C U R R I C U L U M   V I T A E

Jeffrey Todd Borggaard

Mathematics Office
McBryde Hall, Mail Code 0123
225 Stanger Street
Virginia Tech
Blacksburg, VA 24061

ORCiD: 0000-0002-4023-7841
Scopus Author ID: 6603003380
ResearcherID: I-5585-2017

Education

1986	B.S.,	Mechanical Engineering	Worcester Polytechnic Institute
1988	M.S.,	Mechanical Engineering	Worcester Polytechnic Institute
1990	M.S.,	Applied Mathematics	Worcester Polytechnic Institute
1995	Ph.D.,	Mathematics	Virginia Tech

Ph.D. Dissertation

"The Sensitivity Equation Method for Optimal Design." Major Professor–John A. Burns

Professional Experience

1986–1988	Teaching and Research Assistant,	Worcester Polytechnic Institute, Worcester, MA
1988–1990	Mechanical Engineer,	Naval Underwater Systems Center, New London, CT
1990–1994	Teaching and Research Assistant,	Virginia Tech, Blacksburg, VA
1991	Consultant,	Cadkey, Inc., Manchester, CT
1995–1996	Research Assistant Professor,	Virginia Tech, Blacksburg, VA
1997–1998	NSF Post-Doctoral Associate,	Cornell University, Ithaca, NY
1998–2002	Assistant Professor,	Virginia Tech, Blacksburg, VA
2002–2006	Associate Professor,	Virginia Tech, Blacksburg, VA
2003	Visiting Scientist,	Air Force Research Laboratory, Dayton, OH
2007	Visiting Scientist,	Air Force Research Laboratory, Dayton, OH
2006–present	Professor,	Virginia Tech, Blacksburg, VA

Research Interests

My research interest is in the area of fluid flow control which requires expertise in the following areas: Applied and Computational Mathematics, Computational Fluid Dynamics, Computational Statistics, Control Theory, Dynamical Systems, Numerical Analysis, Partial Differential Equations, Optimization, Reduced-Order Modeling, Scientific Computing and Visualization, Sensitivity Analysis, and Uncertainty Quantification.

Honors

Pi Tau Sigma (Mechanical Engineering Honor Society, 1984)
Pi Mu Epsilon (Mathematics Honor Society, 1986)
Graduation with Distinction (Worcester Polytechnic Institute, 1986)
Performance Award (Naval Underwater Systems Center, 1989)
Letter of Commendation (Naval Underwater Systems Center, 1990)
Air Force AASERT Fellowship (Virginia Tech, 1992–1994)
National Science Foundation Post-Doctoral Fellow (Cornell University, 1997–1998)
Air Force Presidential Early Career Award for Scientists and Engineers (Virginia Tech, 2000)
National Research Council Summer Faculty Fellowship (Virginia Tech, 2003)
Virginia Tech Math Club Professor of the Year (Virginia Tech, 2004)
American Society of Engineering Education Summer Faculty Fellowship (Virginia Tech, 2007)

Sponsored Research

"Control and Optimization Tools for Systems Governed by Nonlinear Partial Differential Equations," Air Force Office of Scientific Research, 2000–2005, $500,000.

"Southeastern Atlantic Regional Conference on Differential Equations," National Science Foundation, 2000–2001, $7,000 (used for student/new Ph.D. travel reimbursement).

"Industrial Applications of Flow Sensitivity Calculations," AeroSoft, Inc., 2000, $5,000.

"Analysis and Design Tools for Active Control of Combustion," (with E. Cliff), STTR to AFOSR with AeroSoft, Inc., 2000–2001, $15,000.

"A Study of Geometric Sensitivities in Turbulent Flows," (with E. Cliff), STTR to AFOSR with AeroSoft, Inc., 2002, $33,000.

"Computational Methods for Design, Control and Optimization of Micro Air Vehicles," (with J. Burns, E. Cliff and T. Iliescu), Air Force Office of Scientific Research, 2003–2006, $600,000.

"Scientific Computing Research Environments in Mathematical Sciences (SCREMS)," (with T. Iliescu), National Science Foundation, 2003–2005, $153,000.

"Computation and Analysis of Reduced-Order Models for Distributed Parameter Systems," (with C. Beattie, S. Gugercin and T. Iliescu), National Science Foundation, 2005–2008, $431,342.

"High Performance Parallel Algorithms for Improved Reduced-Order Modeling," (with C. Beattie, S. Gugercin and T. Iliescu), Air Force Office of Scientific Research, 2005–2007, $552,369.

"Reduced-Order Modeling for Optimization and Control of Complex Flows," (with T. Iliescu), Air Force Office of Scientific Research, 2007–2010, $391,021.

"Improved Parameterization of Groundwater Flow Models using Interferograms and Adjoint Sensitivity Analysis," (with T. Burbey and S. Sharp), National Science Foundation, 2010–2012, $260,000.

"Transcending POD: Model Reduction for Complex Fluid Flows," (with T. Iliescu and J.P. Roop), National Science Foundation, 2010-2013, $383,389.

"Advanced Computer Design Tools for Modeling, Design, Control, Optimization and Sensitivity Analysis of Integrated Whole Building Systems," (with J. Burns, E. Cliff, S. Gugercin, T. Herdman, T. Iliescu, M. Marathe and L. Zietsman), Department of Energy (through Penn State University), 2010-2015, $1,463,459.

"Residual-based Methods for Controlling Discretization Error in CFD," (with C. Roy), Air Force Office of Scientific Research, 2012–2015, $389,643.

"Sixth Annual Graduate Student Mini-conference on Computational Mathematics," (with L. Zietsman), National Science Foundation, 2014–2015, $8,966 (used for student and advisor travel reimbursement).

"Investigation of Reduced Order Fire Modeling for Improved Safety and Response in Underground Coal Mines," (with K. Luxbacher, S. Gugercin, B. Lattimer, and S. Schafrik), National Institute for Occupational Safety and Health, 2014–2019, $1,247,839.

"Interpolatory Model Reduction for the Control of Fluids," (with S. Gugercin), National Science Foundation, 2015–2018, $320,000.

"Efficient Algorithms for Optimal Control of Time-Periodic and Nonlinear Systems," (with C. Beattie and S. Gugercin), National Science Foundation, 2018–2021, $280,000.

"Collaborative Research: Nonlinear Balancing: Reduced Models and Controllers," (with S. Gugercin and B. Kramer), National Science Foundation, 2022–2024, $469,799 (VT portion).

Proceedings Edited

Optimal Design and Control, Edited by J.T. Borggaard, J.V. Burkardt, M.D. Gunzburger and J.M. Peterson, Birkhäuser, Boston, 1995, xii+286 pages.

Computational Methods for Optimal Design and Control, Edited by J. Borggaard, J. Burns, E. Cliff and S. Schreck, Birkhäuser, Boston, 1998, xii+460 pages.

Refereed Journal Articles

1. Boundary Element Implicit Differentiation Equations for Design Sensitivities of Axisymmetric Structures (with S. Saigal and J. H. Kane), *International Journal of Solids and Structures*, Vol. 25, No. 5, pages 527–538 (1989) (doi).

2. Highly Accurate Evaluation of System Matrices for Curved Boundary Elements (with J. H. Kane and J. Turi), *Computers and Structures*, Vol. 40, No. 4, pages 885–892 (1991) (doi).

3. A PDE Sensitivity Equation Method for Optimal Aerodynamic Design (with J. Burns), *Journal of Computational Physics*, Vol. 136, pages 366–384, (September 1997) (doi).

4. A Continuous Sensitivity Equation Approach to Optimal Design in Mixed Convection (with D. Pelletier and É. Turgeon), *Numerical Heat Transfer, Part A: Applications*, Vol. 38, No. 8, pages 869–885 (2000) (doi).

5. On Efficient Solutions to the Continuous Sensitivity Equation Using Automatic Differentiation (with A. Verma), *SIAM Journal on Scientific Computing*, Vol. 22, No. 1, pages 39–62 (2001) (doi).

6. Parametric Uncertainty Analysis for Thermal Fluid Calculations (with D. Pelletier and É. Turgeon), *Journal of Nonlinear Analysis: Series A, Theory and Methods*, Vol. 47, pages 4533–4543 (2001) (doi).

7. Reduced Order Controllers for Burgers' Equation with a Nonlinear Observer (with J. Atwell and B.B. King), *International Journal of Applied Mathematics and Computer Science*, Vol. 11, No. 6, pages 1311–1330 (2001) (link).

8. A General Continuous Sensitivity Equation Formulation for Complex Flows (with É. Turgeon and D. Pelletier), *Numerical Heat Transfer: Part B, Fundamentals*, Vol. 42, No. 6, pages 485–498 (2002) (doi).

9. Applications of Continuous Sensitivity Equations to Flows with Temperature-Dependent Properties (with É. Turgeon and D. Pelletier), *Numerical Heat Transfer: Part A, Applications*, Vol. 44, No. 6, pages 611-624 (2003) (doi).

10. Adaptivity, Sensitivity, and Uncertainty: Toward Standards of Good Practice in Computational Fluid Dynamics (with D. Pelletier, É. Turgeon and D. Lacasse), *AIAA Journal*, Vol. 41, No. 10, pages 1925–1933 (2003).

11. A General Continuous Sensitivity Equation Formulation for the $k - \epsilon$ Model of Turbulence (with É. Turgeon and D. Pelletier), *International Journal of Computational Fluid Dynamics*, Vol. 18, No. 1, pages 29–46 (2004).

12. Simulating the Fate of Subsurface-Banded Urea (with S.B. Shah and M.L. Wolfe), *Nutrient Cycling in Agroecosystems*, Vol. 70, pages 47–66 (2004).

13. A Second-order Sensitivity Equation Method for Laminar Flows (with S. Étienne, J.-N. Mahieu and D. Pelletier), *International Journal of Computational Fluid Dynamics*, Vol. 19, No. 2, pages 143–157 (2005).

14. Application of a Sensitivity Equation Method to Turbulent Flows with Heat Transfer (with E. Colin, S. Étienne and D. Pelletier), *International Journal of Thermal Sciences*, Vol. 44, No. 11, pages 1024–1038 (2005).

15. A Continuous Sensitivity Equation Method for Time-dependent Incompressible Laminar Flows (with H. Hristova, S. Étienne, and D. Pelletier), *International Journal for Numerical Methods in Fluids*, Vol. 50, No. 7, pages 817–844 (2006).

16. A General Sensitivity Equation Formulation for Turbulent Heat Transfer (with E. Colin, S. Étienne and D. Pelletier), *Numerical Heat Transfer: Part B, Fundamentals*, Vol. 49, No. 2, pages 125–153 (2006).

17. Approximate Deconvolution Boundary Conditions for Large Eddy Simulation (with T. Iliescu), *Applied Math Letters*, Vol. 19, No. 8, pages 735–740 (2006).

18. An Improved Continuous Sensitivity Equation Method for Optimal Shape Design in Mixed Convection (with R. Duvigneau and D. Pelletier), *Numerical Heat Transfer: Part B, Fundamentals*, Vol. 50, No. 1, pages 1–24 (2006).

