of Maple, a computer algebra system. The students are able to begin their Rose career in sophomore-level mathematics courses.

Staff Scientist, Institute for Computer Applications in Science and Engineering (ICASE), NASA Langley Research Center, Hampton, VA, 8/90 to 7/93. Consultant, 7/93-9/94.

- Worked with NASA Langley researchers to derive inverse heat conduction models suitable for use in the non-destructive testing of materials, analyze the models, develop suitable numerical methods, collect and analyze laboratory data to verify the accuracy of the mathematical models.

- With Michael Vogelius of Rutgers University, examined the problem of detecting and identifying cracks in electrical conductors, as a means of non-destructive testing. Devised and implemented numerical algorithms for the location of multiple cracks in a conductor. With University of Michigan researchers, collected experimental data to verify the accuracy of the model and efficiency of the algorithms.

Mathematician/Statistician, Blount Industries, Oregon Cutting Systems Division, Portland, Oregon, 5/84 to 7/90.

- Developed and programmed mathematical and numerical models to investigate the behavior of mechanical systems and manufacturing processes.

- Researched techniques and wrote comprehensive software package for signal processing and time series analysis related to mechanical vibration.

- Developed and utilized a variety of statistical techniques to design and analyze experiments for evaluating product prototypes and laboratory measurement systems.

- Organized, prepared texts for, and taught courses in statistics for engineering and lab personnel.

Visiting and Adjunct Positions

- Applied Mathematics Researcher, Research and Development Group, Crane Payment Innovations (Malvern, PA), 7/14 to 7/15, 6/16 to 8/16, and 6/17 to 8/17. Carried out research on machine learning and computational optics related to new product development, taught short courses in statistics and machine learning.

- Distinguished Visiting Professor at the U.S. Air Force Academy, 7/10 to 5/11; taught multivariable calculus, advised two senior theses, collaborated with USAFA faculty on mathematics course development and research, gave a series of departmental lectures on modern topics in applied mathematics.

- Visiting Professor at Rutgers University, 8/99 to 6/2000 and 1/07 to 5/07; conducted research with Michael Vogelius in the mathematics department, gave several graduate seminar lectures on inverse problems, taught linear algebra and PDE classes.

- Adjunct professor (numerical analysis class) at Christopher Newport University, 1/91 to 5/91.

JOURNAL PUBLICATIONS (* indicates papers written with undergraduates.)

[1] Bryan, K., *Single measurement detection of a discontinuous conductivity.* Comm. in PDE, 15, (1990), pp. 503-514.

[2] Bryan, K., *Numerical recovery of certain discontinuous electrical conductivities.* Inverse Problems, 7, (1991), pp. 827-840.

[3] Bryan, K. and Vogelius, M., *A uniqueness result concerning the identification of a collection of cracks from finitely many electrostatic boundary measurements.* SIAM J. Math. Anal., 23, (1992), pp. 950-958.

[4] Bryan, K. and Vogelius, M., *A computational algorithm to determine crack locations from electrostatic boundary measurements: the case of multiple cracks.* Int. J. Engng Sci., 32, (1994), pp. 579-603.

[5] Bryan, K., *A boundary integral method for an inverse problem in thermal imaging.*, Journal of Mathematical Systems, Estimation, and Control, 7, (1997), pp. 1-27.

[6] Bryan, K., Liepa, V., and Vogelius, M., *Reconstruction of multiple cracks from experimental, electrostatic boundary measurements.* In Inverse Problems and Optimal Design in Industry (Eds. H.W. Engl and J. McLaughlin) Teubner, Stuttgart (1994), pp. 147-167.

[7] Bryan, K., and Caudill, L. *An inverse problem in thermal imaging,* SIAM J. Appl. Math, 59, (1996), pp. 715-735.

[8] Bryan, K., and Vogelius, M. *Effective behavior of clusters of microscopic cracks inside a homogeneous conductor. Applications to impedance imaging.* Asymptotic Analysis, 16 (1998), pp. 141-179.

