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## CURRICULUM VITAE

**John Allen Burns**

Hatcher Professor of Mathematics

Department of Mathematics

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### I. Home Address

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### II. Education

1967 B.S.E., Mathematics, Arkansas State University  
1968 M.S.E., Mathematics, Arkansas State University  
1970 M.A., Mathematics, The University of Oklahoma  
1973 Ph.D., Mathematics, The University of Oklahoma

#### Ph.D. Dissertation

“Variational and Optimal Control Problems Involving Unbounded Operators:” Major Professor - William T. Reid.

### III. Professional Experience

#### Employment

1995-Present: Hatcher Professor of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, VA.  
1993-Present: Director, Center for Optimal Design and Control, Virginia Polytechnic Institute and State University, Blacksburg, VA.  
1987-Present: Technical Director, Interdisciplinary Center for Applied Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, VA.

- 1983-1984: Program Advisor in Control Theory, Air Force Office of Scientific Research, Washington, D.C.
- 1982-Present: Professor of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- 1978-1982: Associate Professor of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- 1974-1978: Assistant Professor of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- 1973-1974: Assistant Professor - Research, Lefschetz Center for Dynamical Systems, Division of Applied Mathematics, Brown University, Providence, RI.
- 1972-1973: Special Instructor - Department of Mathematics, University of Oklahoma, Norman, OK.
- 1968-1972: Research - Teaching Assistant, Department of Mathematics, University of Oklahoma, Norman, OK.

#### Visiting and Consulting Appointments

- 2015-Present: Visiting Research Fellow, United Technologies Research Center, Hartford, CN.
- 2010-Present: Consultant United Technologies System Control Engineering, Hartford, CN.
- 2008-2009: Visiting Research Fellow, United Technologies Research Center, Hartford, CN.
- 2008-2009: Consultant, Science and Technology Associates, Arlington, VA.
- 2003-2004: Consultant, Booz Allen & Hamilton, Inc., McLean, VA.
- 2002-2003: Consultant, Solers Inc., Arlington, VA.
- 2001: Visiting Professor, Department of Mathematics, University of Graz, Graz, Austria (June - August).
- 2001 Visiting Scientist, Control Sciences Center of Excellence, Air Force Research Laboratory, Wright-Patterson AFB, Oh 45433 (January – May).
- 1999 Visiting Professor, Department of Mathematics, University of Trier, Trier, Germany (March)
- 1990 Visiting Professor, Center for Applied Mathematical Sciences, University of Southern California, Los Angeles, CA (February-June)
- 1990 Distinguished Visiting Professor, Department of Mathematical Sciences, Clemson University, Clemson, SC (January)
- 1988 Visiting Professor, Institut Für Mathematik, Universität Graz, Graz, Austria (June-July).
- 1985-1997: Consultant, ICASE, NASA Langley Research Center, Hampton, VA.
- 1978-1981: Consultant, The Babcock and Wilcox Company, Lynchburg Research Center, Lynchburg, VA.

#### **IV. Research Interest**

Applied and Computational Control; Ordinary, Functional and Partial Differential Equations; Approximation, Control, Identification and Optimization of Distributed Parameter Systems; Aeroelastic Control Systems; Fluid/Structural Control Systems; Smart Materials; Design, Control and Optimization of Flexible Structures, Optimal Design; Sensitivity Analysis, Modeling and Control of Energy Efficient Systems, Physics Based Modeling and Simulation.

## V. Research Publications

### BOOKS EDITED

Sturmian Theory for Ordinary Differential Equations by W. T. Reid, Edited by C. Ahlbrandt, J. A. Burns, and T. L. Herdman, Springer-Verlag, New York, 1980, 557 pages.

Computational Methods for Optimal Design, Edited by Jeff Borggaard, John Burns, Eugene Cliff and Scott Schreck, Progress in Systems and Control Theory, Birkhäuser, Boston, 1998, 475 pages.

### BOOKS AUTHORED

John A. Burns, *An Introduction to the Calculus of Variations and Control with Modern Applications*, Taylor & Francis Publishers, Boca Raton, 2014, 544 Pages.

### PAPERS

1. Lecture Notes on Generalized Inverses of Linear Operators in Normed Linear Spaces, *Lefschetz Center for Dynamical Systems*, CDS Lecture Notes 74-2, Brown University, Providence, RI, 1974, 71 pages.
2. Existence Theorems and Necessary Conditions for a General Formulation of the Minimum Effort Problem, *J. of Optimization Theory and Applications*, Vol. 15, 1975, 413-440.
3. The Geometry of the Minimum Cost Problem, *J. of Mathematical Analysis and Applications*, Vol. 50, 1975, 639-646.
4. An Abstract Framework for Approximate Solutions to Optimal Control Problems Governed by Hereditary Systems (with H. T. Banks), *International Conference on Differential Equations*, H. A. Antosiewicz, Ed., Academic Press, New York, 1975, 10-25.
5. Adjoint Semigroups Theory for a Volterra Integro-Differential System (with T. L. Herdman), *Bull. American Mathematical Society*, Vol. 81, 1975, 1099-1102.
6. Numerical Solutions of Hereditary Control Problems Via an Approximation Technique (with H. T. Banks, E. M. Cliff, P. R. Thrift), *CDS Technical Report 75-6*, Lefschetz Center for Dynamical Systems, Brown University, Providence, RI, 1975, 102 pages.
7. Integration of Compact Set-valued Functions (with Z. Artstein), *Pacific J. of Mathematics*, Vol. 58, 1975, 297-307.
8. Adjoint Semigroup Theory for a Class of Functional Differential Equations (with T. L. Herdman), *SIAM J. on Mathematical Analysis*, Vol. 7, 1976, 729-745.
9. Projection Methods for Hereditary Systems (with H. T. Banks), *Dynamical Systems, An Int'l. Symp.*, L. Cesari, J. Hale, J. P. LaSalle, eds., Academic Press, New York, 1976, 287-290.
10. Stability Analysis of Spatially Dependent Non-linear Reactor Systems Using a Semi-group Approach (with R. Onega, L. Mync), *J. of Nuclear Science and Engineering*, Vol. 61, 1976, 399-407.
11. A Piecewise Linear Approximation Scheme for Hereditary Optimal Control Problems (with E. M. Cliff), *Proc. 1977 Joint Automatic Control Conference*, Vol. 2, 1977, 867-873.
12. Hereditary Control Problems: Numerical Methods Based on Averaging Approximations (with H. T. Banks), *SIAM J. on Control and Optimization*, Vol. 16, 1978, 169-208.
13. Numerical Solutions of a Control Problem Governed by Functional Differential Equations (with H. T. Banks, E. M. Cliff, P. R. Thrift), *Numerical Methods for Differential Equations*

- and Simulation*, A. W. Bennett and R. Vichnevetsky, Eds., North-Holland, New York, 1978, 9-12.
14. On Approximating Linear Hereditary Dynamics by Systems of Ordinary Differential Equations (with E. M. Cliff), *Numerical Methods for Differential Equations and Simulation*, A. W. Bennett and R. Vichnevetsky, Eds., North-Holland, New York, 1978, 67-72.
  15. Methods for Approximating Linear Hereditary Quadratic Optimal Control Problems (with E. M. Cliff), *IEEE Trans. on Automatic Control*, AC - 23, 1978, 21-36.
  16. On the Formulation of Some Distributed System Parameter Identification Problems (with E. M. Cliff), *Proc. First AIAA Symp. On Dynamics and Control of Large Flexible Spacecraft*, L. Meirovitch, Ed., June 1977, 87-105.
  17. Euclidean Controllable Realizations of Linear Hereditary Systems (with E. M. Cliff), *Math. Systems Theory*, Vol. 12, 1978, 133-149.
  18. Parameter Identification for Linear Hereditary Systems Via an Approximation Technique (with E. M. Cliff). *Information Linkage Between Applied Math. and Industry*, P. C. Wang, Ed., Academic Press, New York, 1979, 527-538.
  19. An Abstract Quasilinearization Algorithm for Estimating Parameters in Hereditary Systems, (with E. M. Cliff), in 1978 IEEE Conference on Decision and Control including the 17th Symposium on Adaptive Processes, Volume 17, Part 1, Jan. 1978 , 572 – 577.
  20. An Abstract Quasi-Linearization Algorithm for Estimating Parameters in Hereditary Systems, (with E. M. Cliff), *IEEE Trans. on Automatic Control*, AC-25, 1980, 126-129. Also appeared in Proc. 17th IEEE Conference on Decision and Control, San Diego, January 1979, 572-577.
  21. Functional Differential Equations with Discontinuous Right Hand Side (with T. L. Herdman), Volterra Equations, *Proc. Helsinki Symposium on Integral Equations*, S. Londen and O. Staffans, Eds., Springer-Verlag, New York, 1979, 99-106.
  22. Spline Based Approximation Methods for Control and Identification of Hereditary Systems (with H. T. Banks and E. M. Cliff), *Proc. Int'l. Symposium on System Optimization and Analysis*, A. Bensoussan and J. Lions, Eds., Springer-Verlag, New York, 1979, 314-320.
  23. Hilbert Space Realizations for Hereditary Systems, (with E. M. Cliff), *Proc. 18th IEEE Conference on Decision and Control*, Fort Lauderdale, December 1979, 679-683.
  24. A Comparison of Numerical Methods for Identification and Optimization Problems Involving Control Systems with Delays, (with H. T. Banks and E. M. Cliff), *LCDS Technical Report, TR 79-7*, Lefschetz Center for Dynamical Systems, Brown University, Providence, RI, 1979, 185 pages.
  25. The Cauchy Problem for Linear Functional Differential Equations, (with T. L. Herdman and H. W. Stech), *Integral and Functional Differential Equations*, T. L. Herdman, S. M. Rankin and H. W. Stech, Eds., Marcel Dekker, 1981, 137-147.
  26. Parameter Identification for Hereditary Systems: Final Technical Report on Grant AFOSR-77-3221A, (with E. M. Cliff), September 1979, *AFWAL Technical Memorandum 80-10-FLGC*, Wright-Patterson AFB, Ohio, 136 pages.
  27. Parameter Estimation and Identification for Systems with Delays (with H. T. Banks and E. M. Cliff), *SIAM J. on Control and Optimization*, Vol. 19, 1981, 791-828.
  28. A Difference Equation Approach to Parameter Estimation for Differential-Delay Equations (with P. D. Hirsch), *Applied Math. and Computation*, Vol. 4, 1980, 281-311.
  29. Finite Difference Methods for Identification of Hereditary Control Systems, *Nonlinear Phenomena in Mathematical Sciences*, V. Lakshmikantham, Ed., Academic Press, 1982, 169-178.