19. Interval-Based Reduced-Order Models for Unsteady Fluid Flow (with A. Hay and D. Pelletier), *International Journal of Numerical Analysis and Modeling*, Vol. 4, Nos. 3-4, pages 353–367 (2007). (link)

20. A Continuous Second Order Sensitivity Equation Method for Time-Dependent Incompressible Laminar Flows (with F. Ilinca and D. Pelletier), *International Journal for Numerical Methods in Fluids*, Vol. 55, No. 6, pages 565–587 (2007).

21. Application of a Sensitivity Equation Method to the $k - \epsilon$ Model of Turbulence (with S. Etienne, D. Pelletier and É. Turgeon), *Optimization and Engineering*, Vol. 8, No. 3, pages 341–372 (2007). (doi)

22. The Sensitivity Equation Method in Fluid Mechanics (with S. Etienne, A. Hay and D. Pelletier), *European Journal of Computational Mechanics*, Vol. 17, No. 1–2, pages 31–61 (2008). (doi)

23. A Two-Level Discretization Method for the Smagorinsky Model (with T. Iliescu, H. Lee, J.P. Roop and H. Son), *SIAM Journal of Multiscale Modeling and Simulations*, Vol. 7, No. 2, pages 599–621 (2008). (doi)

24. An Improved Penalty Method for Power-Law Stokes Problems (with T. Iliescu and J.P. Roop), *Journal of Computational and Applied Mathematics*, Vol. 223, No. 2, pages 646–658 (2009). (doi)

25. A Bounded Artificial Viscosity Large Eddy Simulation Model (with T. Iliescu and J.P. Roop), *SIAM Journal on Numerical Analysis*, Vol. 47, No. 1, pages 622–645 (2009). (doi)

26. Local Improvements to Reduced-Order Models Using Sensitivity Analysis of the Proper Orthogonal Decomposition (with A. Hay and D. Pelletier), *Journal of Fluid Mechanics*, Vol. 629, pages 41–72 (2009). (doi)

27. Reduced-Order Models for Parameter Dependent Geometries Based on Shape Sensitivity Analysis (with I. Ahktar, A. Hay and D. Pelletier), *Journal of Computational Physics*, Vol. 229, No. 4, pages 1327–1352 (2010). (doi)

28. Shape Sensitivity Analysis in Flow Models Using a Finite-Difference Approach (with I. Akhtar and A. Hay), *Mathematical Problems in Engineering*, Vol. 2010, Article ID 209780, 22 pages (2010). (doi)

29. Artificial Viscosity Proper Orthogonal Decomposition (with T. Iliescu and Z. Wang), *Mathematical and Computer Modelling*, Vol. 53, No. 1–2, pages 269–279 (2011). (doi)

30. Two-Level Discretizations of Nonlinear Closure Models for Proper Orthogonal Decomposition (with I. Akhtar, T. Iliescu and Z. Wang), *Journal of Computational Physics*, Vol. 230, No. 1, pages 126–146 (2011). (doi)

31. On the Use of Sensitivity Analysis in Model Reduction to Predict Flows for Varying Inflow Conditions (with I. Akhtar and A. Hay), *International Journal for Numerical Methods in Fluids*, Vol. 68, No. 1, pages 122–134 (2012). (doi)

32. Two-Level Discretization of the Navier-Stokes Equations with r-Laplacian Subgridscale Viscosity (with T. Iliescu and J.P. Roop), *Numerical Methods for Partial Differential Equations*, Vol. 28, No. 3, pages 1056–1078 (2012). (doi)

33. A New Closure Strategy for Proper Orthogonal Decomposition Reduced-Order Models (with I. Akhtar, T. Iliescu and Z. Wang), *Journal of Computational and Nonlinear Dynamics*, Vol. 7, No. 034503, pages 1–6 (2012). (doi)

34. Proper Orthogonal Decomposition Closure Models for Turbulent Flows: A Numerical Comparison (with I. Akhtar, T. Iliescu and Z. Wang), *Computer Methods in Applied Mechanics and Engineering*, Vols. 237–240, pages 10–26 (2012). (doi)

35. Using Dominant Modes for Optimal Feedback Control of Aerodynamic Forces (with I. Akhtar, J. Burns and M. Naqvi), *Journal of Aerospace Engineering*, Vol. 227, pages 1859–1869 (2013). (doi)

36. Sensitivity and Uncertainty Quantification of Random Distributed Parameter Systems (with V. Leite Nunes and H.-W. van Wyk), *Mathematics in Engineering, Science and Aerospace*, Vol. 4, No. 2, pages 117–129 (2013). (link)

37. A New Zonation Algorithm with Parameter Estimation Using Hydraulic Head and Subsidence Observations (with M. Zhang, T. Burbey, and V. Leite Nunes), *Groundwater*, Vol. 52, No. 4, pages 514–524 (2014). (doi)

38. Principal Interval Decomposition Framework for POD Reduced-Order Modeling of Convective Boussinesq Flows (with O. San), *International Journal for Numerical Methods in Fluids*, Vol. 78, No. 1, pages 37–62 (2015). (doi)

39. Gradient-based Estimation of Uncertain Parameters for Elliptic Partial Differential Equations (with H.-W. van Wyk), *Inverse Problems*, Vol. 31, No. 065008 (2015). (doi)

40. Development, Validation and Application of a Coupled Reduced-order CFD Model for Building Control Applications (with D. Kim, J. E. Braun, and E. M. Cliff), *Building and Environment*, Vol. 93, No. 2, pages 97–111 (2015). (doi)

41. Using Functional Gains for Effective Sensor Location in Flow Control: A Reduced-order Modelling Approach (with I. Akhtar, J. Burns, H. Imtiaz, and L. Zietsman), *Journal of Fluid Mechanics*, Vol. 781, pages 622–656 (2015). (doi)

42. A Goal-Oriented Reduced-Order Modeling Approach for Nonlinear Systems (with Z. Wang and L. Zietsman), *Computers and Mathematics with Applications*, Vol. 71, No. 11, pages 2155–2169 (2016). (doi)

43. Optimal Control of Indoor-air Cooling in Buildings Using a Reduced Order Model (with S. Ben Ayed, D. Kim, and E. M. Cliff), *Energy*, Vol. 116, No. 1, pages 1191–1204 (2016). (doi)

44. Error Transport Equation Boundary Conditions for the Euler and Navier-Stokes Equations (with J. M. Derlaga, T. S. Phillips, and C. J. Roy), *Journal of Computational Physics*, Vol. 330, pages 46–64 (2017). (doi)

45. Learning-based Robust Stabilization for Reduced-Order Models of 2D and 3D Boussinesq Equations (with M. Benosman, O. San, and B. Kramer), *Applied Mathematical Modelling*, Vol. 49, pages 162–181 (2017). (doi)

46. Thermal Morphing Anisogrid Smart Space Structures Part 2: Ranking of Geometric Parameter Importance, Trust Region Optimization, and Performance Evaluation (with A. Phoenix and P. Tarazaga), *Journal of Vibration and Control*, Vol. 24, No. 13, pages 2873–2893 (2018). (doi)

47. Computing Functional Gains for Designing More Energy-Efficient Buildings Using a Model Reduction Framework (with I. Akhtar and J. Burns), *Fluids*, Vol. 3, No. 4-97 (2018). (doi)

48. Interpolatory Model Reduction of Parameterized Bilinear Dynamical Systems (with A. Carracedo Rodriguez and S. Gugercin), *Advances in Computational Mathematics*, Vol. 44, No. 6, pages 1887–1916 (2018). (doi)

49. GPU-Accelerated Particle Methods for Evaluation of Sparse Observations for Inverse Problems Constrained by Diffusion PDEs (with N. Glatt-Holtz and J. Krometis), *Journal of Computational Physics*, Vol. 391, No. 15, pages 142–154 (2019). (doi) (arXiv)

50. On Bayesian Consistency for Flows Observed Through a Passive Scalar (with N. Glatt-Holtz and J. Krometis), *The Annals of Applied Probability*, Vol. 30, No. 4, pages 1762–1783 (2020). (doi) (arXiv)

51. A Bayesian Approach to Estimating Background Flows from a Passive Scalar (with N. Glatt-Holtz and J. Krometis), *SIAM/ASA Journal on Uncertainty Quantification*, Vol. 8, No. 3, pages 1036–1060 (2020). (doi) (arXiv)

52. Robust Nonlinear Estimation Using Reduced-Order Models (with M. Benosman), *International Journal of Control*, Vol. 94, No. 5, pages 1309–1320 (2021). (doi)

53. Data-driven Robust State Estimation for Reduced-order Models of 2D Boussinesq equations with Parametric Uncertainties (with M. Benosman), *Computers and Fluids*, Vol. 214, No. 104773 (2021). (doi)

54. Extremum Seeking-Based Observer Design of Coupled Thermal and Fluid Systems (with M. Benosman and S. Koga), *International Journal of Adaptive Control and Signal Processing*, Vol. 35, No. 7 (2021). (doi)

55. Quantum Distance to Uncontrollability and Quantum Speed Limits (with D. Burgarth and Z. Zimborás), *Physical Review A*, Vol. 105, No. 042402, 2022. (doi)

56. Performance Assessment of Energy-preserving, Adaptive Time-step Variational Integrators (with H. Sharma, M. Patil, and C. Woolsey), *Communications in Nonlinear Science and Numerical Simulation*, Vol. 114, No. 106646, 2022. (doi)

57. Nonlinear Balanced Truncation: Part 1–Computing Energy Functions (with B. Kramer, S. Gugercin, and L. Balicki), submitted. (arXiv)

58. A Statistical Framework for Domain Shape Estimation in Stokes Flows (with N. Glatt-Holtz and J. Krometis), submitted. (arXiv)

Refereed Proceedings and Book Chapters

1. Large-Scale Reynolds Averaged Navier-Stokes Simulations of Flow Around and Endwall Mounted Cylinder Using Optimal Cray Techniques (with C. A. Wagner, D. C. Brondum, A. Zachary and L. J. Alperi), in *Proceedings of AIAA 9th Computational Fluid Dynamics Conference*, Buffalo, NY, pages 353–358, AIAA Paper 89-1965 (June 1989). (doi)

2. Sensitivity Calculations for a 2D, Inviscid, Supersonic Forebody Problem (with J. Burns, E. Cliff and M. Gunzburger), in *Identification and Control in Systems Governed by Partial Differential Equations*, H. T. Banks, R. H. Fabiano and K. Ito editors, SIAM, Philadelphia, pages 14–25, (1993). (Also appeared as ICASE Report No. 93-13)

3. On Control Design for a Fluid-Structure Interaction Problem (with T. L. Herdman and J. Turi), in *Proceedings of 1993 IEEE Conference on Aerospace Control Systems*, pages 236–242 (May 1993) (doi).

4. A Sensitivity Equation Approach for the Optimal Design of Nozzles (with J. Burns), in *Proceedings of AIAA 5th Symposium on Multidisciplinary Analysis and Optimization*, pages 232–241, AIAA Paper 94-4274 (September 1994). (doi)

5. On an Application of the Boundary Element Method to Study Flow Induced Vibrations (with T. L. Herdman and J. Turi) in *Applied Mechanics in the Americas*, L.A. Godoy, S.R. Idelsohn, P.A.A. Laura and D.T. Mook editors, Vol. 2, Sanre Fi, Argentina, pages 317–321 (January 1995).