[9] Bryan, K. and Caudill, L. *Uniqueness for a boundary identification problem in thermal imaging,* Electronic Journal of Differential Equations, C-1, (1997), pp. 23-39.

[10] Bryan, K. and Caudill, L. *Stability and reconstruction for an inverse problem for the heat equation,* Inverse Problems, 14, (1998), pp. 1429-1453.

[11] Bryan, K. and Vogelius, M. *Singular solutions to a nonlinear elliptic boundary value problem originating from corrosion modeling.* Quarterly of Applied Math, (60), 2002, pp. 675-694.

[12] Bryan, K. and Vogelius, M. *A review of selected works on crack identification,* in "Geometric Methods in Inverse Problems and PDE Control," IMA Volume 137, Springer-Verlag, 2004.

[13] *Bryan, K., Ogborne, R., and Vellela, M., *Reconstruction of cracks with unknown transmission condition from boundary data*, Inverse Problems (21), 2005, pp. 21-36.

[14] Bryan, K., and Caudill, L., *Reconstruction of an unknown boundary portion from Cauchy data in n-dimensions* , Inverse Problems (21), 2005, pp 239-256.

[15] *Bryan, K., Krieger, R., and Trainor, N., *Imaging of multiple linear cracks using impedance data*, J. of Computational and Applied Math, March 2007, Volume 200 (1), p. 388-407.

[16] Bryan, K., and Leise, T., *The $25,000,000,000 Eigenvector: The Linear Algebra Behind Google*, SIAM Review, August 2006, Volume 48, Issue 3, p. 569-581.

[17] *Bryan, K., Haugh, J., and McCune, D., *Fast imaging of partially conductive linear cracks using impedance data*, Inverse Problems 22, (2006) 1337-1358.

[18] Bryan, K., and Caudill, L., *Algorithm-independent optimal input fluxes for boundary identification in thermal imaging*, proceedings of the AIP conference, Vancouver BC, June 2007.

[19] Bryan, K., and Leise, T., *Impedance Imaging, Inverse Problems, and Harry Potter's Cloak*, in the Education Section of SIAM Review, Volume 52, No. 2, (May 2010), 359-377.

[20] Bryan, K., *A Tale of Two Masses*, PRIMUS, 21 (2), February 2011, 149-162.

[21] Bryan, K., and Vogelius, M. *Precise bounds for finite time blow-up of solutions to very general one space-dimensional nonlinear Neumann problems*, Quarterly of Applied Mathematics, 69 (1), 2011, pp. 57-78.

[22] Bryan, K., and Vogelius, M. *Transient behavior of solutions to a class of nonlinear boundary value problems*, Quarterly of Applied Mathematics, 69 (2), 2011, pp. 261-290.

[23] Bryan, K., and Leise, T., *Making Do With Less: The Mathematics of Compressed Sensing*, SIAM Review, 55(3), pp. 547-566. http://dx.doi.org/10.1137/110837681.

[24] Bryan, K., Zhang, J., Pervez, N., Cox, M., Jia, X., and Kymissis, I., *Inexpensive photonic crystal spectrometer for colorimetric sensing*, Optics Express, Vol. 21, Issue 4, pp. 4411-4423 (2013), http://dx.doi.org/10.1364/OE.21.004411.

[25] Bryan, K., Walter, D., *Geolocation of Multiple Noncooperative Emitters Using Received Signal Strength: Sparsity, Resolution, and Detectability*, IEEE Access, Vol. 8, 2020, doi:10.1109/ACCESS.2020.3006859.

CONFERENCE PROCEEDINGS

[1] Bryan, K. *Structure characterization with thermal wave imaging.* Proceedings of Review of Progress in Quantitative Nondestructive Testing, UCSD, San Diego, CA, 1992. Plenum Publishers, 1993.

[2] Bryan, K. *An inverse problem in thermal nondestructive testing.* Proceedings of Computation and Control III, University of Montana, Bozeman, MT, July, 1992. Birkhauser, 1993.