30. Linear Functional Differential Equations as Semigroups on Product Spaces (with T. L. Herdman and H. W. Stech), *SIAM J. Math. Anal.*, Vol. 14, 1983, 98-116.
31. Differential-Boundary Operators and Associated Neutral Functional Differential Equations (with T. L. Herdman and H. W. Stech), *Rocky Mountain J. Math.*, Vol. 13, 1983, 125-142.
32. Hereditary Models for Airfoils in Unsteady Aerodynamics; Numerical Approximations and Parameter Estimation, (with E. M. Cliff), *AFWAL Technical Report AFWAL-TR-81-3173*, Wright-Patterson AFB, Ohio, February 1982, 75 pages.
33. An Approximation Technique for the Control and Identification of Hybrid Systems, (with E. M. Cliff), *Proc. Third AIAA Symp. on Dynamics and Control of Large Flexible Spacecraft*, L. Meirovitch, Ed., June 1981, 269-284.
34. Reduced Approximations in Parameter Identification of Hereditary Systems (with E. M. Cliff), *Proc. 10<sup>th</sup> IFIP Conference on System Modeling and Optimization*, New York, August 1981, Springer-Verlag, 241-249.
35. Nonlinear Neutral Functional Differential Equations in Product Spaces (with J. M. Amillo and E. M. Cliff), *Ordinary and Partial Differential Equations*, W. N. Everitt and B. D. Sleeman, Eds., Springer-Verlag, 1982, 118-134.
36. A State Space Model for an Aeroelastic System (with E. M. Cliff and T. L. Herdman), *22<sup>nd</sup> IEEE Conference on Decision and Control*, 1983, 1074-1077.
37. Chandrasekhar Equations and Computational Algorithms for Distributed Parameter Systems (with K. Ito and R. Powers), *23rd IEEE Conference on Decision and Control*, 1984, 262-267. Also appeared as NASA-ICASE Report No. 84-50, NASA Langley Research Center, Hampton, VA, September, 1984, 24 pages.
38. Well-Posedness of Functional Differential Equations with Nonatomic D Operators (with T. Herdman and J. Turi), *Proc. 6<sup>th</sup> International Conference on Nonlinear Analysis*, V. Lakshmikantham, Ed., Academic Press, New York, 1985, 71-77.
39. Modeling and Control of Flexible Structures (with E. M. Cliff, R. M. Goff, H. J. Kelley, F. H. Lutze), *AFRPL-TR-85-030*, May 1985, 94 pages.
40. Mathematical and Computer Sciences in the FY 1986 Budget, *AAAS Report X: Research and Development FY 1986*. 1985, 201-210.
41. Computational Methods for the Control of Distributed Parameter Systems (with E. M. Cliff and R. K. Powers), *24<sup>th</sup> IEEE Conference on Decision and Control*, 1985, 1994-1998. Also appeared as NASA-ICASE Report No. 86-32, NASA Langley Research Center, Hampton, VA, May 1986, 18 pages.
42. Factorization and Reduction Methods for Optimal Control of Hereditary Systems (with R. K. Powers), *Mathematica Applicada E Computational*, Vol. 5, No. 3, 1987, 203-248. Also appeared as NASA-ICASE Report No. 85-58, NASA Langley Research Center, Hampton, VA, November 1985, 103 pages.
43. Modeling and Control of an Aeroelastic System (with E. M. Cliff and R. K. Powers), *Fourth IFAC Symposium on Control of Distributed Parameter Systems*, UCLA, July 1986, 6-11.
44. Nonatomic Neutral Functional Differential Equations (with T. L. Herdman and J. Turi), *Nonlinear Analysis and Applications*, V. Lakshmikantham, Ed., Marcel Dekker, Inc., 1987, 635-646.
45. On Integral Transforms Appearing in the Derivation of the Equations of an Aeroelastic System (with E. M. Cliff, T. L. Herdman and J. Turi), *Nonlinear Analysis and Applications*, V. Lakshmikantham, Ed., Marcel Dekker, Inc., 1987, 89-98.

46. Modeling and Approximation for a Viscoelastic Control Problem (with R. Fabiano), *Distributed Parameter Control*, F. Kappel, K. Kunisch and W. Schappacher, Eds., Springer-Verlag, 1987, 23-39.
47. Optimal Control of a Distributed System (with E. M. Cliff), *Proc. Int'l Conference on Optimal Control*, Oberwolfach, FRG, R. Bulirsch, A. Miele, J. Stoer and K. Well, Eds., Springer-Verlag, 1987, 304-318.
48. On Robustness and Controllability for Finite Dimensional Approximations of Distributed Parameter Systems, (with G. Peichl), *IMACS/IFAC Symposium on Distributed Parameter Systems*, Hiroshima, Japan, October 1987, 491-496.
49. On Non-Convergence of Adjoint Semigroups for Control Systems with Delays (with K. Ito and G. Propst), *SIAM J. Control and Optimization*, Vol. 26, 1988, 1442-1454. Also, as NASA-ICASE Report No. 87-47, NASA Langley Research Center, Hampton, VA, July 1987, 32 pages.
50. Neutral Functional Integro-Differential Equations with Weakly Singular Kernels (with T. L. Herdman and J. Turi), *J. Math. Anal. Appl.*, Vol. 145, 1990, 371-401.
51. Control of a Viscoelastic Shaft with Attached Tip Mass (with R. E. Miller and E. M. Cliff), *26<sup>th</sup> IEEE Conference on Decision and Control*, 1987, 997-1001.
52. Time Optimal Slewing of Flexible Spacecraft (with J. Ben-Asher and E. M. Cliff), *26<sup>th</sup> IEEE Conference on Decision and Control*, 1987, 524-528.
53. Feedback Control of a Hyperbolic Partial-Functional Differential Equation with Viscoelastic Damping (with R. Fabiano), *Journal of Control Theory and Advanced Technology*, Vol. 5, No. 2, 1989, 157-188.
54. Preservation of Controllability Under Approximation and Controllability Radii for Hereditary Systems (with G. Peichl), *Journal of Differential and Integral Equations*, Vol. 2, 1989, 439-452.
55. Soft-Constrained Time-Optimal Maneuvering of Flexible Spacecraft (with J.Z. Ben-Asher and E.M. Cliff), *Proceedings of the 30th Israel Annual Conference on Aviation and Astronautics*, February, 1989, 218-225.
56. System Radii of Semi-Discretized Hereditary Control Systems (with G. Peichl), *27<sup>th</sup> IEEE Conference on Decision and Control*, 1988, 2003-2005.
57. Time Optimal Slewing Flexible Spacecraft (with J. Z. Ben-Asher and E. M. Cliff), *AIAA Journal of Guidance, Control and Dynamics*, Vol. 15, No. 2, 1992, 360-367.
58. Control of a Thermoviscoelastic System, (with E. M. Cliff, Z. Y. Liu and R. E. Miller), *27<sup>th</sup> IEEE Conference on Decision and Control*, 1988, 1249-1252.
59. Computational Methods for the Minimum Effort Problem with Applications to Spacecraft Rotation Maneuvers (with J. Z. Ben-Asher and E. M. Cliff), *1989 IEEE Conf. on Control and Applications*, Paper WA-6-5, 1-7.
60. State Space Formulations for Functional Differential Equations of Neutral Type (with T. L. Herdman and J. Turi), Nonlinear Semigroups, *Partial Differential Equations and Attractors*, T. L. Gill and W.W. Zachary, Eds., Lecture Notes in Mathematics, Vol. 1394, 1989, Springer-Verlag, 1-10.
61. On Well-Posedness of Integro-Differential Equations in Weighted  $L^2$ -Spaces (with K. Ito), *Journal of Differential and Integral Equations*, 1995, Vol. 8, No. 3, 627-646.
62. A Summary of Control System Radii and Approximation: A Case Study for the 1-D Heat Equation (with G. Peichl), *Journal of Mathematical Systems, Estimation and Control*, Vol. 5, No 3, 371-375.