6. On the Presence of Shocks in Domain Optimization of Euler Flows, in *Flow Control*, M. Gunzburger editor, Springer-Verlag, pages 35–48 (1995).

7. A Sensitivity Equation Approach to Shape Optimization in Fluid Flows (with J. Burns), in *Flow Control*, M. Gunzburger editor, Springer-Verlag, pages 49–78 (1995). (Also appeared as ICASE Report No. 94-8)

8. Algorithms for Flow Control and Optimization (with J. Burkardt, J. Burns, E. Cliff, M. Gunzburger, H. Kim, H. Lee, J. Peterson, A. Shenoy and X. Wu) in *Optimal Design and Control*, J. Borggaard, J. Burkardt, M. Gunzburger and J. Peterson editors, Birkhäuser, pages 97–116 (April 1995).

9. On Active Control of Flow Induced Vibrations (with T. L. Herdman and J. Turi) in *Proceedings of the 34th IEEE Conference on Decision and Control*, pages 3725–3729 (December 1995) (doi).

10. Computing Design Sensitivities Using an Adaptive Finite Element Method (with D. Pelletier) in *Proceedings of the 27th AIAA Computational Fluid Dynamics Conference*, AIAA Paper 96-1938 (June 1996). (doi)

11. Asymptotically Consistent Gradients in Optimal Design (with J. Burns), in *Multidisciplinary Design Optimization: State of the Art*, N. Alexandrov and M. Hussaini editors, SIAM, Philadelphia, pages 303–314, (1997).

12. On Optimal Design Using an Adaptive Finite Element Method (with D. Pelletier) in *Proceedings of the First International Conference on Nonlinear Problems in Aeronautics and Aerospace*, S. Sivasundaram editor, Embry-Riddle Aeronautical University Press, pages 33–40 (1997).

13. Optimal Shape Design in Forced Convection Using Adaptive Finite Elements (with D. Pelletier) in *Proceedings of the 36th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 98-0908 (January 1998). (doi)

14. Observations in Adaptive Refinement Strategies for Optimal Design (with D. Pelletier), in *Computational Methods for Optimal Design and Control*, J. Borggaard, J. Burns, E. Cliff and S. Schreck editors, Birkhäuser, pages 59–76, (1998).

15. A Continuous Sensitivity Equation Approach to Optimal Design in Mixed Convection (with D. Pelletier and É. Turgeon), in *Proceedings of the 1999 AIAA Thermophysics Conference*, AIAA Paper Number 99-3625 (June 1999). (doi)

16. A Two-Dimensional Model for Simulating the Fate of Subsurface-Banded Nitrogen (with S. Shah and M.L. Wolfe), in *Proceedings of the 1999 ASAE Annual International Meeting*, ASAE Paper Number 99-2140 (July 1999).

17. A Continuous Sensitivity Equation Method for Conduction and Phase Change Problems (with D. Pelletier and J.-F. Hétu), in *Proceedings of the 38th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2000-0881 (January 2000). (doi)

18. A Study of Optimal Cooling Strategies in Thermal Processes (with D. Pelletier and É. Turgeon), in *Proceedings of the 38th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2000-0563 (January 2000). (doi)

19. Recent Advances in Numerical Techniques for the Design and Analysis of COIL Systems (with W. Eppard, W. McGrory, A. Godfrey and E. Cliff), in *Proceedings of the 31st AIAA Plasmadynamics and Lasers Conference*, AIAA Paper Number 2000-2576 (June 2000). (doi)

20. A General Continuous Sensitivity Equation Formulation for Complex Flows (with D. Pelletier and É. Turgeon), in *Proceedings of the 8th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Design*, AIAA Paper Number 2000-4732 (September 2000). (doi)

21. A Continuous Sensitivity Equation Method for Flows with Temperature Dependent Properties (with D. Pelletier and É. Turgeon), in *Proceedings of the 8th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Design*, AIAA Paper Number 2000-4821 (September 2000). (doi)

22. Sensitivity Analysis for Chemical Laser Design: A Model Problem (with E. Cliff), in *Proceedings of the 2000 IEEE International Conference on Control Applications*, pages 519–523 (September 2000) (doi).

23. Sensitivity and Uncertainty Analysis for Variable Property Flows (with D. Pelletier and É. Turgeon), in *Proceedings of the 39th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2001-0140 (2001). (doi)

24. Adaptivity, Sensitivity and Uncertainty: Towards Standards in CFD (with D. Lacasse, D. Pelletier and É. Turgeon), in *Proceedings of the 39th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2001-0192 (2001). (appeared in *AIAA Journal* in 2003) (doi)

25. A Sensitivity Equation Method for Conduction and Phase Change Problems (with D. Pelletier), in *Nonsmooth/Nonconvex Mechanics: Modeling, Analysis and Numerical Methods*, (Nonsmooth Optimization and Applications Series, Volume 45), D. Gao, R. Ogden and G. Stavroulakis, editors, Kluwer Academic, pages 43–68 (2001).

26. Application of a Sensitivity Equation Method to the k–ϵ Model of Turbulence (with É. Turgeon and D. Pelletier), in *Proceedings of the 15th AIAA Computational Fluid Dynamics Conference*, AIAA Paper Number 2001-2534 (2001). (doi)

27. A General Continuous Sensitivity Equation Formulation for the k–ϵ Model of Turbulence (with É. Turgeon and D. Pelletier), in *Proceedings of the 15th AIAA Computational Fluid Dynamics Conference*, AIAA Paper Number 2001-3000 (2001). (doi)

28. Sensitivity Analysis with Sliding Boundary Conditions (with E. Cliff and A. Godfrey), in *Proceedings of the 40th AIAA Aerospace Sciences Meeting and Exhibition*, AIAA Paper Number 2002-0100 (2002). (doi)

29. Sensitivity and Uncertainty Analysis for Turbulent Flows (with S. Étienne, D. Pelletier and É. Turgeon), in *Proceedings of the 40th AIAA Aerospace Sciences Meeting and Exhibition*, AIAA Paper Number 2002-0985 (2002). (doi)

30. Reliable Sensitivity Analysis via an Adaptive Sensitivity Equation Method (with D. Pelletier, É. Turgeon and S. Étienne), in *Proceedings of the 3rd Theoretical Fluid Mechanics Meeting*, AIAA Paper Number 2002-2758 (2002). (doi)

31. A Continuous Control Design Method (with J. Burns), in *Proceedings of the 3rd Theoretical Fluid Mechanics Meeting*, AIAA Paper Number 2002-2989 (2002). (doi)

32. On Sensitivity Analysis for Problems with Numerical Noise (with D. Pelletier and K. Vugrin), in *Proceedings of the 9th AIAA Multidisciplinary Analysis and Optimization Meeting*, AIAA Paper Number 2002-5553 (2002). (doi)

33. Parametric Uncertainty Analysis in a Phase Change Model (with J.-F. Hètu and D. Pelletier), in *Proceedings of the 9th AIAA Multidisciplinary Analysis and Optimization Meeting*, AIAA Paper Number 2002-5601 (2002). (doi)

34. Second-Order Sensitivity Analysis for Conjugate Phase-Change Problems (with D. Pelletier and C. Winter), in *Proceedings of the 41st Aerospace Sciences Meeting and Exhibition*, AIAA Paper Number 2003-0512 (2003). (doi)

35. A Second Order Sensitivity Equation Method for Laminar Flows (with S. Étienne, J.-N. Mahieu and D. Pelletier), in *Proceedings of the 10th Annual Conference of the CFD Society of Canada*, (2003).

36. Sensitivity Analysis of Transient Non-Linear Heat Conduction (with S. Étienne, H. Hristova, J.-N. Mahieu and D. Pelletier), in *Proceedings of the 10th Annual Conference of the CFD Society of Canada*, (2003).

37. A Sensitivity Equation Method for Turbulent Heat Transfer (with E. Colin, S. Étienne and D. Pelletier), in *Proceedings of the 36th AIAA Thermophysics Conference*, AIAA Paper Number 2003-3636 (2003). (doi)

38. Optimization of an Integrated Actuator Placement and Robust Control Scheme for Distributed Parameter Processes Subject to Worst-Case Spatial Disturbance Distribution (with M. Demetriou), in *Proceedings of the 2003 American Control Conference*, (2003) (doi).

39. Application of a Sensitivity Equation Method to Transient Non-Linear Heat Conduction (with H. Hristova, S. Etienne and D. Pelletier), in *Proceedings of the 42nd AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2004-0495 (2004). (doi)

40. Second Order Sensitivity and Uncertainty Analysis of Laminar Airfoil Flows (with J. Mahieu, D. Pelletier and J. Trepanier), in *Proceedings of the 42nd AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2004-0742 (2004). (doi)

41. Application of a Sensitivity Equation Method to Turbulent Flows with Heat Transfer (with E. Colin, S. Etienne and D. Pelletier), in *Proceedings of the 42nd AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2004-1290 (2004). (doi)

42. Sensitivity Equations for the Design of Control Systems (with J. Vance), in *Proceedings of the Sixth IASTED International Conference on Control and Applications*, IASTED Paper Number 441-050 (2004).

43. Computational Challenges in Control of Partial Differential Equations (with J. Burns and L. Zietsman), in *Proceedings of the 2nd AIAA Flow Control Conference*, AIAA Paper Number 2004-2526 (2004). (doi)

44. Optimization of a joint sensor placement and robust estimation scheme for distributed parameter processes subject to worst case spatial disturbance distributions (with M. Demetriou), in *Proceedings of the 2004 American Control Conference*, (2004).

45. A Continuous Sensitivity Equation Method for Time-Dependent Incompressible Laminar Flows (with H. Hristova, S. Etienne and D. Pelletier), in *Proceedings of the 34th AIAA Fluid Dynamics Conference and Exhibit*, AIAA Paper Number 2004-2630 (2004). (doi)

46. On Strong Convergence of Feedback Operators for Non-Normal Distributed Parameter Systems (with J. Burns, E. Vugrin and L. Zietsman), in *Proceedings of the 43rd IEEE Conference on Decision and Control*, IEEE Paper Number WeA04.5, pages 1526–1531, (2004) (doi).

47. Application of a Sensitivity Equation Method to Turbulent Conjugate Heat Transfer (with E. Colin, S. Etienne and D. Pelletier), in *Proceedings of the 43rd AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2005-0186 (2005). (doi)

48. Design of Worst Spatial Distribution of Disturbances for a Class of Parabolic Partial Differential Equations (with M. Demetriou), in *Proceedings of the 2005 American Control Conference*, (2005). (doi)

49. Optimal Shape Design in Mixed Convection using a Continuous Sensitivity Equation Approach (with R. Duvigneau and D. Pelletier), in *Proceedings of the 38th AIAA Thermophysics Conference*, AIAA Paper Number 2005-4823 (2005). (doi)

50. A Sensitivity Equation Method for Compressible Subsonic Laminar Airfoil Flows (with P. Edmond, D. Pelletier and S. Etienne), in *Proceedings of the 23rd AIAA Applied Aerodynamics Conference*, AIAA Paper Number 2005-4601 (2005). (doi)

51. A Continuous Second Order Sensitivity Equation Method for Time-Dependent Incompressible Laminar Flows (with F. Ilinca and D. Pelletier), in *Proceedings of the 17th AIAA Computational Fluid Dynamics Conference*, AIAA Paper Number 2005-5252 (2005). (doi)

52. Application of a Sensitivity Equation Method to Compressible Subsonic Impinging Jets (with P. Edmond, D. Pelletier, S. Etienne, and A. Hay), in *Proceedings of the 44th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2006-0909 (2006).