[3] Bryan, K. and Caudill, L. *Stability and resolution in thermal imaging.* Proceedings of the Symposium on Parameter Estimation in the proceedings of the 1995 ASME Design Engineering Technical Conference, Boston, 1995.

[4] Bryan, K., and Hariri, H. *Teaching a transport phenomena problem using a symbolic algebra package*, in the proceedings of the Illinois-Indiana meeting of the ASEE, March, 1997.

[5] Anderson, C., Bryan, K., et. al. *Competency Matrix Assessment in an Integrated First-Year Curriculum in Science, Engineering, and Mathematics*, in the proceedings of the Frontiers in Education Conference, November 6-9, 1996, Salt Lake City, Utah.

[6] Bryan, K. *The Rose-Hulman REU in Mathematics*, in the proceedings of the Conference on Promoting Undergraduate Research in Mathematics, (September 2006, Chicago), AMS 2007, pp 125-129, J. Gallian editor.

[7] Walter D., Bryan K., Stephens J., Bullmaster C., and Chakravarthy V., *Localization of RF Emitters using Compressed Sensing with Multiple Cooperative Sensors*, proceedings of NAECON 2012, Dayton OH, July 25-27 2012.

OTHER PUBLICATIONS

[1] Black, K. and Bryan, K., "SIAM Awards Two Prizes at the 2006 Intel International Science and Engineering Fair," SIAM News Vol. 39, No. 6, July/August 2006.

[2] Bryan, K., "Applying for Jobs at an Undergraduate Insitution," SIAM News Vol. 43, No. 9, November 2010.

[3] Bryan, K. and Leise, T., "Cloaking," Princeton Companion To Applied Mathematics, editor Nick Higham, September, 2015.

[4] Bryan, K. "Home Heating," a student project in the SIMIODE repository, (2018), `https://simiode.org/resources/4419`.

[5] Bryan, K. "A Shot in the Water," a student project in the SIMIODE repository, (2018), `https://simiode.org/resources/4498`.

[6] Bryan, K. "Dimensionless Variables and Scaling for Differential Equations" instructional material in the SIMIODE repository, (2018), `https://www.simiode.org/resources/5125`.

[7] Bryan, K. "Stiff Differential Equations" instructional material in the SIMIODE repository, (2019), `https://www.simiode.org/resources/5946`.

[8] Bryan, K. "A Matter of Some Gravity" a student project in the SIMIODE repository, (2019), `https://www.simiode.org/resources/6189`.

[9] Bryan, K., "It's a Blast (Furnace)!", a student project in the SIMIODE repository, (2019), `https://www.simiode.org/resources/6240`.

[10] Bryan, K., "Mirror, Mirror", a student project in the SIMIODE repository, (2019), `https://www.simiode.org/resources/6316`.

[11] Bryan, K., "Unearthing the Truth", a student project in the SIMIODE repository, (2019), `https://www.simiode.org/resources/6351`.

[12] Bryan, K., "Dash It All!", a student project in the SIMIODE repository, (2019), `https://www.simiode.org/resources/6391`.

[13] Bryan, K. "The Matrix Exponential" instructional material in the SIMIODE repository, (2019), `https://www.simiode.org/resources/6423`.

BOOKS

[1] Broughton, S.A., and Bryan, K., *Discrete Fourier Analysis and Wavelets: Applications to Signal and Image Processing*, John Wiley and Sons, Hoboken NJ, 2009. Second edition released in 2018.

[2] Bryan, K., *Ordinary Differential Equations: A Toolbox for Modeling the World*, SIMIODE, Cornwall NY, 2021.