63. A Note on the Asymptotic Behavior of Controllability Radii for a Scalar Hereditary System (with G. Peichl), *Control and Estimation of Distributed Parameter Systems*, F. Kappel, K. Kunisch and W. Schappacher, Eds., Birkhäuser Verlag, 1989, 27-39.
64. Parameter Identification for an Abstract Cauchy Problem by Quasi-linearization (with D.W. Brewer and E. M. Cliff), *Quarterly of Applied Mathematics*, Vol. LI, March 1993, 1-22. Also, as NASA-ICASE Report No. 89-75, NASA Langley Research Center, Hampton, VA, October, 1989, 35 pages.
65. Approximations of Thermoelastic and Viscoelastic Control Systems (with Z.Y. Liu and R.E. Miller), *Journal of Numerical Functional Analysis and Optimization*, Vol. 12, No. 1, 1991, 79-136. Also, as NASA-ICASE Report No. 90-43, NASA Langley Research Center, Hampton, VA, June 1990, 68 pages.
66. A Control Problem for Burgers' Equation with Bounded Input/Output (with S. Kang), *Journal of Nonlinear Dynamics*, Vol. 2, 1991, 235-262. Also appeared as NASA-ICASE Report No 90-45, NASA Langley Research Center, Hampton, VA, June 1990, 35 pages.
67. A Stabilization Problem for Burgers' Equation with Unbounded Control and Observation (with S. Kang), *Control and Estimation of Distributed Parameter Systems*, F. Kappel, K. Kunisch and W. Schappacher, Eds., Birkhäuser Verlag, 1991, 51-72.
68. Optimal Control of Lift/Drag Ratios on a Rotation Cylinder (with Yuh-Roung Ou), *Applied Math Letters*, Vol. 5, No. 3, 1992, 57-62.
69. A Note on Computing System Radii for Galerkin Approximations of Elastic Systems (with E. F. Berdager, G. H. Peichl and R. S. Sanchez Pena), *29<sup>th</sup> IEEE Conference on Decision and Control*, 1990, 17-21.
70. Effect of Rotation Rate on the Forces of a Rotation Cylinder (with Yuh-Roung Ou), *NASA-ICASE Report No. 93-11*, NASA Langley Research Center, Hampton, VA, March 1993, 49 pages.
71. Modelling for Control of Shape Memory Alloys (with R. Spies), *30<sup>th</sup> IEEE Conference on Decision and Control*, December 1991, 2334-2339.
72. Approximation of the Thermoviscoelastic Control System, (with Z. Y. Liu and R. E. Miller), *Computation and Control II*, K.L. Bowers and J. Lund, Eds., Birkhäuser, 1991, 31-44.
73. Sensitivity Calculations for a 2D, Inviscid, Supersonic Forebody Problem (with J.T. Borggaard, E.M. Cliff and M.D. Gunzburger), *Identification and Control of Systems Governed by Partial Differential Equations*, H.T. Banks, R. Fabiano and K. Ito, Eds., SIAM Publications, Philadelphia, PA, 1993, 14-24.
74. Finite Element Approximation of a Shape Memory Alloy (with R. Spies), *Active Materials and Adaptive Structures*, Gareth Knowles, Ed., Institute of Physics Publishing, London, 1992, 207-210.
75. Unbounded Observation and Boundary Control Problems for Burgers' Equation (with S. Kang and K. Ito), *30<sup>th</sup> IEEE Conference on Decision and Control*, December 1991, 2687-2692.
76. On the Energy Decay of a Linear Thermoelastic Bar, (with Z. Liu and S. Zheng), *J. Math. Anal. Appl.*, Vol. 179, No.2, 1993, 574-591.
77. Optimal Fixed-Finite-Dimensional Compensator for Burgers' Equation with Unbounded Input/Output Operators, (with H. Marrekchi), *Computation and Control III*, K.L. Bowers and J. Lund, Eds., Birkhauser, 1993, 83-104. Also, as NASA-ICASE Report No. 93-19, NASA Langley Research Center, Hampton, VA, April 1993, 23 pages.

78. A Sensitivity Equation Approach to Shape Optimization in Fluid Flows, (with J.T. Borggaard), *Flow Control*, M. Gunzburger, Ed., Springer-Verlag, 1994, 49-78.
79. A Numerical Study of Parameter Sensitivities in Landau-Ginzburg Models of Phase Transitions in Shape Memory Alloys (with R. Spies), *Journal of Intelligent Material Systems and Structures*, Vol. 5, 1994, 321-332.
80. Sensitivity Analysis for a Dynamic Model of Phase Transition in Materials with Memory, (with R.D. Spies), *Recent Advances in Adaptive and Sensory Materials and Their Applications*, Rogers, C.A. and Rogers, R.C., Eds., Technomic Publishing Co., Basel, 1992, 82-93.
81. Active Control of Vortex Shedding (with Yuh-Roung Ou), *32nd AIAA Aerospace Sciences Meeting*, Reno, Nevada, Paper AIAA-94-0182, January, 1994, 1-10.
82. A Note on the Regularity of Solutions of Infinite Dimensional Riccati Equations (with B.B. King), *Applied Math Letters*, Vol.7, No. 6, 1994, 13-17. Also, as NASA-ICASE Report No. 94-20, NASA Langley Research Center, Hampton, VA, March 1994, 18 pages.
83. Feedback Controller for a Flexible Structure Using Piezoceramic Actuators (with M.Tadi), *Journal of Dynamics and Control*, Vol. 5, No.4, 1995, 401-419.
84. Optimal Sensor Location for Robust Control of Distributed Parameter Systems (with B. B. King), *33rd IEEE Conference on Decision and Control*, December 1994, 3967-3972.
85. A Sensitivity Equation Approach to Optimal Design of Nozzles (with J. T. Borggaard), *5th AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Design*, Panama City, FL, AIAA Paper AIAA-94-4274, September 1994, 232-241.
86. Feedback Control of the Driven Cavity Problem Using LQG Designs (with R. Y. Ou), *33rd IEEE Conference on Decision and Control*, December 1994, 289-294.
87. A Reduced Basis Approach to the Design of Low Order Feedback Controllers for Nonlinear Continuous Systems (with B.B. King), *Journal of Vibration and Control*, Vol. 4, (1998), 297-323.
88. A Comparison of Minmax and LQG Control for a Hybrid Nonlinear Continuous Systems (with B.B. King), *Applied Mechanics in the Americas, Vol. II*, L. A. Godoy, S. R. Idelshon, P. A. Laura and D. Mook, Eds., AMM and AMCA, Santa Fe, Argentina, 1995, 503-506.
89. Algorithms for Flow Control and Optimization (with J. Borggaard, J. Burkardt, E. Cliff, M. Gunzburger, H. Kim, H. Lee, J. Peterson, A. Shenoy and X. Wu), *Optimal Design and Control*, J. Borggaard, J. Burkardt, M. Gunzburger, and J. Peterson, Eds., Birkhäuser, 1995, 97-116.
90. Representation of Feedback Operators for Hyperbolic Systems (with B. B. King), *Computation and Control IV*, K.L. Bowers and J. Lund, Eds., Birkhäuser, 1995, 57-73.
91. A Computational Approach to Sensor/Actuator Location for Feedback Control of Fluid Flow Systems, (with B. B. King and Y. R. Ou), *SPIE Conference on Sensing, Actuation and Control in Aeropropulsion*, Orlando, FL, April, 1995, 60-70.
92. Asymptotically Consistent Gradients in Optimal Design, (with J. Borggaard), *Multidisciplinary Design Optimization*, N. M. Alexandrov and M. Y. Hussaini, Ed., SIAM Publications, 1997, 303-314.
93. System Dynamics and Feedback Control Formulations for Real Time Dynamic Traffic Routing, (with S. Kang, P. Kachroo and K. Özbay), *Journal of Mathematical and Computer Modeling*, Vol. 27, No. 9, (1998), 27-49.



94. Regularity of Feedback Operators for Boundary Control of Thermal Processes (with B. B. King and D. Rubio), *First International Conference on Nonlinear Problems in Aeronautics and Aerospace*, S. Sivasundaram, Ed., Embry-Riddle Aeronautical Press, May, 1996, 67-73.
95. A Note on Numerical Stationary Solutions for the Viscous Burgers' Equation (with A. Balogh, D. Gilliam and V. Shubov), *Journal of Math. Systems, Estimation, and Control*, Vol. 8, No. 2, (1998), 1-12. Full electronic manuscript published March, 1998, 16 pages. Retrieval code: 55578.
96. A PDE Sensitivity Equation Method for Optimal Aerodynamic Design (with J.T. Borggaard), *Journal of Computational Physics*, Vol. 136, (1997), 366-384.
97. Control of the Boussinesq Equations in a Thermal Loop (with D. Rubio), *Applied Mechanics in the Americas, Vol. VI*, M. Rysz, L. Godoy and L. Suarez, Eds., University of Iowa Press, January 1997, 142-145.
98. A Note on the Mathematical Modelling of Damped Second Order Systems (with B. B. King), *Journal of Math. Systems, Estimation, and Control*, Vol. 8, No. 2, (1998), 1-12. Full electronic manuscript published March, 1998, Retrieval code: 82674.
99. A Projection Method for Accurate Computation of Design Sensitivities (with L.G. Stanley and D.L. Stewart), *Optimal Control: Theory, Algorithms, and Applications*, W.W. Hager and P.M. Pardalos, Eds., Kluwer Academic Press, 1998, 40-66.
100. Control of a Thermal Fluid Using State Estimators (with B. B. King and D. Rubio), *International Journal of Computational Fluid Dynamics*, Vol. 11, (1998), 393-112.
101. A Distributed Parameter Control Approach to Sensor Location for Optimal Feedback Control of Thermal Processes (with D. Rubio), *36<sup>th</sup> IEEE Conference on Decision and Control*, December 1997, 2243-2247.
102. Automated Optimization Techniques for Phase Change Piezoelectric Ink Jet Performance Enhancement (with Sharon S. Berger, Ronald F. Burr and Paul A. Gilmore), *1997 International Conference on Digital Printing Technologies*, Society for Imaging Science and Technology, IS&T's NIP13, November, 1997, 716-721.
103. On the Design of Feedback Controllers for a Convecting Fluid Flow via Reduced Order Modeling, (with B. B. King and D. Rubio), *1999 IEEE International Conference on Control Applications*, 1157-1162.
104. Parameter Differentiability of the Solution of a Nonlinear Abstract Cauchy Problem (with Pedro Morin and Ruben Spies), *JMAA*, 252 (2000), 18-31.
105. Computational Methods for Identification and Control of Nanoscale Materials (with B. B. King and O. Stein), *Proceedings of 2000 MTNS*, June 2000, Perpignan, France, Paper S121-A7, 6 pages.
106. A Note on the Use of Transformations in Sensitivity Computations for Elliptic Systems (with Lisa Stanley), *Journal of Mathematical and Computer Modeling*, 33 (2001), 101-114.
107. Numerical Methods for Approximating Functional Gains in LQR Boundary Control Problems (with Kevin Hulsing), *Journal of Mathematical and Computer Modeling*, 33 (2001), 89-100.
108. On the Long Time Behavior of Approximating Dynamical Systems, (with J. R. Singler), *Distributed Parameter Control*, F. Kappel, K. Kunisch and W. Schappacher, Eds., Springer-Verlag, 2001, pp. 73 - 86.
109. Boundary Layer Control of the Viscous Burgers' Equation, (with J. Myatt and L. Zeitsman), *2002 IEEE Conference on Control Applications*, Glasgow, Scotland, 548-553.
110. Functional Gain Computations for a 1D Parabolic Equation Using Non-Uniform Meshes, (with B. B. King and L. Zeitsman), *Proceedings of 2002 MTNS*, Paper 23323-5, 11 pages.