53. Optimal Reduced-Order Modeling for Nonlinear Distributed Parameter Systems, in *Proceedings of the 2006 American Control Conference*, Paper WeB13.3 (2006) (doi).

54. A Domain Decomposition Approach to POD (with C. Beattie, S. Gugercin and T. Iliescu), in *Proceedings of the 45th IEEE Conference on Decision and Control*, Paper FrIP14.12, pages 6750–6756 (2006) (doi).

55. A Penalty Method Approach to LQR Control for Saddle Point Problems (with M. Stoyanov and L. Zietsman), in *Proceedings of the International Conference on Nonlinear Problems in Aviation and Aerospace 2006*, Cambridge Scientific Publishers, Chap. 64, 67–74 (2007).

56. Optimal Design of Airfoils Using NURBS and a Continuous Sensitivity Equation Method (with J. Cori, S. Étienne, A. Hay, D. Pelletier and J. Trépanier), in *Proceedings of the 45th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2007-1129 (2007).

57. Reduced-Order Models for Optimal Control of Vortex Shedding (with I. Akhtar and J. Burns), in *Proceedings of the 4th AIAA Flow Control Conference*, AIAA Paper Number 2008-4083 (2008). (doi)

58. On the Use of Sensitivity Analysis to Improve Reduced-Order Models (with A. Hay and D. Pelletier), in *Proceedings of the 4th AIAA Flow Control Conference*, AIAA Paper Number 2008-4192 (2008).

59. A Reduced Order Solver for Lyapunov Equations with High Rank Matrices (with M. Stoyanov), in *Proceedings of the 18th International Symposium on Mathematical Theory of Networks and Systems*, Blacksburg, VA (2008).

60. Reduced-Order Modeling of Turbulent Flows (with A. Duggleby, A. Hay, T. Iliescu and Z. Wang), in *Proceedings of the 18th International Symposium on Mathematical Theory of Networks and Systems*, Blacksburg, VA (2008).

61. Reduced-Order Models for Parameter Dependent Geometries Based on Shape Sensitivity Analysis of the POD (with A. Hay and D. Pelletier), in *Proceedings of the 12th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, AIAA Paper Number 2008-5962 (2008).

62. Model-Based Computation of Functional Gains for Feedback Control of Vortex Shedding (with I. Akhtar, J. Burns and L. Zietsman), in *Proceedings of the 2008 ASME International Mechanical Engineering Congress & Exposition*, pages 495–501, Paper Number IMECE2008-68950 (2008).

63. An Efficient Long-Time Integrator for Chandrasekhar Equations (with M. Stoyanov), in *Proceedings of the 47th IEEE Conference on Decision and Control*, pages 3983–3988, Paper Number ThTA07.1 (2008) (doi).

64. A PDE Approach to Optimization and Control of High Performance Buildings (with J. Burns, E. Cliff and L. Zietsman), in *Proceedings of the Oberwolfach Workshop on Numerical Techniques for Optimization Problems with PDE Constraints*, M. Heinkenschloss, R.H.W. Hoppe and V. Schulz, Eds., pages 205–208 (2009).

65. Sensitivity Analysis-Based Reduced-Order Models for Flow Past an Elliptic Cylinder (with I. Akhtar, A. Hay and T. Iliescu), in *Proceedings of the 47th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2009-0583 (2009).

66. Control, Estimation and Optimization of Energy Efficient Buildings (with J. Burns, A. Surana and L. Zietsman), in *Proceedings of the 2009 American Control Conference*, pages 837–841, Paper Number WeB05.4 (2009) (doi).

67. Modeling High Frequency Modes for Accurate Low-Dimensional Galerkin Models (with I. Akhtar, T. Iliescu and C. Ribbens), in *Proceedings of the 39th AIAA Fluid Dynamics Conference*, AIAA Paper Number 2009-4202 (2009).

68. On the Sensitivity Analysis of Angle-of-Attack in a Model Reduction Setting (with A. Hay and I. Akhtar), in *Proceedings of the 48th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2010-1473 (2010).

69. Closure for Improved Reduced-Order Models using High Performance Computing (with I. Akhtar, T. Iliescu and Z. Wang), in *Proceedings of the 48th AIAA Aerospace Sciences Meeting and Exhibit*, AIAA Paper Number 2010-1276 (2010).

70. Linear Feedback Control of a von Kármán Street by Cylinder Rotation (with M. Stoyanov and L. Zietsman), in *Proceedings of the 2010 American Control Conference*, Paper Number FrB06.3 (2010). (doi)

71. Large Eddy Simulation Ideas for Nonlinear Closure in Model Reduction of Fluid Flows (with I. Akhtar, T. Iliescu and Z. Wang), in *Proceedings of the 5th AIAA Flow Control Conference*, AIAA Paper Number 2010-5089 (2010).

72. On Commutation of Reduction and Control: Linear Feedback Control of a von Kármán Vortex Street (with I. Akhtar, M. Stoyanov and L. Zietsman), in *Proceedings of the 5th AIAA Flow Control Conference*, AIAA Paper Number 2010-4832 (2010).

73. A Novel Strategy for Nonlinear Closure in Proper Orthogonal Decomposition Reduced-Order Models (with I. Akhtar, T. Iliescu and Z. Wang), *ASME Early Career Technical Journal 2010*, Vol. 9, 189–197.

74. High Performance Computing for Energy Efficient Buildings (with I. Akhtar and J. Burns), in *Proceedings of the International Conference on Power Generation Systems and Renewable Energy Technologies (PGSRET)*, Islamabad, Pakistan (2010).

75. On a Control Strategy for Fluid Flows using Model Reduction (with I. Akhtar and J. Burns), in *Proceedings of the 8th International Bhurban Conference on Applied Sciences & Technology (IBCAST)* (2011).

76. Fréchet Sensitivity Analysis for Partial Differential Equations with Distributed Parameters (with V. Leite Nunes), in *Proceedings of the 2011 American Control Conference*, Paper Number ThA02.5 (2011). (doi)

77. On Using LQG Performance Metrics for Sensor Placement (with J. Burns and L. Zietsman), in *Proceedings of the 2011 American Control Conference*, Paper Number ThB02.5 (2011). (doi)

78. Reduced-Order Models of Fluids for Simulation, Design and Control (with I. Akhtar, A. Hay, T. Iliescu and Z. Wang), in *Proceedings of Schnelle Löser für Partielle Differentialgleichungen*, Oberwolfach Reports Series, Report No. 28/2011, pages 22–26 (2011).

79. Model Reduction for Indoor-Air Behavior in Control Design for Energy-Efficient Buildings (with E. Cliff and S. Gugercin), in *Proceedings of the 2012 American Control Conference*, Paper Number WeC20.3, pages 2283–2288 (2012). (doi)

80. An Optimal Control Approach to Sensor/Actuator Placement for Optimal Control of High Performance Buildings (with J. A. Burns, E. M. Cliff and L. Zietsman), in *Proceedings of the 2nd International High Performance Buildings Conference*, Purdue University, pages 34661–34667, July (2012).

81. Coupled CFD/Building Envelope Model for the Purdue Living Lab, (with D. Kim, J. Braun, E.M. Cliff, and S. Gugercin), in *Proceedings of the 2nd International High Performance Buildings Conference*, Purdue University, July (2012).

82. Optimization-Based Estimation of Random Distributed Parameters in Elliptic Partial Differential Equations, (with H.-W. van Wyk), in *Proceedings of the 51st IEEE Conference on Decision and Control*, Paper TuB07.5, pages 2926–2933, December (2012). (doi)

83. Using Fréchet Sensitivity Analysis to Interrogate Distributed Parameters in Random Systems, (with V. Leite Nunes and H.-W. van Wyk), in *Proceedings of the 2013 American Control Conference*, Paper Number MoA14.4, June (2013). (doi)

84. Adjoint and Truncation Error Based Adaptation for 1D Finite Volume Schemes, (with J. M. Derlaga and C. J. Roy), in *Proceedings of the 21st AIAA Computational Fluid Dynamics Conference*, AIAA Paper Number 2013–2865, July (2013).

85. Finite Volume Solution Reconstruction Methods for Truncation Error Estimation, (with T. S. Phillips, J. M. Derlaga, and C. J. Roy), in *Proceedings of the 21st AIAA Computational Fluid Dynamics Conference*, AIAA Paper Number 2013–3090, July (2013). (doi)

86. Error Transport Equation Boundary Conditions for the Euler and Navier-Stokes Equations, (with T. S. Phillips and C. J. Roy), in *Proceedings of the 52nd AIAA Aerospace Sciences Meeting*, AIAA Paper Number 2014–1432, January (2014).

87. Basis Selection and Closure for POD Models of Convection Dominated Boussinesq Flows, (with O. San), in *Proceedings of the 21st International Symposium on Mathematical Theory of Networks and Systems*, Groningen, The Netherlands, Paper MoA05.4, pages 132–139, July (2014). (link)

88. A Reduced Order Model of the Indoor-Air Environment for Energy Efficient Building Studies, (with S. Ben Ayed and E. M. Cliff), in *Proceedings of the 19th IFAC World Congress*, Cape Town, South Africa, pages 612–619, August (2014). (doi)

89. Parametric Reduced Order Models Using Adaptive Sampling and Interpolation, (with K. R. Pond and L. Zietsman), in *Proceedings of the 19th IFAC World Congress*, Cape Town, South Africa, pages 7773–7778, August (2014). (doi)

90. Compensators via $\mathcal{H}_2$-based Model Reduction and Proper Orthogonal Decomposition, (with S. Gugercin and L. Zietsman), in *Proceedings of the 19th IFAC World Congress*, Cape Town, South Africa, pages 7780–7784, August (2014). (doi)

91. Development of Control Benefit Evaluation Tool for Small Commercial Buildings, (with D. Kim, E. Cliff, and J. E. Braun), in *Proceedings of the 2014 ASHRAE/IBPSA-USA Building Simulation Conference*, Atlanta, pages 64–71, September (2014). (link)

92. Model Reduction for DAEs with an Application to Flow Control, (with S. Gugercin), in *Active Flow and Combustion Control 2014*, R. King, ed., Notes on Numerical Fluid Mechanics and Multidisciplinary Design, Volume 127, Springer, pages 381–396, (2015). (doi)

93. Adjoint and Truncation Error Based Adaptation for Finite Volume Schemes with Error Estimates, (with J. Derlaga, T. S. Phillips, and C. J. Roy), in *Proceedings of the 53rd AIAA Aerospace Sciences Meeting*, January (2015). (doi)

94. Performance Evaluation of an RTU Coordination Controller Using a Reduced-Order CFD Coupled Model, (with J. Braun, E. Cliff, J. Hu, and D. Kim), in *Proceedings of the 2015 ASHRAE Annual Conference*, *ASHRAE Transactions*, Volume 121, January (2015). (link)

95. Optimal Sensor Location in the Control of Energy-Efficient Buildings, (with J. A. Burns and E. M. Cliff), in *The Princeton Companion to Applied Mathematics*, N. J. Higham, M. R. Dennis, P. Glendinning, P. A. Martin, F. Santosa, and J. Tanner eds., Princeton University Press, pages 763–767, September (2015). (link)