RESEARCH SUPERVISION

Senior Theses

[1] Steven Feng, 2021-2022, "Sparse Approximation for Dictionary Learning"

[2] Zheng Zhang, 2012-2021, "Computed and Simulated Value of Probability of Condorcet Winner"

[3] Haulein McInerney, 2019-2020, "The Matrix Exponential"

[4] Muqing Zheng, 2018-2019, "Cloaking With The Damped Wave Equation"

[5] Maxx Philiposian, 2017-2018, "Producing Quality Images From Reduced Data Via Compressed Sensing"

[6] Matthew Moon, 2017-2018, "Anomaly Detection In Hyperspectral Images"

[7] Daniel Hartung, 2016-2017, "Sparse Approximation for Crack Detection Using Impedance Imaging"

[8] Travis Baumbaugh, 2013-2014, "Optimization of UAV Positions for Geolocation"

[9] Chase Mathison, 2012-2013, "Determining Materials Parameters Via Impedance Measurements"

[10] Casey Shotwell, 2010-2011 (Air Force Academy), "Cloaking for the Heat Equation"

[11] Nichole Stilwell, 2010-2011 (Air Force Academy), "Impedance Imaging for Corrosion Detection"

[12] Kris Williams, 2008-2009, "Pricing Financial Derivatives with Non-Tradable Underlyings"

[13] Steve Torno, 2008-2009, "Morphological Image Segmentation: An Overview with Examples"

REU Research and Technical Reports

All reports available at `https://www.rose-hulman.edu/~bryan/reu2.html`

[1] Sameer Shah and Cynthia Gangi, "Characterizing a Defect in a One-Dimensional Bar," 2002.

[2] Ron Ogborne and Melissa Vellela, "A Thermal Imaging Approach for Finding a Generalized Linear Crack," 2002.

[3] Holly Walrath and Natasha Yarlikina, "Determining the Length of a One Dimensional Bar with Thermal Measurements," 2003.

[4] Nic Trainor and Rachel Krieger, "Fast Reconstruction of Cracks Using Electrical Boundary Measurements," 2003.

[5] Nic Christian and Mat Johnson, "Nondestructive Testing of Thermal Resistances for a Single Inclusion in a Two-Dimensional Domain," 2004.

[6] Janine Haugh and David McCune, "Reconstruction of Partially Conductive Cracks Using Boundary Data," 2004.

[7] Don Brown and Mark Hubenthal, "Time Dependent Thermal Imaging of Circular Inclusions," 2005.

[8] Hilary Spring and Shannon Talbot, "Thermal Imaging of Circular Inclusions Within a Two-Dimensional Region," 2005.

[9] Tom Werne and James Preciado, "Utilizing Thermal Testing for Recovering Voids in Two-Dimensional Regions," 2006.

[10] Breeane Baker, "Thermal Imaging to Recover a Defect in Two or Three-Dimensional Objects," 2006.

[11] Victor Oyeyemi, "Nondestructive Recovery of Voids within a Three-Dimensional Domain using Thermal Imaging," 2006.

[12] Esther Chiew and Vincent Selhorst-Jones, "Determining the Shape of a Resistor Grid Through Boundary Measurements," 2008.

[13] David Kiblinger and Michael Janas, "Electrothermal Imaging in One and Two Dimensions," 2008.

[14] Court Hoang and Kate Osenbach, "Electrical Impedance Imaging of Corrosion on a Partially Accessible Two-Dimensional Region," 2009.

[15] Brooke Phillips and Tess Anderson, "Anti-cloaking: The Mathematics of Disguise," 2009.

[16] Brittany Ambeau, Harris Enniss, and Stefan Schnake, "Nondestructive Electrothermal Detection of Corrosion.," 2011.

[17] Maple So, "Cloaking Against Thermal Imaging," 2011 (winner of Outstanding Poster award at JMM, 2012).

[18] Matthew Charnley and Andrew Rzeznik, "Thermal Detection of Inaccessible Corrosion," 2012, submitted to SIAM Undergraduate Research Online.

[19] Chase Mathison and Laura Booton, "Determining Properties of Metal by Analyzing Chagnes in Impedance," 2012.