111. On the Computation of Singular Functional Gains for Linear Quadratic Optimal Boundary Control Problems, (with B. B. King and L. Zeitsman), *2002 AIAA Flow Control Conference*, St. Louis, MO, June, 2002, Paper AIAA 2002-3074, 7 pages.
112. The Impact of Finite Precision Arithmetic and Sensitivity on the Numerical Solution of Partial Differential Equations, (with E. Allen, D. Gilliam, J. Hill and V. Shubov), *Journal of Mathematical and Computer Modeling*, 35 (2002), 1165-1195.
113. Functional Gain Computations for Feedback Control of a Thermal Fluid, (with B. B. King, A. D. Rubio and L. Zeitsman), *2002 AIAA Flow Control Conference*, St. Louis, MO, June, 2002, Paper AIAA 2002-2992, 11 pages.
114. A Continuous Control Design Method, (with J. Borggaard), *2002 AIAA Flow Control Conference*, St. Louis, MO, June, 2002, Paper AIAA 2002-2989, 10 pages.
115. Modelling Modal Based Sensors for Oscillatory Systems, (with C. Byrnes, D. Gilliam and V. Shubov), *41<sup>st</sup> IEEE Conference on Decision and Control*, December 2002, Paper WeM05-2, 6 pages.
116. Computation of Feedback Operators for Distributed Parameter Systems with Non-Normal Linearizations, (with B. B. King, D. Krueger and L. Zeitsman), *2003 American Control Conference*, June 2003, Paper TA04-2, 6 pages.
117. Non-Linear Distributed Parameter Control Systems with Non-Normal Linearizations: Applications and Approximations, *Research Directions in Distributed Parameter Systems*, R. C. Smith and M. A. Demetriou, Eds., SIAM Publications, Philadelphia, 2003, 17-53.
118. Computational Challenges in Control of Partial Differential Equations, (with Jeff Borggaard and Lizette Zietsman), *Proc. High Performance Computing 2004*, pp. 51-56.
119. On Strong Convergence of Feedback Operators for Non-Normal Distributed Parameter Systems (with Jeff Borggaard, Eric Vugrin and Lizette Zietsman), *43<sup>rd</sup> IEEE Conference on Decision and Control*, St. Thomas, VI, December, 2004, 6 pp.
120. Finite Element Formulation for Static Control of a Thin Euler-Bernoulli Beam Using Piezoelectric Actuators (with Daniel Inman, Eric Ruggiero and John Singler), *42004 ASME International Mechanical Engineering Congress and Exposition*, Anaheim, CA, November 2004, 6 pp.
121. A Petrov-Galerkin Finite Element Method for Interface Problems Arising in Sensitivity Computations (with T. Lin and L. G. Stanley *Computers and Mathematics with Applications*, 49 (2005), pp. 1889 - 1903.
122. Control System Radii and Robustness Under Approximation, (with Gunther H. Peichl), *Robust Optimization-Directed Design*, A. Kurdila, P. Pardalos and M. Zabaranin, Eds., Springer-Verlag, 2005, pp. 25 – 62.
123. Sensitivity Analysis and Parameter Estimation for a Model of Chlamydia Trachomatis Infection, (with E. M. Cliff and S. Doughty), *J. Inverse and Ill Posed Problems*, 2007, **15**, pp. 243-256.
124. Feedback Control of Low Dimensional Models of Transition to Turbulence, (with John Singler), *44<sup>th</sup> IEEE Conference on Decision and Control*, Seville, Spain, December 2005, pp. 3140 – 3145.
125. Modeling Transition: New Scenarios, System Sensitivity and Feedback Control, (with John Singler), *Transition and Turbulence Control*, M. Gad-el-Hak and H. M. Tsai, Eds., World Scientific Publishing, 2005, pp. 1 – 37.
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127. Sensitivity Computations for Elliptic Equations with Interfaces, (with D. Rubio and M. I. Tropicovsky), *Proceedings ICNPAA-2006 Conference on Nonlinear Problems in Aviation and Aerospace*, Budapest, Hungary, 2006, pp. 2086 – 2092.
128. Approximations and Mesh Independence for LQR Optimal Control, (with E. W. Sachs and L. Zietsman), *45<sup>th</sup> IEEE Conference on Decision and Control*, San Diego, December 2006, pp. 81 - 86.
129. Polynomial Stability of a Joint-Leg-Beam System with Local Damping, (with E. M. Cliff, Z. Liu and R. D. Spies), *Journal of Mathematical and Computer Modeling*, **46** (2007) 1236–1246.
130. Results on Transversal and Axial Motions of Two Beams Coupled to a Joint Through two Legs, with E. M. Cliff, T. L. Herdman, Z. Liu and R. D. Spies), *Proceedings ICNPAA-2006 Conference on Nonlinear Problems in Aviation and Aerospace*, Camb. Sci. Publ., Cambridge, 2007, 85 - 98.
131. Upwind Approximations and Mesh Independence for LQR Control of Convection Diffusion Equations, (with L. Zietsman), *46<sup>th</sup> IEEE Conference on Decision and Control*, New Orleans, December 2007.
132. On Coupled Transversal and Axial Motions of Two Beams with a Joint, (with E. M. Cliff, Z. Liu and R. D. Spies), *Journal of Mathematical Analysis and Applications*, **339** (2008) 182–196.
133. Sensitivity Analysis and Computational Uncertainty with Applications to Control of Nonlinear Parabolic Partial Differential Equations, (with L. Davis) *47<sup>th</sup> IEEE Conference on Decision and Control*, Cancun, Mexico, December 2008, 3989 - 3994.
134. Model Based Computation of Functional Gains for Feedback Control of Vortex Shedding, (with I. Akhtar, J. Borggaard and L. Zietsman), in, *Proceedings of 2008 ASME International Congress on Mechanical Engineering*, Boston, MA, paper IMECE2008-68950, 1 – 7.
135. Reduced-Order Models for Optimal Control of Vortex Shedding, (with I. Akhtar and J. Borggaard), *Proceedings of the 4th AIAA Flow Control Conference*, AIAA Paper Number 2008-4083 June (2008).
136. On the use of Numerical Methods for Analysis and Control of Nonlinear Convective Systems, (with E. Allen and D. Gilliam), *47<sup>th</sup> IEEE Conference on Decision and Control*, Cancun, Mexico, December 2008, 197 – 202.
137. A PDE Approach to Optimization and Control of High Performance Buildings, (with J. Borggaard, E. M. Cliff, 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., January 2009, 205--208.
138. Control, Estimation and Optimization of Energy Efficient Buildings, (with J. Borggaard, A. Surana and L. Zietsman), in *Proceedings of the 2009 American Control Conference*, St. Louis, MO, June 2009, 837--841.
139. A Distributed Parameter Control Approach to Optimal Filtering and Smoothing with Mobile Sensor Networks, (with E. M. Cliff and C. N. Rautenberg), in *Proceedings of the 17<sup>th</sup> Mediterranean Conference on Control and Automation*, June 2009, 181--186.
140. Bounded Error Parameter Estimation for Non-Linear Continuous Dynamical Systems, (with A. Childers), in *Proceedings of the 17<sup>th</sup> Mediterranean Conference on Control and Automation*, June 2009, 193--198.
141. Optimal Sensor Design for Estimation and Optimization of PDE Systems, (with E. M. Cliff, C. Rautenberg and L. Zietsman), in *Proceedings of the 2010 American Control Conference*, Baltimore, MD, June 30-July 02, 2010, 4127--4132.

142. High Performance Computing for Energy Efficient Buildings, (with Imran Akhtar and Jeff Borggaard), in *Proceedings of the International Conference on Frontiers of Information Technology*, Islamabad, Pakistan, Dec 21-23, 2010, 1--6.
143. Reduced-Order Modeling in Control and Optimization of High Performance and Energy Efficient Buildings”, (with Imran Akhtar and Jeff Borggaard), *Proceedings of the International Conference on Power Generation Systems and Renewable Energy Technologies*, Islamabad, Pakistan, Nov 29-Dec 2, 2010, 1--5.
144. On Control Strategies for Fluid Flows using Model Reduction, (with Imran Akhtar and Jeff Borggaard), in *Proceedings of the International Bhurban Conference on Applied Sciences and Technology (IBCAST)*, Islamabad, Pakistan, Jan 10-13, 2011, 1--10.
145. On Using LQG Performance Metrics for Sensor Placement, (with Jeff Borggaard and Lizette Zietsman), in *Proceedings of the 2011 American Control Conference*, San Francisco, CA, June 29-July 01, 2011, 2381--2386.
146. Bochner Integrable Solutions to Riccati Partial Differential Equations and Sensor Placement (with Eugene. M. Cliff and Carlos N. Rautenberg), in *Proceedings of the 2011 American Control Conference*, San Francisco, CA, June 29-July 01, 2011, 2368--2373.
147. An Inverse Method for Bounded Error Parameter Identification, (with Adam Childers), *J. Inverse Ill-Posed Problems*, 19 (2011), 549--572.
148. Control of the Boussinesq Equations and Implications for Sensor Location in Energy Efficient Buildings, (with Xiaoming He and Weiwei Hu), in *Proceedings of the 2012 American Control Conference*, Montreal, CA, June 27-June 29, 2012, 2232--2237.
149. On the Inclusion of Actuator Dynamics in Boundary Control of Distributed Parameter Systems, (with Lizette Zietsman), in *Proceedings 4th IFAC Workshop on Lagrangian and Hamiltonian Methods for Non Linear Control*, University of Bologna, Bertinoro, Italy, August, 2012, 126-130.
150. An Optimal Control Approach to Sensor / Actuator Placement for Optimal Control of High Performance Buildings, (with Jeff Borggaard, Eugene Cliff, Lizette Zietsman), in *Proceedings of the 2<sup>nd</sup> International High Performance Buildings Conference*, Purdue University, July, 2012, 34661-34667.
151. Control and Sensitivity Reduction for a Viscous Burgers’ Equation, (with E. Allen and D. S. Gilliam), in *Proceedings of the 51<sup>st</sup> IEEE Conference on Decision and Control*, Maui, HI, December 2012, 967--972.
152. An example of thermal regulation of a two dimensional non-isothermal incompressible flow, (with Eugenio Aulisa, David S. Gilliam), in *Proceedings of the 51<sup>st</sup> IEEE Conference on Decision and Control*, Maui, HI, December 2012, 1578—1583.
153. Numerical Approximations of the Dynamical System Generated by Burgers' Equation with Neumann Boundary Conditions, (with Edward J. Allen and David S. Gilliam), *ESIAM Mathematical Modelling and Numerical Analysis*, **47** (2013) 1465--1492.
154. Approximating Parabolic Boundary Control Problems with Delayed Actuator Dynamics, (with Terry L. Herdman and Lizette Zietsman), in *Proceedings of the 2013 American Control Conference*, June, 2013, 2083--2088.
155. Control of PDE Systems with Delays, (with Terry L. Herdman and Lizette Zietsman), in *Proceedings 1<sup>st</sup> IFAC Conference on Control of Partial Differential Equations*, September, 2013, 85--90.
156. Using Dominant Modes for Optimal Feedback Control of Aerodynamic Forces (with Imran Akhtar, Jeff Borggaard and Muntazir Naqvi), *Journal of Aerospace Engineering*, 227 (12), (2012), 1859--1869.