96. High Fidelity Reduced Order Models for Wildland Fires, (with S. Gugercin, A. Lattimer, and B. Lattimer), in *Proceedings of the 5th Annual Fire Behavior and Fuels Conference*, April (2016). (link)

97. Computationally Efficient Wildland Fire Spread Models, (with S. Gugercin, A. Lattimer, B. Lattimer, and K. Luxbacher), in *Interflam 2016: Proceedings of the 14th International Fire Science & Engineering Conference*, Volume 1, pages 305–316, July (2016). (link)

98. Feedback Stabilization of Fluids Using Reduced-Order Models for Control and Compensator Design, (with S. Gugercin and L. Zietsman), in *Proceedings of the 55th IEEE Conference on Decision and Control*, pages 7579–7585, Paper Number WeC21.5, December (2016). (doi)

99. Robust POD Model Stabilization for the 3D Boussinesq Equations Based on Lyapunov Theory and Extremum Seeking, (with M. Benosman and B. Kramer), in *Proceedings of the American Control Conference*, pages 1827–1832 (2017). (doi)

100. POD Models for Positive Fields in Advection-Diffusion-Reaction Equations, (with A. Lattimer), in *Proceedings of the American Control Conference*, pages 3797–3802 (2017). (doi)

101. Subsystem Interpolation for Parameterized Bilinear Dynamical Systems, (with A. Carracedo Rodriguez and S. Gugercin), in *Proceedings of the 9th Vienna International Conference on Mathematical Modelling*, pages 75–76 (2018). (link) (doi)

102. Computation of Nonlinear Feedback for Flow Control Problems, (with L. Zietsman), in *Proceedings of the American Control Conference*, Paper WeC04.4, pages 1726–1731 (2018). (doi)

103. Uncertainties on Cooling Energy Based on Computational Indoor Air Modeling in Sports Facilities, (with S. Ben Ayed, D. Kim, and E. Cliff), in *Proceedings of the 2019 ASHRAE Annual Conference*, Kansas City, MO (2019). Paper KC-19-A004. (link)

104. Sensitivity Analysis of Optimal Energy in Buildings to Environment Parameters, (with S. Ben Ayed and E. Cliff), in *Proceedings of the 2019 ASHRAE Annual Conference*, Kansas City, MO (2019). Paper KC-19-A019. (link)

105. Learning-Based Robust Observer Design for Coupled Thermal and Fluid Systems, (with S. Koga and M. Benosman), in *Proceedings of the American Control Conference*, Philadelphia PA (2019). Paper WeB08.5. (doi)

106. Robust Nonlinear State Estimation for Thermal-Fluid Models Using Reduced-Order Models: The Case of the Boussinesq Equations, (with M. Benosman), in *Proceedings of the 58th IEEE Conference on Decision and Control*, Nice, France (2019).

107. Reinforcement Learning-based Model Reduction for Partial Differential Equations, (with M. Benosman and A. Chakrabarty), in *Proceedings of the 21st IFAC World Congress*, (meeting held online) (2020). (link)

108. The Quadratic-Quadratic Regulator Problem: Approximating feedback controls for quadratic-in-state nonlinear systems, (with L. Zietsman), in *Proceedings of the American Control Conference*, (meeting held online) (2020). (doi) (arXiv)

109. On Approximating Polynomial-Quadratic Regulator Problems, (with L. Zietsman), *Proceedings of the 2020 Mathematical Theory of Networks and Systems*, (appeared in **IFAC-PapersOnLine**, Vol. 54, Issue 9, 2021, pages 329–334). (doi) (arXiv)

110. Reinforcement Learning-based Model Reduction for Partial Differential Equations: Application to the Burgers Equation, (with M. Benosman and A. Chakrabarty), in *Handbook of Reinforcement Learning and Control*, K. G. Vamvoudakis, Y. Wan, F. L. Lewis, and D. Canserver editors, Studies in Systems, Decision and Control, vol. 325, Springer, Cham (2021). (doi)

Other Publications

1. Axisymmetric Boundary Element Design Sensitivity Analysis (with S. Saigal), Third International Conference on CAD/CAM, Robotics and FOF, Southfield, MI (August 1988).

2. Torpedo Drag Disk Analysis (with M. A. Tucchio, A. D. Carlson, R. A. Lafreniere, R. S. Munn and C. A. Wagner), NUSC Technical Memorandum (TM 881208) (November 1988).

3. Computational Fluid Dynamics Analysis of Sail-Hull Junction Modifications (with C. A. Wagner, D. C. Brondum, and L. S. Langston), NUSC Technical Report (TR 8641) (June 1990).

4. Iterative Matrix Solvers in Incompressible Computational Fluid Dynamics, NUSC Technical Memorandum (TM 901153) (August 1990).

5. A Systems Approach to High Performance Buildings: A Computational Systems Engineering R& D Program to Increase DoD Energy Efficiency (with S. Narayanan, S. Ahuja, N. Desai, Z. O'Neill, S. Peles, A. Surana, R. Taylor, S. Yuan, B. Eisenhower, V. Fonoberov, I. Mezic, K. Otto, E. Cliff, J. Borggaard, J. A. Burns, A. Lewis, P. Ehrlich, and J. Seewald), SERDP Project EW-1709 Final Report, DTIC Document, 193 pages (February 2012). (link)

Invited Short Courses

2005   Reduced-Order Model Development and Control Design (with K. Kunisch),
2005 SIAM Annual Meeting and SIAM Activity Group on Control and Systems Theory (July).

2008   Large Scale Optimization & Design, for the DoD High Performance Computing Program Office, University of Tennessee Space Institute, Arnold AFB, TN (February).

Plenary Lectures

2005   MOPTA 05, Modeling and Optimization: Theory and Applications,
Windsor, ON, Canada, July.

2007   SEARCDE, Southeastern-Atlantic Regional Conference on Differential Equations,
Murray, KY, October.

2022   ICAM Conference on Applied and Computational Mathematics, Blacksburg, VA, June.

Invited Conference Presentations

1995   SIAM Annual Meeting, Charlotte, NC, October.

1995   AMS Fall Southern Sectional Meeting, Greensboro, NC, November.

1996   First International Conference on Nonlinear Problems in Aeronautics and Aerospace, Daytona, FL, May.

1997   18th IFIP TC7 Conference on System Modelling and Optimization, Detroit, MI, July.

1997   Conference on Optimal Design and Control, Washington, DC, October.

1998   Fourth SIAM Conference on Control and its Applications, Jacksonville, FL, May.

1998   Society of Engineering Science 35th Annual Technical Meeting, Pullman, WA, September.

1999   SIAM Conference on Optimization, Atlanta, GA, May.

1999   Annual Meeting of the Canadian Applied and Industrial Mathematics Society, Québec City, Québec, June.

1999   International Symposium on Nonsmooth/Nonconvex Mechanics, Blacksburg, VA, June.

2000   Third International Conference on Non-Linear Problems in Aviation and Aerospace, Daytona Beach, FL, May.

2000   CFD2K, 8th Annual Conference of the CFD Society of Canada, Montréal, Québec, June.

2000   American Control Conference, Chicago, IL, June.

2000   3rd World Congress on Nonlinear Analysis, Catania, Italy, July.

2001   SIAM Control Conference, San Diego, CA, July.

2001   Sensitivity Analysis Workshop 2001, Livermore, CA, August.

2001   Center for Turbomachinery and Compressor Design Annual Review, Blacksburg, VA, September.

2002   3rd AIAA Theoretical Fluids Meeting, 1st AIAA Flow Control Meeting, St. Louis, MO, June. (1 hour invited lecture)

2002   SIAM Annual Meeting, Philadelphia, PA, July.

2002   Fifteenth International Symposium on Mathematical Theory of Networks and Systems, South Bend, IN, August.

2003   IMA Workshop on Optimization in Simulation-Based Models, Minneapolis, MN, January.

2003   SIAM Conference on Computational Science and Engineering, San Diego, CA, February.

2003   27th Annual Conference of the South African Society for Numerical and Applied Mathematics, Stellenbosch, South Africa, March.

2003   First Joint CAIMS/SIAM Annual Meeting, Montréal, Québec, June.

2003   SciCADE 2003, International Conference on Scientific Computation and Differential Equations, Trondheim, Norway, June.

2003   7th US National Congress on Computational Mechanics, Albuquerque, NM, July.

2003   Computation, Control and Biological Systems VIII, Bozeman, MT, July.

2003   AMS Fall Southeastern Sectional Meeting, Chapel Hill, NC, October.

2004   CSIT Workshop on Emerging Methods for Numerical Solution of PDEs, Tallahassee, FL, March.

2004   Advanced Simulation Technologies Conference, Alexandria, VA, April.

2004   IFIP Workshop on Shape Optimization and Control, Lisbon, Portugal, June.

2004   2nd AIAA Flow Control Conference, Portland, OR, June.

2004   AMS Fall Southeastern Sectional Meeting, Pittsburgh, PA, November.

2004   IFIP Workshop on Free and Moving Boundaries, Analysis, Simulation and Control, Houston, TX, December.

2005   International Conference on Approximation Methods for Design and Control, Buenos Aires, Argentina, March.

2005   SIAM Annual Meeting, New Orleans, LA, July.

2005 Workshop on Large-Scale Robust Optimization, Sante Fe, NM, September.
2005 Austrian Mathematical Society, Klagenfurt, Austria, September.
2006 6th International Conference on Cooperative Control and Optimization,
     Gainsville, FL, February.
2006 SIAM Annual Meeting, Boston, MA, July.
2006 7th World Congress on Computational Mechanics, Los Angeles, CA, July.
2007 14th International Conference on Finite Elements in Flow Problems, Santa Fe, NM, March.
2007 CMMSE 2007 (Computational and Mathematical Methods in Science and Engineering), Chicago, IL, June.
2007 SIAM Control Conference, San Francisco, CA, June.
2007 IFIP TC7 Conference on System Modelling and Optimization, Kraków, Poland, July.
2008 Inverse Problems: Modeling and Simulation, Fethiye, Turkey, May.
2008 4th AIAA Flow Control Conference, Seattle, WA, June.
2008 ASME International Mechanical Engineering Congress & Exposition, Boston, MA, November.
2008 47th IEEE Conference on Decision and Control, Cancun, Mexico, December.
2009 SIAM Conference on Computational Science and Engineering (CSE09), Miami, FL, March.
2009 International Conference on Approximation Methods for Design and Control,
     Buenos Aires, Argentina, March.
2009 AMS Spring Southeastern Sectional Meeting, Raleigh, NC, April.
2009 SIAM Conference on Mathematical and Computational Issues in the Geosciences,
     Leipzig, Germany, June.
2009 SIAM Conference on Control and its Applications, Denver, CO, July.
2010 American Control Conference, Baltimore, MD, July.
2010 SIAM Annual Meeting, Pittsburgh, PA, July.
2011 SIAM Conference on Mathematical & Computational Issues in the Geosciences, Long Beach, CA, March.
2011 Schnelle Löser für Partielle Differentialgleichungen, Mathematisches Forschungsinstitut Oberwolfach,
     Germany, May.
2011 American Control Conference, San Francisco, CA, June.
2011 7th International Congress on Industrial and Applied Mathematics (ICIAM), Vancouver, BC, July.
2011 SIAM Conference on Control and its Applications, Baltimore, MD, July.
2012 ICNPAA Congress: Mathematical Problems in Engineering, Aerospace and Sciences, Vienna, Austria, July.
2012 51st IEEE Conference on Decision and Control, Maui, HI, December.
2013 SIAM Conference on Computational Science and Engineering, Boston, MA, February.
2013 SIAM Conference on Computational Science and Engineering, Boston, MA, February.
2013 IMA Hot Topics Workshop, Mathematical and Computational Challenge in the Control, Optimization,
     and Design of Energy-Efficient Buildings, Minneapolis, MN, June.
2013 2013 American Control Conference, Washington, DC, June.
2013 Intelligent Building Operations Workshop, UC Boulder, Boulder, CO, June.
2013 SIAM Annual Meeting, San Diego, CA, July.
2013 SIAM Conference on Analysis of Partial Differential Equations Orlando, FL, December.
2014 21st International Symposium on Mathematical Theory of Networks and Systems,
     Groningen, Netherlands, July.
2014 19th International Federation on Automatic Control (IFAC) World Congress,
     Cape Town, South Africa, August.
2014 19th International Federation on Automatic Control (IFAC) World Congress,
     Cape Town, South Africa, August.
2014 AMS Fall Southeastern Sectional Meeting, Greensboro, NC, November.
2014 Active Drag Reduction Symposium, Aachen, Germany, November.