Other Student Research Projects

[1] Raymond Prendergast, "Applications of Compressed Sensing to Inverse Problems," winter quarter 2011-12 (first place poster winner at the MESCON 2012 undergraduate conference.)

[2] Mingmin Liu and Xiaohan Ding, "Spectral Estimation From Limited Channel Data," spring quarter 2011-12.

[3] (with D. Walter) Brett Sneed, "Application of Compressed Sensing to Localization of RF Emitters,", fall and winter quarter, 2012-13.

[4] (with D. Walter) Alex Zellner, "Numerical Method for Localization of RF Emitters Using Compressed Sensing,", fall and winter quarter, 2013-14.

[5] (with D. Walter) Rain Dartt, "SLAM Techniques for Localizing RF Emitters,", spring quarter, 2013-14.

[6] Zachary Schafer, "Curvature Sensing for Wavefront Reconstruction" (industrial project for ForeSight Innovations), spring quarter, 2015-16.

[7] Zhen Ni, "Simulation and Analysis for Optimal Strategy of a Bill Dispenser," (industrial project for Crane Payment Innovations), winter/spring 2016-17.

Students in items [3]-[5], as well as senior thesis [8], were part of an interdisciplinary research group run by Deb Walter in ECE from 2013 to 2017, working with funds from the Air Force Research Laboratory in Dayton, Ohio.

GRANTS AND CONTRACTS

[1] (co-PI) "A Proposal to Develop a Course in Optimization and Optimal Design," for $5,000 funded in February, 1994 by the Lilly Endowment. Co-authored with Yosi Shibberu, the grant funded summer support for the development of an interdisciplinary engineering-oriented optimization course at Rose-Hulman.

[2] (PI) "A Proposal to Develop a Course in Mathematical Modeling," for $9,500, funded in May, 1995 by the Foundation Coalition. This grant brought together a team of engineers to help develop a new junior/senior-level course in mathematical modeling using conservation laws.

[3] (co-PI) "Inverse Problems in Thermal Imaging," NSF Grant #DMS-9623279, for $85,000 funded from June 1996 through June 1999. This research grant was written jointly with Lester Caudill at the University of Richmond and funded through the RUI program and Mathematical Science Division of the National Science Foundation.

[4] (co-PI) "Computational Group Theory, Hyperbolic Geometry, Number Theory, and Inverse Problems NSF-REU," #DMS-0097804, for $144,000 funded from 2001 through 2003. This grant (Allen Broughton was the PI) funded a three-year renewal of our mathematics summer REU program; I directed groups of 4 students in the summers of 2002 and 2003.

[5] (PI) "REU Site: Rose-Hulman Undergraduate Research Experience in Mathematics," NSF Grant #DMS-0352940, for $167,000 funded from April 2004 through April 2007. A three year grant to support Rose-Hulman's summer REU ("Research Experiences for Undergraduates") program in mathematics.

[6] (PI) "REU Site: Rose-Hulman Undergraduate Research Experience in Mathematics," NSF Grant #DMS-0647121, for $187,000 funded from April 2007 through April 2010. A three year grant to support Rose-Hulman's summer REU ("Research Experiences for Undergraduates") program in mathematics.

[7] (senior investigator) "REU Site: Rose-Hulman Undergraduate Research Experience in Mathematics," NSF Grant #DMS-1003924, for $310,000 funded from April 2010 through April 2013. A three year grant to support Rose-Hulman's summer REU ("Research Experiences for Undergraduates") program in mathematics.

[8] Funding from the U.S. Air Force, $135,800 to support a position as as Distinguished Visiting Professor in the mathematics department at the U.S. Air Force Academy, July 2010 to May 2011.

CONSULTING

[1] Consultant for ICASE, NASA Langely Research Center, 7/1-7/19/94.

[2] Consultant on NSF grant "Analytical and Numerical Studies of Direct and Inverse Problems for Parabolic Initial-Boundary Value Problems", DMS-0104205, (PI Lester Caudill), 8/15/01-6/30/05.