157. Infinite Dimensional Delay Differential Equations in Control and Sensitivity Analysis, (with Terry L. Herdman and Lizette Zietsman), *J. Nonlinear Studies*, **4** (2013), 131--157.
158. On Optimal Thermal Control of an Idealized Room Including Hard Limits on Zone-Temperature and a Max-control Cost Term, (with E. M. Cliff), in *Proceedings of the 52<sup>nd</sup> IEEE Conference on Decision and Control*, December, 2013, 4821--4826.
159. Approximation Methods for Boundary Control of the Boussinesq Equations, (with W. Hu), in *Proceedings of the 52<sup>nd</sup> IEEE Conference on Decision and Control*, December, 2013, 454--459.
160. Optimal Sensor Location in the Control of Energy Efficient Buildings, (with J. T. Borggaard and E. M. Cliff, *Princeton Companion to Applied Mathematics*, Nicholas Higham, Ed., Princeton University Press, 2015, 763--767.
161. Solutions and Approximations to the Riccati Integral Equation in a Space of Compact Operators (with C. N. Rautenberg), *SIAM J. Control and Optimization*, **53**, No. 5, (2015), 2846--2877.
162. The Infinite Dimensional Optimal Filtering Problem with Mobile and Stationary Sensor Networks, (with C. N. Rautenberg), *Numerical Functional Analysis and Optimization*, **36** (2015), 1--43.
163. Numerical Methods for Optimal Control of Heat Exchangers, (with E. M. Cliff), in *Proceedings of the 2014 American Control Conference*, June, 2014, 1649 - 1654.
164. Parameter Estimation and Model Discrepancy in Control Systems with Delays, (with Eugene M. Cliff and Kasie Farlow), in *Proceedings 19<sup>th</sup> World Congress of the International Federation of Automatic Control*, Capetown, South Africa, August, 2014, 11679 - 11684.
165. Control of Hyperbolic PDE Systems with Actuator Dynamics, (with E. M. Cliff), in *Proceedings of the 53<sup>rd</sup> IEEE Conference on Decision and Control*, December, 2014, 2864--2869.
166. Full Flux Models for Optimization and Control of Heat Exchangers, (with Boris Kramer), *Proceedings of the 2015 American Control Conference*, July, 2015, 577--582.
167. The Effect of Viscosity in a Tracking Regulation Problem for a Counter-Flow Heat Exchanger, (with E. Aulisa and D. S. Gilliam), in *Proceedings of the 54<sup>rd</sup> IEEE Conference on Decision and Control*, December, 2015, 561 - 566.
168. Using functional gains for effective sensor location in flow control: a reduced-order modelling approach (with Imran Akhtar, Jeff Borggaard, Haroon Imtiaz and Lizette Zietsman), *Journal of Fluid Mechanics*, **781**, (2015), 622--656.
169. Feedback Stabilization of a Thermal Fluid System with Mixed Boundary Control (with X. He and W. W. Hu), *Computers and Mathematics with Applications*, **71** (2016), 2170--2191.
170. Control of Composite Distributed Parameter Systems with Actuator Dynamics, *Journal of Mathematics in Engineering, Science and Aerospace*, **7** (2016), 267--286.
171. Velocity Control of a Counter-Flow Heat Exchanger (with Eugenio Aulisa, and David Gilliam), *Proceedings NOLCOS 2016, 10th IFAC Symposium on Nonlinear Control Systems, California*, August, 2016, 104--109.
172. Control of a Thermal Fluid Heat Exchanger with Actuator Dynamics (with Lizette Zietsman), in *Proceedings of the 55<sup>th</sup> IEEE Conference on Decision and Control*, Las Vegas, CA, December, 2016, 3131--3136.
173. A New Wavelet Family Based on Second Order LTI-Systems (with Tariq Abuhamdia, and Saied Taheri), *Journal of Vibration and Control*, (2016), DOI: 10.1177/1077546316674089, 1--20.

174. Laplace Wavelet Transform Theory and Applications, (with Tariq Abuhamdia, and Saied Taheri), *Journal of Vibration and Control*,(2017), DOI: 10.1177/1077546317707103, 1--21.
175. Identification of Dynamical Systems with Structured Uncertainty, (with E. M. Cliff and T. L. Herdman), *Journal of Inverse Problems in Science and Engineering*, (2017), 1--42.

## VI. Graduate Theses Directed

1. P. D. Hirsch, *Parameter Estimation in Differential-Delay Models*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, June 1980.
2. J. Amillo-Gil, *Nonlinear Neutral Functional Differential Equations in Product Spaces*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August 1981 - Professor, Computer Science, Universidad Politecnica De Madrid.
3. Robert K. Powers, *Chandrasekhar Algorithms for Distributed Parameter Systems*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, June 1984.
4. Richard. Fabiano, *Approximations of Integro-Partial Differential Equations of Hyperbolic Type*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, June 1986 – Professor of Mathematics, University of North Carolina at Greensboro.
5. Robert. Miller, *Approximation of the LQR Control Problem for Systems Governed by Partial Functional Differential Equations*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, December 1988 – Senior Scientist, Clear Science Inc.
6. Z. Liu, *Approximation and Control of a Thermoviscoelastic System*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August 1989 – Professor of mathematics, University of Minnesota-Duluth.
7. D. Hill, *Finite Dimensional Approximations of Distributed Parameter Control Systems*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August 1989. - Associate Professor, Bluefield College
8. S. Kang, *A Control Problem for Burgers Equation*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, April 1990 - Professor, Chosun University, Korea.
9. K. L. Oates, *A Study of Control System Radii for Approximations of Infinite Dimensional Systems*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August 1991 - Staff Scientist, Applied Physics Laboratory.
10. M. Tadi, *An Optimal Control Problem for a Timoshenko Beam*, Ph.D. Thesis, Engineering Science and Mechanics Department, Virginia Polytechnic Institute and State University, August 1991 - Associate Professor, Mechanical Engineering Department, University of Colorado at Denver.
11. R. D. Spies, *Mathematical Modeling, Finite Dimensional Approximations and Sensitivity Analysis for Phase Transitions in Shape Memory Alloys*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, June 1992 – Professor of Mathematics, University of Santa Fe, Santa Fe, Argentina.
12. H. Marrekchi, *Dynamic Compensators for a Nonlinear Conservation Law*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, September, 1993 - Associate Professor, University of Tunis, Tunis, Tunisia.

13. W. Huang, *Compensator Design for a System of Two Connected Beams*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August, 1994 - Private Business.
14. J. Borggaard, *The Sensitivity Equation Method for Optimal Design*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, December, 1994 – Professor of Mathematics, Virginia Tech.
15. L. Zhang, *Parameter Identification in Linear and Nonlinear Parabolic Partial Differential Equations*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August, 1995.
16. S. M. Pugh, *Finite Element Approximations of Burgers' Equation*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, September 1995 - Systems Analysts, Circuit City.
17. D. Rubio, *Distributed Parameter Control of Thermal Fluids*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, February, 1997 –Professor of Mathematics, Universidad Nacional de San Martín, Buenos Aires, Argentina.
18. T.R. Bail, *A Disturbance Rejection Problem for a 2D Airfoil*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, April 1997 - System Engineer, Hughes Missiles.
19. S. D. Olds, *Modeling and LQR Control of a Two-Dimensional Airfoil*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, April 1997 - Staff Scientist, Applied Physics Laboratory.
20. L. C. Smith, *Finite Element Approximations of Burgers' Equation with Robin's Boundary Conditions*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, July 1997 - Systems Analysts, Naval Research Labs.
21. K. L. Massa, *Control of Burgers' Equation with Mixed Boundary Conditions*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, March 1998 - Systems Analysts, Lockheed-Martin.
22. D. L. Stewart, *Numerical Methods for Accurate Computation of Design Sensitivities*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, June, 1998 - Assistant Professor, US Air Force Academy.
23. R. C. Camphouse, *Approximations and Object-Oriented Implementation for a Parabolic Partial Differential Equation*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, January, 1999 – Senior Scientist, Sandia National Labs., Carlsbad, NM.
24. D. T. Herdman, *Approximations for Singular Integral Equations*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, May, 1999 – Director of Information Technology, Veridian Corporation.
25. L. G. Stanley, *Computational Methods for Sensitivity Analysis with Applications to Elliptic Boundary Value Problems*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, June, 1999 - Associate Professor, Montana State University.
26. K. P. Hulsing, *Methods for Computing Functional Gains for LQR Control of Partial Differential Equations*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, December, 1999 – Senior Scientist, TRW Corporation.
27. V. Q. Nguyen, *A Numerical Study of Burgers' Equation with Robin Boundary Conditions*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, January, 2001.