2015   SIAM Conference on Computational Science & Engineering, Salt Lake City, UT, March.
2015   SIAM Conference on Computational Science & Engineering, Salt Lake City, UT, March.
2015   SIAM Conference on Control and Its Applications, Paris, France, July.
2015   Advances in Scientific Computing and Applied Mathematics, Las Vegas, NV, October.
2016   V Encuentro Cuba-México de Métodos Numéricos y Optimización, Havana, Cuba, January.
2016   IMA Workshop on Computational Methods for Control of Infinite-Dimensional Systems, Minneapolis, MN, March.
2016   Numerical Analysis and Predictability of Fluid Motion, Pittsburgh, PA, May.
2016   ALOP Workshop: Reduced Order Models in Optimization, Trier, Germany, September.
2016   55th IEEE Conference on Decision and Control, Las Vegas, NV, December.
2017   American Control Conference, Seattle, WA, May.
2017   SIAM Conference on Control and its Application, Pittsburgh, PA, July.
2017   US National Congress on Computational Mechanics 14 (keynote), Montréal, QC, July.
2018   American Control Conference, Milwaukee, WI, June.
2018   SIAM Annual Meeting, Portland, OR, July.
2019   9th International Congress on Industrial and Applied Mathematics (ICIAM), Valencia, Spain, July.
2019   SIAM Southeast Atlantic Sectional Meeting, Knoxville, TN, September.
2020   ICERM Workshop on Mathematics of Reduced Order Models, Providence, RI, February.
2020   American Control Conference, Denver, CO, July (virtual).
2021   SIAM Conference on Computational Science and Engineering, Austin, TX, March (virtual).
2022   SIAM Conference on Uncertainty Quantification, Atlanta, GA, April (virtual).
2022   Accurate ROMs for Industrial Applications, Blacksburg, VA, July.

Invited Colloquia

1993	University of Texas at Dallas, Mathematics Seminar, Richardson, TX, July.
1995	Oregon State University, Mathematics Department Colloquium, Corvallis, OR, February.
1996	Virginia Tech, Mathematics Department Colloquium, Blacksburg, VA, May.
1997	Industrial Materials Institute, Montréal, Québec, March.
1997	Cornell University, Stability, Transition and Turbulence Seminar, Ithaca, NY, October.
1997	University of Texas at Arlington, Mathematics Colloquium, Arlington, TX, November.
1997	University of Texas at Dallas, Mathematics Seminar, Richardson, TX, November.
1998	University of Pittsburgh, Mathematics Colloquium, Pittsburgh, PA, February.
1998	Washington State University, Mathematics Seminar, Pullman, WA, February.
1998	Virginia Tech, Mathematics Seminar, Blacksburg, VA, February.
1998	Iowa State University, Mathematics Seminar, Ames, IA, March.
1998	University of California at Davis, Mathematics Seminar, Davis, CA, March.
1998	Virginia State University, Mathematics Seminar, Petersburg, VA, November.
1999	University of North Carolina Greensboro, Mathematics Colloquium, Greensboro, NC, April.
1999	University of Pittsburgh, Mathematics Colloquium, Pittsburgh, PA, June.
2000	Montana State University, Mathematics Colloquium, Bozeman, MT, March.
2000	United Technologies Research Center, East Hartford, CT, July.
2001	Sandia National Labs, CSRI Seminar Series, Livermore, CA, March.
2001	Virginia Tech, Aerospace and Ocean Engineering Seminar, Blacksburg, VA, April.
2001	University of Trier, Numerical Analysis Seminar, Trier, Germany, November.
2002	Iowa State University, Mathematics Colloquium, Ames, IA, March.
2002	Worcester Polytechnic Institute, Mechanical Engineering Colloquium, Worcester, MA, September.
2003	Virginia Tech, Mathematics Colloquium, Blacksburg, VA, January.
2003	Montana State University, Applied Mathematics Seminar, Bozeman, MT, February.
2003	University of Louisville, Mathematics Colloquium, Louisville, KY, February.
2003	United States Air Force Academy, Seminar in Closed Loop Flow Control, Colorado Springs, CO, July.
2003	Wright-Patterson Air Force Base, National Research Council Summer Faculty Seminar, Wright-Patterson Air Force Base, OH, August.
2003	Ohio State University, Collaborative Center for Control Science, Columbus, OH, September.
2003	Florida State University, School of Computational Science and Information Technology, Tallahassee, FL, November.
2003	George Mason University, Mathematics Colloquium, Fairfax, VA, November.
2004	University of Florida Graduate Education Research Center, Seminar, Destin, FL, March.
2004	Argonne National Laboratories, Wilkinson Visitor Program, Argonne, IL, October.
2005	George Mason University, Mathematics Colloquium, Fairfax, VA, February.
2005	Florida State University, School for Computational Science Colloquium, Tallahassee, FL, November.
2006	Florida State University, School for Computational Science Colloquium, Tallahassee, FL, January.
2006	INFORMS Student Seminar, Industrial Systems Engineering, Blacksburg, VA, March.
2007	Wright-Patterson Air Force Base, American Society of Engineering Education Summer Faculty Seminar, Wright-Patterson Air Force Base, OH, July.
2007	MIT, Model Order Reduction Seminar, Cambridge, MA, October.
2008	Clemson University, Mathematics Colloquium, Clemson, SC, April.
2008	Florida State University, Department of Scientific Computing Colloquium, Tallahassee, FL, October.
2009	Auburn University, Mathematics and Statistics Colloquium, Auburn, AL, January.
2009	University of Pittsburgh, Mathematics Colloquium, Pittsburgh, PA, February.

2009	Goethe Center for Scientific Computing, Goethe University Frankfurt am Main, Germany, June.
2010	Air Force Institute of Technology, Wright-Patterson Air Force Base, OH, December.
2011	Worcester Polytechnic Institute, Mechanical Engineering Seminar, Worcester, MA, November.
2013	Virginia Tech, Mathematics Colloquium, Blacksburg, VA, April.
2013	Portland State University, Maseeh Mathematics & Statistics Colloquium, Portland, OR, October.
2015	Mitsubishi Electric Research Laboratories, Cambridge, MA, November.
2016	Auburn University, Applied Mathematics Seminar, Auburn, AL, January.
2016	Virginia Tech, Mathematics Colloquium, Blacksburg, VA, August.
2017	Tulane University, Mathematics Colloquium, New Orleans, LA, October.
2020	Oak Ridge National Laboratories, Computational and Applied Mathematics Seminar, September.
2022	University of Pittsburgh, Computational Mathematics Seminar, November.

Contributed Talks and Other Presentations

1992   Worcester Polytechnic Institute, Worcester, MA, March.

1992   IMA Period of Concentration on Flow Control, Minneapolis, MN, November.

1994   5th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, Panama City, FL, September.

1995   34th IEEE Conference on Decision and Control, New Orleans, LA, December.

1996   27th AIAA Computational Fluid Dynamics Conference, New Orleans, LA, June.

1997   Air Force Contractors Meeting, Dayton, OH, May.

1998   36th AIAA Aerospace Sciences Meeting and Exhibition, Reno, NV, January.

1999   SIAM Southeast Regional Mathematics in Industry Workshop, Raleigh, NC, October.

2000   38th AIAA Aerospace Sciences Meeting and Exhibition, Reno, NV, January.

2000   AD2000 (Automatic Differentiation 2000), Nice, France, June.

2000   AFOSR Workshop on Dynamics and Control, Pasadena, CA, August.

2000   8th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, Long Beach, CA, September.

2000   Boeing Seminar on Control and Design, Boeing Aerospace, Seattle, WA, September.

2000   United Technologies Research Center, Project Summary, East Hartford, CT, December.

2001   31st AIAA Fluid Dynamics Conference and Exhibit, Anaheim, CA, June.

2001   AFOSR Workshop on Dynamics and Control, Dayton, OH, July.

2002   AFOSR Workshop on Dynamics and Control, Pasadena, CA, August.

2002   9th AIAA Symposium on Multidisciplinary Analysis and Optimization, Atlanta, GA, September.

2002   9th AIAA Symposium on Multidisciplinary Analysis and Optimization, Atlanta, GA, September.

2002   22nd Annual Southeastern-Atlantic Regional Conference on Differential Equations, Knoxville, TN, October.

2003   36th AIAA Thermophysics Conference, Orlando, FL, June.

2003   AFOSR Workshop on Dynamics and Control, Destin, FL, September.

2003   23rd Annual Southeastern-Atlantic Regional Conference on Differential Equations, Atlanta, GA, October.

2004   SIAM Parallel Processing for Scientific Computing, San Francisco, CA, February.

2004   Optimization Days, Montreal, Canada, May.

2004   SIAM Annual Meeting, Portland, OR, July.

2004   10th AIAA Symposium on Multidisciplinary Analysis and Optimization, Albany, NY, September.

2004   American Physical Society, 57th Annual Meeting of the Division of Fluid Dynamics, Seattle, WA, November.

2005   American Control Conference, Portland, OR, June.

2005   AFOSR Workshop on Computational Mathematics, Long Beach, CA, August.

2006   30th Annual Conference of the South African Society for Numerical and Applied Mathematics, Stellenbosch, South Africa, April.

2006   AFOSR Joint Program Review, Atlanta, GA, August.

2006   26th Annual Southeastern-Atlantic Regional Conference on Differential Equations, Greensboro, NC, October.

2007   2007 SIAM Conference on Computational Science and Engineering, Costa Mesa, CA, February.

2007   AFOSR Joint Program Review, Long Beach, CA, August.

2008   AFOSR Computational Mathematics Program Review, Arlington, VA, August.

2008   12th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Victoria, British Columbia, Canada, September.