[3] Short course on compressed sensing, 10/13-10/14/11, and consultant (10/11 to 8/17) for MEI (West Chester PA) (now Crane Payment Innovations).

[4] Consultant for Chromation LLC, 8/11-8/14.

INVITED LECTURES AND PANEL DISCUSSIONS

[1] "Single Measurement Detection and Identification of Inhomogeneities in Impedance Imaging." Annual meeting of the Oregon Academy of Science, University of Portland, Portland, OR, January, 1989.

[2] "A Boundary Integral Technique for an Inverse Problem in Impedance Imaging." Rutgers University, January, 1991.

[3] "Numerical Recovery of Certain Discontinuous Conductivities." AMS Special Session on Inverse Problems, Portland State University, Portland, OR, June, 1991.

[4] "An Inverse Problem in Thermoelasticity." Center for Applied Mathematical Sciences, University of Southern California, November, 1991.

[5] "Detecting Cracks in an Electrical Conductor with Electrostatic Boundary Measurements." University of Washington, Seattle, WA, January, 1992.

[6] "A Uniqueness Result for the Recovery of Multiple Cracks in an Electrical Conductor." Rutgers University, February, 1992.

[7] "Structure Characterization with Thermal Wave Imaging." Review of Progress in Quantitative Nondestructive Testing, University of California at San Diego, July, 1992.

[8] "An Inverse Problem in Thermal Nondestructive Testing." Computation and Control III, Montana State University, Bozeman, MT, August, 1992.

[9] "An Algorithm for the Location of Multiple Cracks in an Electrical Conductor." IMAG, Université Joseph Fourier, Grenoble, France, January, 1993.

[10] "An Inverse Problem for Electrical Crack Detection." North Carolina State University, Raleigh, February, 1993.

[11] "Determination of Multiple Cracks with Electrostatic Experimental Boundary Measurements." IEEE/URSI 1993 Radio Science Meeting, University of Michigan, Ann Arbor, Michigan, June, 1993.

[12] "Sensitivity and Stability for an Inverse Problem in Thermal Imaging." SIAM Annual Meeting, San Diego, July, 1994.

[13] "An Inverse Problem in Thermal Imaging," AMS-IMS-SIAM Summer Research Conference on Electrical Impedance Tomography, Seattle, WA, July, 1995.

[14] "Stability and Resolution in Thermal Imaging," ASME Design Engineering Technical Conferences, Boston, MA, September, 1995.

[15] "An Inverse Problem in Thermal Imaging,", Iowa State University, December, 1995.

[16] "Issues in Integrating Electromagnetics and Vector Calculus", AMS-MAA joint meetings, Baltimore, 1998.

[17] "Integrating Electromagnetics and Vector Calculus in a First Year Curriculum", MAA Mathfest meeting, Toronto, 1998.

[18] "Stability and Reconstruction for an Inverse Problem for the Heat Equation", SIAM annual meeting, Toronto, 1998.

[19] "Singular Solutions to a Nonlinear Elliptic Boundary Value Problem", Rutgers University, April 2000.

[20] "An Introduction to Inverse Problems", Wabash College, January 2004.

[21] "Reconstruction of Internal Cracks with Unknown Transmission Condition", Rensellaer Polytechnic, April 2004.

[22] "Structuring Research to Include Undergraduates" (part of the Project NeXT workshop), Mathfest, August 2004.

[23] "Sustaining Undergraduate Research", MAA session on Initializing and Sustaining Undergraduate Research Projects and Programs, AMS/MAA joint meetings, January 2005.

[24] "Fast Reconstruction of Cracks Using Boundary Data", special session on Inverse Problems, AMS/MAA joint meetings, January 2005.

[25] "Inverse Problems in Transient Thermal Imaging for Nondestructive Testing", minisymposium MS4, SIAM annual conference, Boston, July 2006.