28. R. C. Camphouse, *Modeling and Numerical Approximations of Optical Activity in the Chemical Oxygen-Iodine Laser*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, July, 2001 – Senior Scientist, Sandia National Labs., Carlsbad, NM.
29. E. D. Vugrin, *On Approximation and Optimal Control of Non-normal Distributed Parameter Systems*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, April, 2004 – Senior Scientist, Sandia National Labs., Carlsbad, NM.
30. John Singler, *Sensitivity Analysis of Partial Differential Equations With Applications to Fluid Flow*, , Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, June, 2005 – Assistant Professor of Mathematics, Missouri University of Science and Technology, Rolla, MO.
31. Golnar Newbury, *A Numerical Study of a Delay Differential Equation Model for Breast Cancer*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August, 2007 – Senior Scientist, LMI, Mclean, VA.
32. Adam Childers, *Parameter Identification and the Design of Experiments for Continuous Non-Linear Dynamical Systems*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, June, 2009 – Assistant Professor of Mathematics, Roanoke College.
33. Carlos N. Rautenberg, *A Distributed Parameter Approach to Optimal Filtering and Estimation with Mobile Sensor Networks*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, April, 2010 – Assistant Professor of Mathematics, University Graz, Graz, Austria.
34. Boris Kramer, *Model Reduction of the Coupled Burgers Equation in Conservation Form*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August, 2011 – Post Doctoral Fellow, MIT, Cambridge, MA.
35. Brian K. BcBee, *Computational Approaches to Improving Room Heating and Cooling for Energy Efficiency in Buildings*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, August, 2011 – Assistant Professor of Mathematics, Air Force Institute of Technology, Dayton, OH.
36. Christopher Jarvis, *Reduced Order Model Study of Burgers' Equation using Proper Orthogonal Decomposition*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, February, 2012 – Graduate Student, Virginia Tech.
37. Weiwei Hu, *Approximation and Control of the Boussinesq Equations with Application to Control of Energy Efficient Building Systems*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, May, 2012 – Postdoctoral Researcher in Mathematics, Department of Mathematics, University of Southern California, Los Angeles, CA.
38. Alexander Grimm, *Taming of Complex Dynamical Systems*, M.S. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, December, 2013 – Graduate Student, Virginia Tech.
39. Christopher Jarvis, *Parameter Dependent Model Reduction for Complex Fluid Flows*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, March, 2014 – Research Scientist, Eglin Air Force Base, Florida.
40. Boris Kramer, *Model and Data Reduction for Control, Identification and Compressed Sensing*, Ph.D. Thesis, Department of Mathematics, Virginia Polytechnic Institute and State University, July, 2015– Post Doctoral Fellow, MIT, Cambridge, MA



## VII. Sponsored Research

- 1975-1976: "Approximate Solutions of Optimal Control Problems Governed by Functional Differential Equations", Principal Investigator, NSF Grant MPS-75-06993.
- 1977-1979: "Parameter Identification of Hereditary Systems", Principal Investigator (with E. M. Cliff), AFOSR Grant AFOSR-77-3221.
- 1978-1980: "Identification of Hereditary Control Systems via Approximation Techniques", Principal Investigator (with E. M. Cliff), ARO Grant DAAG-29-78-G-0125.
- 1980-1981: "Identification of Hereditary Control Systems", Principal Investigator (with E. M. Cliff), ARO Grant DAAG-29-80-C-0126.
- 1980-1981: "Parameter Identification for an Aeroelastic System", Principal Investigator (with E. M. Cliff), AFOSR Grant AFOSR-80-068.
- 1981-1986: "Computational Methods for Identification and Optimal Control of Hereditary Systems", Principal Investigator (with E. M. Cliff), NSF Grant ECS-81-09245.
- 1984-1986: "Supercomputer Supplement for NSF Grant ECS-81-09245 on Computational Methods for Identification and Optimal Control of Hereditary Systems", Principal Investigator (with E. M. Cliff).
- 1985-1987: "Modeling and Advanced Control Concepts", Principal Investigator (with E. M. Cliff), Lawrence Livermore National Laboratory Grant 752-620-5.
- 1985-1988: "Modeling and Computational Algorithms for Parameter Estimation and Optimal Control of Aeroelastic Systems and Large Flexible Structures", Principal Investigator (with E. M. Cliff), AFOSR Grant AFOSR-85-0278.
- 1987-1990: "Nonlinear Dynamics and Control of Structural Components", Principal Investigator (with E. M. Cliff and A. H. Nayfeh), SDIO/AFOSR Contract F49620-87-C-0088.
- 1987-1991: "An Integrated Research Program for the Modeling, Analysis and Control of Aerospace Systems", Principal Investigator (with E. M. Cliff and T. L. Herdman), DARPA/AFOSR Contract F49620-87-C-0116.
- 1988-1991: "Active Structural Acoustic Control", Associate Investigator (C. R. Fuller, C. A. Rogers, H. H. Robertshaw and E.L. Sittler - Principal Investigators), DARPA/ONR Contract N00014-88-K-0721.
- 1988-1991: "Computational Methods for Modeling and Active Control of Distributed Parameter Systems", Principal Investigator (with E. M. Cliff) AFOSR Grant AFOSR-89-0001.
- 1988-1991: "Identification and Control of Systems with Delays", Principal Investigator (with T. L. Herdman), NSF Grant INT-8815136.
- 1989-1992: "Dynamics and Control of Volterra Integrodifferential Equations", Associate Investigator (with K. Hannsgen and R. L. Wheeler), NSF Grant INT-88-13-331.
- 1990-1994: "Stabilization and Control of Distributed Parameter Systems", Principal Investigator (with K. Hannsgen and R. L. Wheeler), NSF Grant INT-89-22-490.
- 1992-1994: "Computational Methods for Control and Optimal Design of Aerospace Systems", Principal Investigator (with E. M. Cliff), AFOSR Grant F49620-92-J-0078.
- 1992-1995: "Computational Methods for Optimal Design of Aerospace Systems" - Augmentation Award for Science & Engineering Research Training, Principal Investigator, AFOSR Grant F49620-92-J-0261.
- 1993-1997: "Optimal Design And Control of Nonlinear Distributed Parameter Systems" - University Research Initiative Center Grant, Principal Investigator, AFOSR Grant F49620-93-1-0280.

- 1994-1997: “New Directions and Enhanced Laboratory/Industry Interactions - A Supplement for AFOSR Grant F49620-93-1-0280” , Principal Investigator, AFOSR Grant F49620-93-1-0280-P00002.
- 1994-1997: “Designing Optimal Actuation and Sensing Systems NI/ASSERT 94” - Augmentation Award for Science & Engineering Research Training, Principal Investigator, (with H. Cudney), AFOSR Grant F49620-94-1-0346.
- 1994-1995: “Graphical Pre-and-Post Processing for Scientific Computations” , Principal Investigator (with E. M. Cliff and M. Gunzburger), AFOSR Grant F49620-94-1-0457.
- 1994-1997: “Research in Optimal Sensor/Actuator Location and Flutter Suppression - An Enhancement of Support for AFOSR Grant F49620-93-1-028,” Principal Investigator, (with T. L. Herdman), AFOSR Grant F49620-93-1-0280-P00003.
- 1995-1999: “University-Industry Postdoctoral Fellow Support for Mathematical Research in Optimal Design and Control of Fluids,” Jointly funded by Tektronix Corporation and NSF under Grant DMS-9508773.
- 1996-2002: “Sensitivity and Adjoint Methods for Design of Aerospace Systems,” PRET Center Grant, Principal Investigator, AFOSR Grant F49620-96-1-0329.
- 1997-1998: “Pre-processing and Post-processing for Large Scale Scientific Computations in Optimal Design and Control” , Principal Investigator (with E. M. Cliff and T. Herdman), AFOSR Grant F49620-97-1-0304.
- 1997-1998: “Workshop on Optimal Design and Control”, Principal Investigator (with E. M. Cliff), AFOSR Grant F49620-97-1-0264.
- 1997-1999: “Adaptive Methods for Optimal Design ASSERT 97” - Augmentation Award for Science & Engineering Research Training, Principal Investigator, (with E.M. Cliff), AFOSR Grant F49620-97-1-0356.
- 1998-1999: “Sensitivity Based Design Environment”, Principal Investigator (with E. M. Cliff and T. Herdman), AFOSR Grant F49620-98-1-0246.
- 1998-2001: “Design and Diagnostic Tool for Manufacturing of Advanced Nanoscale Layered Materials”, Co-Principal Investigator (with David Baldwin, William Butler, Gerald Granley, Matthew Neurock and Steven Orszag), DARPA Grant N00014-98-C-0318.
- 1999- 2001 “A Computational Environment for Designing Sensor/Actuator Placement and Control”, Principal Investigator (with E. M. Cliff and T. Herdman), AFOSR Grant F49620-99-1-0121.
- 1999-2003: “Analysis and Design Tools for Chemical-Laser Flow-Fields”, Principal Investigator (with E. M. Cliff), AeroSoft, Inc.
- 2001-2003: “Analysis of Data”, Principal Investigator (with E. M. Cliff and T. L. Herdman), FBI Grant A1N103372.
- 2002-2003: “Workshop on Future Directions in Control and Dynamics”, Principal Investigator (with E. M. Cliff and T. L. Herdman), AFOSR Grant F49620-02-01-0166.
- 2002-2005: “A Systematic Investigation of Bluff Body Combustion-Phase II”, Principal Investigator (with E. M. Cliff), AeroSoft Inc. Contract.
- 2002-2004: “Further Studies of Data Classification”, Principal Investigator (with E. M. Cliff and T. L. Herdman), FBI/Harris Corp. Sub-Contract # 3938913.
- 2003-2006: “Computational Methods for Design, Control and Optimization for Micro Air Vehicles”, Principal Investigator (with J. Borggaard, E. M. Cliff and T. Iliescu), AFOSR Grant. F49620-03-1-0243.