2009   SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, May.

2009   The 2009 Joint ASCE-ASME-SES Conference on Mechanics and Materials,
        Blacksburg, VA, June.
2009   AFOSR Computational Mathematics Program Review, Arlington, VA, July.
2009   29th Annual Southeastern-Atlantic Regional Conference on Differential Equations,
        Mercer, GA, October.
2010   Emerging Topics in Dynamical Systems and Partial Differential Equations (DSPDEs'10),
        Barcelona, Spain, June. (poster)
2010   American Physical Society, 63rd Annual Meeting of the Division of Fluid Dynamics,
        Long Beach, CA, November.
2012   American Control Conference, Montreal, Canada, June.
2015   American Physical Society, 68th Annual Meeting of the Division of Fluid Dynamics,
        Boston, MA, November.
2016   American Physical Society, 69th Annual Meeting of the Division of Fluid Dynamics,
        Portland, OR, November.
2017   SIAM Conference on Computational Science & Engineering (CT17), Atlanta, GA, February (poster).
2017   Conference on Classical and Geophysical Fluid Dynamics: Modeling, Reduction and Simulation,
        Blacksburg, VA, June.

Conferences Organized

2000   20th Southeast-Atlantic Regional Conference on Differential Equations – SEARCDE,
        Blacksburg, VA, October.
2002   Workshop in honor of Gene Cliff (with J. Burns and T. Herdman)
        Blacksburg, VA, October.

Conference Organizing Committees

2009   SIAM Conference on Control and its Applications,
        Denver, CO, June.
2010   30th Southeast-Atlantic Regional Conference on Differential Equations – SEARCDE,
        Blacksburg, VA, October.
2017   Conference on Classical and Geophysical Fluid Dynamics: Modeling, Reduction and Simulation,
        Blacksburg, VA, June.

Organized Sessions and Minisymposia

1999   *Optimal Design* at the SIAM Southeast Regional Mathematics in Industry Workshop,
       Raleigh, NC, October.

2000   *Optimal Design and Control* at the 3rd International Conference on Nonlinear Problems
       in Aviation and Aerospace,
       Daytona, FL, May (with T. Herdman and J. Turi)

2000   *Optimal Design* at the World Congress of Nonlinear Analysis 2000,
       Catania, Italy, July (with T. Herdman and E. Cliff).

2003   *Control of Distributed Parameter Systems: Computation and Optimization* at the
       2003 American Control Conference, Denver, CO, June (with M. Demetriou).

2004   *Computational Issues in Control of Complex Flows: I-IV* at the
       SIAM Annual Meeting, Portland, OR, July (with T. Iliescu).

2007   *Emerging Finite Element Methods for Complex Flow* at the
       2007 SIAM Conference on Computational Science and Engineering,
       Costa Mesa, CA, February (with T. Iliescu).

2007   *Model Reduction Methods for Flow in Porous Media* at the
       2007 SIAM Conference on Mathematical and Computational Issues in the Geosciences,
       Santa Fe, NM, March (with E. Gilden and H. Klie).

2009   The 2009 Joint ASCE-ASME-SES Conference on Mechanics and Materials,
       Blacksburg, VA, June (with I. Akhtar).

2013   *Targeted Model Reduction for Nonlinear Systems* at the
       2013 SIAM Conference on Control and its Applications, San Diego, CA, July (with L. Zietsman).

2014   *Control of Distributed Parameter Systems* at the
       19th World Congress of the International Federation of Automatic Control,
       Cape Town, South Africa, August (with L. Zietsman).

2017   *Reduced Order Models for Fluids: Achievements and Open Problems*
       at the 2017 SIAM Conference on Computational Science and Engineering,
       Atlanta, GA, March (with T. Iliescu, H. Liu, and L. Zietsman).

2021   *Model Reduction For Control of High-dimensional Nonlinear Systems*
       at the 2021 SIAM Conference on Control and Systems Theory, online, July
       (with S. Gugercin and B. Kramer).

Published Software

Deriv: Automatic differentiation software for Matlab. The software is based on operator overloading in the forward mode and includes algorithms that treat a number of useful matrix factorizations and ODE solvers.

entrust: A trust-region optimization software package useful in PDE-constrained optimization problems with bound constraints. (doi: 10.5281/zenodo.321874)

KroneckerTools: Library to work with polynomials formed from Kronecker products and solve Kronecker sum systems.

NLbalancing: Software to perform balanced truncation for nonlinear systems.

QQR: Nonlinear feedback control software written in Matlab. This is used to solve the quadratic-quadratic regulator problem using Al'Brecht's polynomial approximation as described by Krener and Navasca but reformulated to leverage modern multilinear algebra. (doi: 10.5281/zenodo.4043649)

Professional Societies

Institute of Electrical and Electronics Engineers (IEEE): Control Systems Society (CSS)
Society for Industrial and Applied Mathematics (SIAM):
   Computational Science and Engineering (CSE) and Control and Systems Theory (CST) Activity Groups

Professional Service

Editorial Boards
Associate Editor, Optimization and Engineering, Springer, 2008–present.
   (`http://www.springer.com/math/journal/11081`)
Associate Editor, ISRN Applied Mathematics, Hindawi Publishing, 2010–2014.
   (`http://www.hindawi.com/isrn/appmath`)

Other Professional Service
Refereed Proposals for AFOSR, DOE, and NSF
Refereed Proposals for NSERC, INRIA, Dutch Science Foundation, Israeli Science Foundation, Swiss NSF
Panel Member for NSF Focused Research Group Review
Panel Member for DOE Multiscale Mathematics and Optimization
Panel Member for DOE ASCR CAREER Awards
Member, NSERC Site Review Panel
Referee for numerous journals including:
   AIAA Journal, AIAA Journal of Thermophysics and Heat Transfer, Alcoholism, Automatica,
   Applied Mathematics and Computation, Applied Mathematical Modeling, Behavior Research Methods,
   Computational Optimization and Applications, Computers and Mathematics with Applications,
   Engineering Optimization, Experimental Thermal and Fluid Science,
   IEEE Transactions on Automatic Control, IMA Journal on Numerical Analysis,
   International Journal of Computer Mathematics,
   International Journal of Mathematics and Mathematical Sciences,
   International Journal of Numerical Methods in Engineering,
   International Journal for Uncertainty Quantification,
   Journal of Computational Physics, Journal of Fluids and Structures, Journal of Fluid Mechanics,
   Journal of Mathematical Analysis and Applications, Journal of Scientific Computing,
   Journal of Turbulence, Mathematical Modelling and Numerical Analysis, Nonlinear Analysis,
   Numerical Algorithms, Optimization and Engineering,
   Physical Review Fluids, Physics of Fluids, PLOS One, SIAM Journal on Control,
   SIAM Journal on Control and Optimization, SIAM Journal on Numerical Analysis,
   SIAM Journal on Optimization,
   SIAM Journal on Multiscale Modeling and Simulation, and SIAM Journal on Scientific Computing.
Refereed Conference Proceedings Papers for:
   American Control Conference, Conference on Decision and Control,
   International Federation of Automatic Control, Mathematical Theory of Networks and Systems.
Refereed Several Books for Taylor and Francis (including CRC Press)
Refereed Book for SIAM
Panel Member for the SIAM Student Paper Competition: 1999, 2001, 2002, 2003
Chair, Steering Committee for the Southeast Atlantic Regional
         Conference on Differential Equations, 2000
Member of IEEE Technical Committee on Distributed Parameter Systems, 2003-present.
Organizing Committee of the 2009 SIAM Conference on Control and its Applications, Denver, CO.
Reviewer for Mathematical Reviews.

University Service

<u>Department Service</u>
Teaching Committee, 1999-2000
Colloquium Committee (Chair), 2006-2007
Graduate Program Committee, 2001-2005, 2010-2015, 2019-2020
Graduate Program Committee (Chair), 2007-2010, 2020-2022
Personnel Committee/Executive Committee, 2002-2003, 2011-2013, 2016-2018
Internal Review Committee, 2015-2016
Undergraduate Advisor, 2010-2022

<u>Search Committees</u>
Analysis Search Committee, 2001-2002
Numerical Analysis Search Committee, 2002-2003
Computational Science Search Committee (Chair), 2003-2004
Computational Mathematics Search Committee, 2007-2008, 2016-2017
Stochastic Analysis Search Committee, 2011-2012, 2014-2015

<u>College Service</u>
College of Science Research Advisory Committee, 2003-2004
College of Science Cluster Committee, 2004-2005
College of Science Faculty Diversity Sub-committee, 2007-2008
College of Science Cluster Planning Committee, 2012-2013
College of Science Promotion and Tenure Committee, 2013-2016

Teaching Experience

Worcester Polytechnic Institute (Mechanical Engineering Department): Performed classroom teaching, bi-weekly problem sessions, office hours and grading.

Virginia Tech: Experience with distance learning technology which was used to broadcast MA4414 and MA5484 to graduate students at Virginia State University and the Northern Virginia Graduate Center. In addition, the course MA5435-6 was simultaneously taught on four campuses. I have experience teaching the following courses:

MATH 1114	Elementary Linear Algebra	MATH 2214	Introduction to Differential Equations
MATH 2224	Multivariable Calculus	MATH 3054	Prog. and Math. Problem Solving
MATH 3144	Linear Algebra I	MATH 3214	Vector Calculus
MATH 4245	Intermediate Differential Equations	MATH 4254	Chaos and Dynamical Systems
MATH 4414	Issues in Scientific Computing	MATH 4425-6	Fourier Series & PDEs
MATH 4445	Intro. to Numerical Analysis	MATH 4564	Operational Methods
MATH 5245-6	Differential Equations	MATH 5435-6	Principles and Tech. of Appl. Math
MATH 5465-6	Numerical Analysis	MATH 5474	Finite Difference Methods
MATH 5484	Finite Element Methods	MATH 5485	Numerical Analysis and Software
MATH 5515	Mathematical Modeling in Biology	MATH 5545-6	Calculus of Variations

Supervised Undergraduate Research Projects at Virginia Tech:

Jeffry Hall & Jarrod Raines, (Spring 1999), "Study of Gibbs Phenomena."

Claude Cundiff, (Spring 2001), "Nonlinear ODEs and RPM."

Firmin Ndeges, (Summer 2003), joint with T. Herdman, "Parameter Dependent Discontinuities."

Grant Boquet, (Spring 2004), joint with T. Iliescu, "Scientific Computing for LES."

David Cross, (Fall 2007), joint with L. Zietsman, "Improved Reduced-Order Models for Control."

Drayton Munster, (Spring 2011), joint with L. Zietsman, "Modeling Thermal Fluids in Buildings."

Marisa Gidwani, (Spring 2012), "Solving Linear Matrix Inequalities for Control Theory."

Ross Thompson, (Spring 2013), "Error Estimation in Finite Element Methods."

Thomas May, (Spring 2014), joint with L. Zietsman, "Minimally Corrective Priors."

Alec Gilliam, (Spring 2018), "Numerical Methods for Stochastic ODEs."

Christopher Jones, (Spring 2018), "Automatic Differentiation of Matlab ODE Solvers."

Sung Kim, (Spring, Fall 2019, Spring 2020), "Computational Methods for Lyapunov Functions."

Danny Sharp, (Spring, Fall 2020), "Reduced Bases for Multiparametric PDEs." and "A Fast Fourier Transform Engine."

Supervised several Undergraduate Independent Study Projects.