[26] "The $25,000,000,000 Eigenvector: The Linear Algebra Behind Google",

- Rutgers University, March 28, 2007.
- Keynote address #1 at the spring meeting of the Associated Colleges of the Chicago Area, April 8, 2010.
- Keynote address at University of Evanville's MESCON conference, March 27, 2010.
- Florida Gulf Coast University, November 10, 2011.
- Purdue University Calumet, September 28, 2015.
- St. Joseph's College, October 19, 2015.
- Indiana Wesleyan, October 27, 2015.
- Ball State University, November 19, 2015.
- St. Mary's College Notre Dame IN, March 16, 2016.
- Depauw University, May 4, 2016.
- University of Indianapolis, October 25, 2016.

- Manchester University, May 4, 2017.
- Hanover College, November 8, 2017.
- University of Evansville, March 14, 2018.
- Central Connecticut State University, March 26, 2021.

[27] "Blow-up Solutions to Parabolic equations with Nonlinear Boundary Conditions.", Rutgers University, April 5, 2007.

[28] "Inverse Problems in Nondestructive Evaluation" (3 lectures), Abo Akademi, Turku Finland, April 20, 2007.

[29] "How to Thrive as a Mathematician at a Small College,", at the SIAM Education Minisymposium: Professional Development and Career Choices for Students, AMS/MAA joint meetings, Washington DC, January 8, 2009.

[30] "Efficient Imaging of Multiple Cracks via Impedance Tomography," Wright State University, February 6, 2009.

[31] "Rose-Hulman's Summer REU in Mathematics," Wright State University, February 6, 2009.

[32] "New Results on Blow-Up Solutions to the Heat Equation with Nonlinear Neumannn Boundary Conditions," BIRS workshop on "Some Mathematical Problems of Material Science: Effect of Multiple Scales and Extreme Aspect Ratios," Banff CA, February 2010.

[33] "The Mathematics of Cloaking and Invisibility"

- Keynote address #2 at the spring meeting of the Associated Colleges of the Chicago Area, April 8, 2010.
- Colorado School of Mines, October 29, 2010.
- University of Kentucky (SIAM student chapter), March 22, 2016.

[34] "Fast Algorithms for Imaging Cracks with Impedance Data," University Colorado at Denver, September 20, 2010.

[35] "How Can I Do Research in Mathematics? I'm Only An Undergrad!"

- Kansas State University, October 11, 2010.
- Florida Gulf Coast University, January 25, 2013, as part of the ASPIRE conference.

[36] "Seeing the Unseeable: The Mathematics of Inverse Problems," Bellarmine University, February 7, 2011. Part of Bellarmine University's "Mathematics and the Public Good" lecture series, aimed at talented high school students and the general public.

[37] "Thermal Detection of Small Cracks"

- Applied Inverse Problems 2011, Texas A and M University, May 25, 2011.
- Center for Communications Research West, San Diego, February 17, 2012.
- Cornell University, CEE Structures Seminar, April 4, 2012.
- SIAM Annual Meeting, Minneapolis, July 10, 2012.
- Applied Analysis for the Material Sciences, CIRM (Marseilles, France), May 29, 2013.
- University of Houston, March 9, 2018.

[38] "Making Do With Less: An Introduction To Compressed Sensing,"

- Indiana State University, September 28 and October 4, 2011 (2 parts).
- Florida Gulf Coast University, November 9, 2011.
- Kansas State University undergraduate colloquium, September 10, 2012.
- Keynote address, Purdue University, April 5, 2013, as part of their Computational Science and Engineering Student Conference.
- Iowa State University, April 29, 2014, mathematics seminar.
- University of Scranton, September 16, 2014, mathematics seminar.
- Amherst College, October 20, 2014, mathematics seminar.
- Moravian College, March 2, 2015, mathematics seminar.
- Purdue University Calumet, November 14, 2016.
- University of Houston, March 8, 2018.

[39] "An Introduction to Inverse Problems," Cornell University (Dept. of Civil and Environmental Engineering), April 6, 2012.