- 2004-2007: “Research on Mathematical and Computational Tools for the Analysis, Design, Control and Optimization of Very Large Membrane Structures with Advanced Material Models”, Principal Investigator (with E. M. Cliff, T. L. Herdman and D. J. Inman), DARPA SPO Grant.
- 2005-2006: “Orbital Intercept and Evasion”, Principal Investigator (with E. M. Cliff ), AFOSR Grant Augmentation # F49620-03-1-0243.
- 2007-2009: “Computational Methods for Identification, Optimization and Control of PDE Systems”, Principal Investigator (with E. M. Cliff and Lizette. Zietsman), AFOSR Grant # FA9550-07-1-0273.
- 2007-2011: “REU Gant on Modeling and Simulation of Biological Networks”, Principal Investigator (with S. Faulkner, R. Laubenbacher and L. Zietsman), NSF Grant # 0755322.
- 2009-2011: “Computer Design Tools for Energy Efficient Buildings: Models, Simulation and Sensitivity Analysis”, Principal Investigator (with Eugene Cliff and Lizette Zietsman, ), Environmental Security Technology Certification Program (ESTCP) / United Technologies Research Center Sub-Contract # 1159787.
- 2010-2013: “Computational Methods for Identification, Optimization and Control of PDE Systems”, Principal Investigator (with E. M. Cliff and Lizette. Zietsman), AFOSR Grant Fa9550-10-10201.
- 2010-2016: “Advanced Computer Design Tools for Modeling, Design, Control, Optimization and Sensitivity Analysis of Integrated Whole Building Systems”, Principal Investigator, DOE Energy-Efficient Building Systems Design HUB, DOE # DE-EE0004261 / Penn State University Sub-Contract # 4345-VT-DOE-4261.

### VIII. Invited Lectures

1. International Symposium on Dynamical Systems, Brown University, Providence, RI, August, 1974.
2. Conference on Functional Differential Equations, Brown University, Providence, RI, May 1977.
3. International Conference on Methods of Mathematical Programming, Zakopane, Poland, September 1977.
4. Special Session on Functional Differential Equations, AMS Summer Meeting, Providence, RI, August 1978.
5. Canadian Mathematical Society Annual Seminar, Toronto, Canada, July 1979.
6. International Conference on Nonlinear Phenomena in Mathematical Sciences, Arlington, TX, June 1980.
7. Workshop on Semigroups and Applications to Numerical Analysis, Norman, OK, May 1981.
8. International Conference on Differential Equations, Dundee, Scotland, April 1982.
9. Seventh Annual Southeast Atlantic SIAM meeting, Clemson, SC, March 1983.
10. IEEE Conference on Decision and Control, San Antonio, TX, December 1983.
11. Eighth Annual Lecture Series in Mathematical Sciences: Estimation and Distributed Control, Fayetteville, AK, April 1984.
12. Second International Conference on Control Theory for Distributed Parameter Systems and Applications, Graz, Austria, July 1984.

13. IEEE Conference on Decision and Control, Las Vegas, NV, December 1984.
14. AIAA Conference on Shear Flow Control, Boulder, CO, March 1985.
15. SIAM Minisymposium on Gradient and Finite Element Techniques in Optimal Control, Pittsburgh, PA, June 1985.
16. Workshop on Control of Space-Based Systems, Monterey, CA, July 1985.
17. Fourth IFAC Symposium on Control of Distributed Parameter Systems, UCLA, Los Angeles, CA, June 1986.
18. Third International Conference on Distributed Parameter Control, Graz, Austria, July 1986.
19. Southeastern-Atlantic Conference on Differential Equations, Clemson University, Clemson, SC, October 1986.
20. International Conference on Optimization, Trier, West Germany, June 1987.
21. IMACS/IFAC International Symposium on Distributed Parameter Systems, Hiroshima, Japan, October, 1987.
22. MIPAC Workshop on Control, University of Wisconsin, Madison, WI, May, 1988.
23. Workshop on Active and Passive Control of Fluid Dynamical Systems, Hampton, VA, March 1988.
24. ONR Conference on Control of Fluid Flow Systems, NRL Washington, DC, May 1988.
25. Fourth International Conference on Distributed Parameter Control, Graz, Austria, July 1988.
26. Brown/INRIA NSF Conference on Control and Identification of Distributed Parameter Systems, Brown University, Providence, RI, August 1988.
27. Midwest Differential Equations Conference, Iowa State University, Ames, Iowa, October 1988.
28. SIAM Conference on Control in the Nineties, San Francisco, CA, May 1989
29. Workshop on Optimal Shape Design, University of California-Berkeley, Berkeley, CA, May 1989
30. Workshop on Control of Space Structures, Los Angeles, CA, November 1989
31. Lockheed Workshop on Control Aerospace Systems, Calabasas, CA, February 1990
32. Fifth International Conference on Distributed Parameter Control, Graz, Austria, July 1990.
33. Second International Conference on Computation and Control, Bozeman, Montana, August 1990.
34. International Symposium on Inverse Problems in Engineering Sciences, Osaka, Japan, August 1990
35. IEEE Conference on Decision and Control, Honolulu, Hawaii, December 1990.
36. SIAM Workshop on Automatic Differentiation, Beckenridge, CO, January 1991.
37. Workshop on Control of Fluid Flows, Ohio State University, Columbus, OH, April, 1991.
38. Variationsrechnung und Optimalsteuerung, Oberwolfach, Germany June 1991.
39. Optimization Methods in Differential Equations and Control, Raleigh, NC, July 1991.
40. IEEE Conference on Decision and Control, Brighton, England, December 1991.
41. SIAM Conference on Optimization, Chicago, IL, May 1992.
42. Conference on Sensing, Identification and Control of Flexible Structures, Waterloo, Ontario, June 1992.
43. AMS/IMS/SIAM Conference on Control of Distributed Parameter Systems, Mt. Holyoke, MA, July 1992.

44. Third International Conference on Computation and Control, Bozeman, MT, August 1992.
45. Conference on Research in Scientific Computing, Raleigh, NC, September 1992.
46. IMA Conference on Fluid Flow Control, Minnesota, MN, November 1992.
47. IEEE Conference on Decision and Control, Tucson, AZ, December 1992.
48. Southeastern Regional Meeting of the AMS, Knoxville, TN, March, 1993.
49. NSF Conference on Graduate Education in the Mathematical Sciences, Clemson, SC, April, 1993.
50. Air Force Meeting on Control, Ann Arbor, MI, May, 1993.
51. IEEE Conference New Directions in Control, Crete, Greece, June, 1993.
52. AIAA Shear Flow Control Conference, Orlando, FL, July, 1993.
53. National SIAM Meeting, Philadelphia, PA, July, 1993.
54. Sixth International Conference on Distributed Parameter Control, Vorau, Austria, July 1993.
55. International Conference on Mathematical Theory of Networks and Systems, Regensburg, Germany, July 1993.
56. SIAM Conference on Linear Algebra, Systems and Control, Seattle, WA, August, 1993
57. Air Force Conference on Dynamics and Control, Dayton, OH, June, 1994.
58. National SIAM Meeting, San Diego, CA, July, 1994.
59. Fourth International Conference on Computation and Control, Bozeman, MT, August 1994.
60. IEEE Conference on Decision and Control, Orlando, FL, December 1994.
61. ICASE/LaRC Multidisciplinary Design Optimization Workshop, Hampton, VA, March, 1995.
62. SPIES Conference on Sensing and Control of Aerosystems, Orlando, FL, April 1995.
63. SIAM Conference on Control, St. Louis, MO, April 1995.
64. Conference on Dynamics and Control, Minneapolis, MN, June, 1995.
65. IMA Workshop in Optimal Design, Minneapolis, MN, July, 1995.
66. SIAM National Meeting, Charlotte, NC, October 1995.
67. IMA Workshop on Control of Materials Processing, Minneapolis, MN, January, 1995.
68. Southeastern SIAM Conference, Clemson, SC, March, 1996.
69. Basic Research in the National Defense, Washington, DC, May, 1996.
70. SIAM Conference on Optimization, Victoria, BC, May, 1996.
71. MNTS 1996 Conference on Control, St. Louis, MO, June, 1996.
72. Second World Congress on Nonlinear Analysis, Athens, Greece, July, 1996.
73. International Conference on Distributed Parameter Control, Vorau, Austria, July 1996.
74. Fifth International Conference on Computation and Control, Bozeman, MT, August 1996.
75. Deutsche Mathematiker-Vereinigung Annual Meeting, Jena, Germany, September, 1996.
76. Showme Lectures, Rolla, MO, November, 1996.
77. IFIP Conference on Optimization, Gainesville, FL, February, 1997.
78. ICASE/NASA Flow Control Workshop, Hampton, VA, May, 1997.
79. XX Congresso Nacional Matematica, Gramado, Brasil, September, 1997.
80. Conference on Multidisciplinary Design Optimization, Montreal, Quebec, March, 1998.
81. DARPA Workshop on Materials Processing and Control, Washington, DC, April, 1998.
82. International Conference on Distributed Parameter Control, Hangzhou, China, June, 1998.