Students

<u>Ph.D. Students</u>

Kay Vugrin, Mathematics, (Ph.D. 2005), Ph.D. Dissertation:

"On the Effects of Noise on Parameter Identification Optimization Problems."

Initially worked for Sandia National Laboratories in Carlsbad, NM.

Currently at VeraLight in Albuquerque, NM.

Miroslav Stoyanov, Mathematics, (Ph.D. 2009), Ph.D. Dissertation:

"Reduced Order Methods for Large Scale Riccati Equations."

Initially a Postdoc in the Department of Scientific Computing, Florida State University.

Currently has a research position in the Computer Science and Mathematics Division at Oak Ridge National Laboratory, Oak Ridge, TN.

Kevin Pond, Mathematics, (Ph.D. 2010), Ph.D. Dissertation:

"Multidimensional Adaptive Quadrature Over Simplices."

Initially an Assistant Professor in the Department of Mathematics and Statistics, Air Force Institute of Technology.

Currently stationed at the Pacific Air Forces, Hawaii.

Hans-Werner van Wyk, Mathematics, (Ph.D. 2012), Ph.D. Dissertation:

"A Variational Approach for Identifying Uncertain, Distributed Parameters in Elliptic Systems."

Initially a Postdoc in the Department of Scientific Computing, Florida State University.

Currently an Associate Professor in the Department of Mathematics and Statistics, Auburn University.

Vitor Manuel Leite dos Santos Nunes, Mathematics, (Ph.D. 2013), Ph.D. Dissertation:

"Fréchet Sensitivity Analysis and Parameter Estimation in Groundwater Flow Models."

Initially a Postdoc in the Department of Mathematical Sciences, University of Texas at Dallas.

Currently working at Fannie Mae as a data scientist.

Alan Lattimer, Mathematics, co-advised with Serkan Gugercin, (Ph.D. 2016), Ph.D. Dissertation:

"Reduction of Nonlinear Fire Dynamics Models."

Initially worked as a senior software engineer at Jenson Hughes.

Currently a senior data scientist at Socially Determined.

Cristina Felicitas Letona Bolivar, Mathematics, (Ph.D. 2016), Ph.D. Dissertation:

"On a Class of Parametrized Domain Optimization Problems with Mixed Boundary Condition Types."

Currently an Instructor at Virginia Tech.

Justin Krometis, Mathematics, co-advised with Nathan Glatt-Holtz, (Ph.D. 2018), Ph.D. Dissertation:

"A Bayesian Approach to Estimating Background Flows from a Passive Scalar."

Currently a Research Assistant Professor with the National Security Institute at Virginia Tech.

<u>M.S. Students (listing project or thesis students only)</u>

Greta Soechting-Garcia, Mathematics, (M.S. 1999), Masters Project:

"Sensitivity Analysis for a Soil Moisture Infiltration Model."

Initially an analyst for Experian in Atlanta, GA.

Currently at Equifax in Atlanta, GA.

Jerri Sayers, Mathematics, (M.S. 2001), Masters Project:

"Investigating Numerical Methods for Approx. Functional Gains for the 1D Heat Equation."
Initially pursued a Ph.D. in Math Education at Virginia Tech.
Currently at University of Maryland, Baltimore County.

Kay Vugrin, Mathematics, (M.S. 2003), Masters Thesis:

"On the Effect of Numerical Noise in Simulation-Based Optimization."
Advised her Ph.D.

Christoph Winter, Mathematics, (M.S. 2003), Masters Project:

"Finite Element Simulation of Phase Change."
Initially a Ph.D. student at Technische Universität Munich.
Currently a Branch Head of Risk Management Group at Allianz Deutschland.

Peter Hou, Mathematics, (M.S. 2005), Masters Thesis:

"Nodal Reordering Strategies to Improve Preconditioning for Finite Element Systems."
Initially and currently an actuary for Mercer Consulting in New York.

Denis Kovacs, Mathematics, (M.S. 2005), joint with C. Beattie, Masters Thesis:

"Inertial Manifolds and Nonlinear Galerkin Methods."
Initially worked for NVidia Corporation, Santa Clara, CA.
Currently a Game Technologies Engineer at Apple.

Daniel Sutton, Mechanical Engineering, (M.S. 2005), Masters Thesis:

"Improved Reduced Order Modeling Strategies for Coupled and Parametric Systems."
Continued as a Ph.D. student Math at Virginia Tech.

Miroslav Stoyanov, Mathematics, (M.S. 2006), Masters Thesis:

"Optimal Linear Feedback Control for Incompressible Fluid Flow."
Advised his Ph.D.

Dimitris Katsoridas, Mathematics, (M.S. 2008), Masters Presentation.

Initially completed a Ph.D. in Economics at University of North Carolina.
Currently a Risk Modeling & Analytics Specialist at UBS, Zürich.

Jacob Dodson, Mathematics, (M.S. 2010), Masters Project:

"Optimal Sensor Location in Linear Distributed Systems for State Estimation."
Initially completed a Ph.D. in Mechanical Engineering at Virginia Tech in 2012.
Currently a Research Mechanical Engineer at Air Force Research Laboratory, Fort Walton Beach.

Oleksandr Bondarenko, Mathematics, (M.S. 2010), joint with T. Herdman, Masters Thesis:

"Optimal Control for an Impedance Boundary Value Problem." (supervised by A. Kirsch)
Initially completed a Ph.D. in Math at Universität Karlsruhe in 2016.
Currently a Machine Learning Engineer at Shippeo (Paris).

Yasser Aboelkassem, Mathematics, (M.S. 2012), Masters Project:

"Accurate Stokeslets-Meshfree Computations via Regularization Techniques."
Initially completed his Ph.D. in Engineering Science and Mechanics in 2012.
Completed Postdocs at Yale, Johns Hopkins University, and the University of California San Diego.

Currently an Assistant Professor at University of Michigan (MIDAS).

Samantha Erwin, Mathematics, (M.S. 2013), Masters Thesis:

"Modeling of Passive Chilled Beams for Use in Efficient Control of Indoor-Air Environments."
Initially completed a Ph.D. in Math at Virginia Tech in 2017.
Currently a postdoc at NC State's College of Veterinary Medicine.

Drayton Munster, Mathematics, (M.S. 2013), joint with L. Zietsman, Masters Thesis:

"Sensitivity-Enhanced Model Reduction."
Currently pursuing a Ph.D. in Math at Virginia Tech.

Benjamin Unger, Mathematics, (M.S. 2013), Masters Thesis:

"Impact of Discretization Techniques on Nonlinear Model Reduction and Analysis of the Structure of the POD Basis."
Initially interned with Allianz Deutschland and Bosch.
Completed his Ph.D. in Math at TU Berlin (Mehrmann).
Currently at University of Stuttgart (Cluster of Excellence SimTech).

Mingqiang Zhang, Mathematics, (M.S. 2014), Masters Project:

"Quantitative Models of Trading based on Behavioral Finance."
Initially continued his Ph.D. in Chemistry at Virginia Tech.
Currently a Data Science Manager at Lyft.

Andrew Glaws, Mathematics, (M.S. 2014), Masters Thesis:

"Finite Element Simulations of Two Dimensional Peridynamic Models."
Initially pursued a Ph.D. in Math at Colorado School of Mines.
Currently pursuing a Ph.D. in Math at the University of Colorado Boulder.

Thomas May, Mathematics, (M.S. 2015), joint with L. Zietsman, Masters Thesis:

"Minimally Corrective, Approximately Recovering Priors to Correct Expert Judgement in Bayesian Parameter Estimation."
Initially performed a two-year internship at the Federal Reserve Bank.
Currently pursuing a Ph.D. in Economics at the University of Minnesota.

Ross Thompson, Mathematics, (M.S. 2015), Masters Thesis:

"Galerkin Projections Between Finite Element Spaces."
Currently at Bloomberg, New York.

Masoud Shirazi, Mathematics, (M.S. 2017), Masters Project:

"Simultaneous Localization and Mapping."
Initially completed his Ph.D. in Engineering Science and Mechanics at Virginia Tech.

Benjamin Beach, Mathematics, (M.S. 2017), joint with S. Gugercin, Masters Thesis:

"An Implementation-Based Exploration of HAPOD: Hierarchical Approximate Proper Orthogonal Decomposition."
Currently pursuing a Ph.D. in Industrial Engineering at Virginia Tech.

Hannah Kurdila, Mathematics, (M.S. 2018), Masters Thesis:

"Gappy POD and Temporal Correspondence for Lizard Motion Estimation."
Initially pursued a Ph.D. Biomechanics at NYU.
Currently working at the Food and Drug Administration.

Harsh Sharma, Mathematics, (M.S. 2020), Masters Project:

"Performance Assessment of Energy-Preserving, Adaptive Time-Step Variational Integrators."

Initially completed his Ph.D. in Aerospace Engineering at Virginia Tech.

Currently a Postdoc at University of California San Diego.

Shree Sanyal, Mathematics, (M.S. 2020), Masters Project:

"Using Matlab ODE Integrators to Solve the Steady Burgers Equation."

Currently a data scientist at Battelle.

Andrew Shedlock, Mathematics, (M.S. 2021), Masters Thesis:

"A Numerical Method for Solving the Periodic Burgers Equation Through a Stochastic Differential Equation."

Currently pursuing a Ph.D. in Mathematics at NCSU.

Jovan Žigić, Mathematics, (M.S. 2021), Masters Thesis:

"Optimization Methods for Dynamic Mode Decomposition of Nonlinear Partial Differential Equations."

Currently an instructor at Dominican College, N.Y.

<u>Current Students</u>

Hamza Adjerid, Mathematics, (M.S. Student).

Camilo Arenas Mata, Mathematics, (M.S. Student).

Ali Bouland, Mechanical Engineering, (Ph.D. Student).

Sydney Lang, Mathematics, (M.S. Student).

Aimane Najmeddine, Mathematics, (M.S. Student).

Sevak Tahmasian, Mathematics, (Ph.D. Student).

Teona Zurabashvili, Mathematics, (M.S. Student).

Post-Docs

John Paul Roop (Ph.D. Mathematics, Clemson University) 2004–2006.

Currently in the Department of Mathematics at North Carolina A&T State University.

Alexander Hay (Ph.D. Computational Fluid Dynamics, Université de Nantes) 2007–2009.

Initially a Mechanical Engineer at the Industrial Materials Institute, Boucherville, QC.
Currently an Assistant Professor of Mechanical Engineering at Polytechnique Montréal.

Imran Akhtar (Ph.D. Engineering Science and Mechanics, Virginia Tech) 2008–2010.

Currently an Assistant Professor at the National University of Science & Technology, Islamabad, Pakistan.

Omer San (Ph.D. Engineering Science and Mechanics, Virginia Tech), joint w/ T. Iliescu 2012–2014.

Currently an Assistant Professor of Mechanical and Aerospace Engineering at Oklahoma State University.

Samah Ben Ayed (Ph.D. Engineering Science and Mechanics, Virginia Tech), joint w/ E. M. Cliff 2013–2016.

Currently an Assistant Professor of Mechanical Engineering Technology at New Mexico State University.

Qingzhao Wang (Ph.D. in Mechanical Engineering, Virginia Tech) 2018.

Currently a Postdoc in Aerospace Engineering at the University of Michigan.