[40] "Compressed Sensing Techniques for Localization of Radio Frequency Emissions," WISENET (Wireless Intelligent Sensor Networks), Duke University, June 10, 2014.

[41] "Dictionaries and Sparsity for Machine Learning," Florida Gulf Coast University, April 22, 2016.

[42] "Source Identification With Compressed Sensing," Kansas State University, April 25, 2017.

[43] "Picture Perfect: The Mathematics of JPEG Image Compression," Florida Gulf Coast University, February 22, 2019.

[44] "PID Control Theory in an Undergraduate ODE Course," SIMIODE Online Expo, February 13, 2021.

PROFESSIONAL SERVICE

Conference and Minisymposia Organization

[1] Co-organizer for *Rose-Hulman Undergraduate Mathematics Conference* (with Yosi Shibberu) March 1998, with Steve Galinaitis, March 2009, and Joe Eichholz, March 2014, 2018, 2019.

[2] Co-organizer for minisymposium "Inverse Problems in Nondestructive Testing" (with Lester Caudill), SIAM annual meeting, Toronto, July 17, 1998.

[3] Organizer for minisymposium "Inverse Problems in Thermal Imaging" Applied Inverse Problems conference, Vancouver BC, June 2007.

[4] Co-organizer for minisymposium "ODE Modeling in the Driver's Seat" (with Brian Winkel), AMA/MAA 2011 Joint Meetings, New Orleans, January 2011.

[5] Co-organizer for minisymposium "Computational Modeling in the Undergraduate Curriculum" (with Joe Eichholz and Jeff Leader), AMA/MAA 2013 Joint Meetings, San Diego, January 2013.

Refereeing and Editorial Work

[1] Editorial board and referee for PRIMUS, 2008-2018.

[2] Regular referee for Inverse Problems and the Rose-Hulman Undergraduate Mathematics Journal.

[3] Refereeing work for Inverse Problems in Science and Engineering, Journal of Mathematical Analysis and Applications, European Journal of Applied Mathematics, IMA Journal of Applied Mathematics, SIAM Journal on Imaging Sciences, Applied Mathematics Letters, Applicable Analysis and Discrete Mathematics, SIAM Journal of Mathematical Analysis, Mechanical Systems and Signal Processing.

[4] Reviewed book manuscripts for SIAM, World Scientific, Rinton Press, Pearson Education.

Other Service

[1] Reviewer for GRE Mathematics subject exam, 10/11, 6/12, 5/16, 5/21.

[2] Member of SIAM's Visiting Lecturer Program, 2006-2017.

[3] MAA undergraduate poster session judge, AMS/MAA Joint Meetings, 2003, 2004, 2005, 2006, 2009, 2011, 2012, 2013, 2014, 2020.

[4] Developed and taught a series of 12 weekly lessons for advanced 5th grade mathematics students at Clay City Elementary, Clay City IN, Fall 2006.

[5] External reviewer for tenure cases at Colorado College (2006), the University of Evansville (2011), Amherst College (2012) and Simmons University (2019), and reviewer for promotion to full professor at Cornell University (2012).

[6] Treasurer for Indiana's MAA section, 8/2012 to 8/2014.

[7] External examiner for Ph.D. thesis, Åbo Akademi University, 2008.

[8] External Ph.D. committee member for Nic Trainor, Rutgers University Department of Mathematics, April 2012.

[9] External Ph.D. committee member for Matthew Charnley, Rutgers University Department of Mathematics, March 2019.

[10] Regular contributor to the "Media Highlights" column in the College Math Journal, January 2012 to present.

HONORS AND AWARDS

Selected by the board of trustees as the outstanding Rose-Hulman faculty scholar for the 2004-2005 academic year.

SPECIAL SKILLS

Extensive programming experience in the "C" language. Experienced in Mathematica, Maple, and Matlab.

PROFESSIONAL MEMBERSHIPS

Society for Industrial and Applied Mathematics (SIAM)
Mathematical Association of America (MA)
Institute of Electrical and Electronics Engineers (IEEE)