83. International Conference on Engineering Science, Pullman, WA, September, 1998.
84. United Technology Workshop on Flow Control, Hartford, CN, November, 1998.
85. VIP Phase III Kickoff Meeting, University of Illinois, IL, October, 1998.
86. DARPA Workshop on Reduced Order Modelling, Washington, DC, January, 1999.
87. International Conference on Optimization, Trier, Germany, March, 1999.
88. AMS Western Regional Meeting, Las Vegas, NV, April, 1999
89. Sixth SIAM Conference on Optimization, Atlanta, GA, May 1999.
90. Workshop on Control of Flows, San Diego, CA, May 1999.
91. Air Force Conference on Dynamics and Control, Dayton, OH, June, 1999.
92. International Symposium on Non-smooth Mechanics, Blacksburg, VA, June, 1999.
93. International Workshop on Modeling and Control, Yogyakarta, Indonesia, July, 1999.
94. SEAMS Conference on Mathematics, Yogyakarta, Indonesia, July, 1999.
95. Air Force Conference on Computational Mathematics, St. Louis, MO, August, 1999.
96. IMA Workshop on Uncertainty in Modeling, Minneapolis, MN, September, 1999.
97. International Conference on Distributed Parameter Control, College Station, TX, October, 1999.
98. DARPA Conference on Materials Processing and Control, Charlottesville, VA, January, 2000.
99. International Conference on Nonlinear Control, Graz, Austria, March, 2000.
100. International Conference on Proper Orthogonal Decomposition, Graz, Austria, May, 2000.
101. Optimal Control of Complex Dynamical Systems, Oberwolfach, Germany, June, 2000.
102. International Conference on Mathematical Theory of Networks and Systems, Perpignan, France, June, 2000.
103. Air Force Conference on Dynamics and Control, Dayton, OH, June, 2000.
104. Air Force Conference on Computational Mathematics, Palo Alto, CA, July, 2000.
105. Sixth International Conference on Computation and Control, Bozeman, MT, August, 2000.
106. VIP Phase III Materials Processing Conference, San Francisco, CA, August, 2000.
107. SIAM Conference on Computational Science and Engineering, Washington, DC, September, 2000.
108. Conference on Control Applications, Anchorage, AK, September, 2000.
109. Advances in Control of Distributed Parameter Systems, Raleigh, NC, October, 2000.
110. DARPA Conference on Materials Processing and Control, Washington, DC, February, 2001
111. Air Force Workshop on Flow Control, Dayton, OH, February 2001.
112. 25<sup>th</sup> Annual South African Conference on Numerical and Applied Mathematics, Stellenbosch, South Africa, April, 2001.
113. Eighth International Conference on Distributed Parameter Control, Graz, Austria, July, 2001.
114. DARPA Conference on Uncertainty, Annapolis, MD, August, 2001.
115. Southeastern Conference on Applied Mathematics, Raleigh, NC, November, 2001.
116. American Physical Society Conference on Flow Control, San Diego, CA, November, 2001.
117. Conference on Vertically Integrated Processing and Control, San Francisco, CA, November, 2001.
118. SIAM Southeastern Conference on Applied Mathematics, Cullowhee, NC, April, 2002.

119. Conference on Flow Control, Air Force Research Lab, Eglin AFB, FL, May, 2002
120. Third AIAA Theoretical Fluid Mechanics Meeting, St. Louis, MO, June, 2002.
121. ICASE 30<sup>th</sup> Conference on Applied Mathematics, Hampton, VA, July, 2002.
122. SIAM Annual Meeting, Philadelphia, PA, July, 2002.
123. IEEE Conference on Control Applications, Glasgow, Scotland, September, 2002.
124. AMS-MAA-SIAM Joint Mathematics Meeting, Baltimore, MD, January, 2003.
125. Conference on Control, Mittag-Leffler Institute, Stockholm, Sweden, January, 2003.
126. AFOSR/AFRL Workshop on Nonlinear Aspects of Aeroelasticity, Air Force Research Lab, Eglin AFB, FL, March, 2003.
127. AFOSR Conference on Challenges in UAV Control, Ft. Walton Beach, FL, March, 2003.
128. 26<sup>th</sup> Annual South African Conference on Numerical and Applied Mathematics, Stellenbosch, South Africa, April, 2003.
129. DARPA Conference on Prognostic Epidemiology, Arlington, VA, June, 2003.
130. IFIP TC7 Conference on System Modeling and Optimization, Sophia Antipolis, France, July, 2003.
131. International Conference on Computation, Control and Biological Systems VIII, Montana State University, Bozeman, MT, August, 2003.
132. International Conference on Engineering and Mathematics, Buenos Aires, Argentina, December 2003.
133. AFOSR Conference on Robust Optimization, Ft. Walton Beach, FL, April, 2004.
134. Air Force Conference on Computational Mathematics, Dayton, OH, June, 2004.
135. Fourth World Congress of Nonlinear Analysts, Orlando, FL, July, 2004.
136. SIAM Annual Meeting, Portland, OR, July, 2004.
137. Workshop on Transition and Turbulence Control, National University of Singapore, December, 2004.
138. SIAM Conference on Computational Science and Engineering, Orlando, FL, February, 2005.
139. International Conference on Approximation Methods for Design and Control, Universidad Tecnologica Nacional, Buenos Aires, Argentina, March, 2005.
140. AMS-MAA Mathematics Meeting, Newark, DL, April, 2005.
141. SIAM Annual Meeting, New Orleans, LA, July, 2005.
142. International Workshop on Control of Infinite-Dimensional Systems, University of Waterloo, Waterloo, CA, July, 2005.
143. International Conference on Optimal Control of PDEs, Johann Radon Institute for Computational and Applied Mathematics, Linz, Austria, November, 2005.
144. Numerical Techniques for Optimization Problems with PDE Constraints, Oberwolfach, Germany, February, 2006.
145. International Conference on Numerical PDEs in the 21<sup>st</sup> Century, Albuquerque, NM, April, 2006.
146. Third International Conference on Inverse Problems, Fethiye, Turkey, May, 2006.
147. International Conference on mathematical Problems in Engineering and Aerospace Sciences, Budapest, Hungary, June, 2006.
148. AFOSR Conference on Control, Atlanta, GA, August, 2006.
149. 26th Southeastern-Atlantic Regional Conference on Differential Equations, Greensboro, NC, October, 2006.

150. 2006 Red Raider Conference on Mathematical Modeling of Novel Materials and Structures, Lubbock, TX, November, 2006.
151. 45<sup>th</sup> IEEE Conference on Decision and Control, San Diego, CA, December 2006.
152. SIAM Conference on Computational Science and Engineering, Costa Mesa, CA, February, 2007.
153. Second International Conference on Approximation Methods for Design and Control, Universidad Tecnologica Nacional, Buenos Aires, Argentina, March, 2007.
154. 7<sup>th</sup> International Conference on Computational and Mathematical Methods in Science and Engineering, Chicago, IL, June 2007
155. AFOSR Conference on Control, Long Beach, CA, August, 2007.
156. International Congress on Applied, Computational and Industrial Mathematics, Cordoba, Argentina, October, 2007.
157. International Conference on Mathematical Modeling and Computational methods in Science and Engineering, Kobe, Japan, October, 2007.
158. 46<sup>th</sup> IEEE Conference on Decision and Control, New Orleans, LA, December 2007.
159. Atlantic Coast Symposium on the Mathematical Sciences in Biology and Medicine, Raleigh, NC, April, 2008.
160. Workshop on High Performance Buildings, Berkeley, CA, May, 2008.
161. United Technology – LBNL Workshop on High Performance Buildings, June, 2008.
162. AFOSR Conference on Control, Arlington, VA, August, 2008.
163. International Conference on Shape and Topology Optimization, Graz, Austria, September, 2008.
164. 47<sup>th</sup> IEEE Conference on Decision and Control, New Orleans, LA, December, 2008.
165. Oberwolfach Workshop on PDE Optimization, Oberwolfach, Germany, January, 2009.
166. Third International Conference on Approximation Methods for Design and Control, Universidad Tecnologica Nacional, Buenos Aires, Argentina, March, 2009.
167. International Conference on Nonlinear Analysis, Donghua University, Shanghai, China, May 2009.
168. International Conference on Mathematical Control Theory, Beijing, China, May 2009.
169. IEEE American Control Conference, St. Louis, Missouri, June, 2009.
170. 24<sup>th</sup> IFIP TC7 Conference on Systems and Control, Buenos Aires, Argentina, July, 2009.
171. AFOSR Conference on Control, Arlington, VA, July, 2009.
172. Istanbul Conference on Mathematical Methods and Modeling in Life Sciences and Biomedicine, Sile, Turkey, August, 2009.
173. International Conference on Systems Theory, KTH, Stockholm, Sweden, September, 2009.
174. The Second International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems, Huntsville, Alabama, October, 2009.
175. Computational Issues in Nonlinear Control, Monterey, California, November 2009.
176. Second International Congress on Applied, Computational and Industrial Mathematics, Rosario, Argentina, December, 2009.
177. IEEE American Control Conference, Baltimore, Maryland, June, 2010.
178. Workshop on Computational Science for Building Energy Efficiency, Arlington, VA, July, 2010.
179. SIAM National Meeting, Pittsburgh, Pennsylvania, July, 2010.



180. AFOSR Conference on Computational Science, Arlington, VA, July, 2010.
181. AFOSR Conference on Control, Arlington, VA, August, 2010.
182. Texas Tech Workshop on Control, Lubbock, Texas, September, 2010.
183. DOE Fall Creek Falls workshop on Applications of High Performance Computing to Energy Efficiency, Memphis, TN, October, 2010.
184. Symposium on Analysis & Control of Infinite-Dimensional Systems, Max Planck Institute, Magdeburg, Germany, November, 2010.
185. International Research Forum: What Can the Academic Community Learn from the Global Crisis? Models, Methods and Transfer, Hong Kong Polytechnic University, December, 2010.
186. Workshop on Future Directions in Applied Mathematics, NC State University, Raleigh, NC, March, 2011.
187. National Summit on Advancing Clean Energy Technologies - Entrepreneurship and Innovation through High Performance Computing, Washington, DC, May 2011.
188. SIAM Conference on Dynamical Systems, Snowbird, UT, May, 2011.
189. Workshop on Building Modeling and Control, Philadelphia, PA, June, 2011.
190. American Control Conference, San Francisco, CA, June, 2011.
191. 7th Workshop on Control of Distributed Parameter Systems, Wuppertal, Germany, July, 2011.
192. Third Istanbul Conference on Mathematical Methods and Modeling in Life Sciences and Biomedicine, Sile, Turkey, August, 2011.
193. Fifth International Conference on High Performance Computing, Hanoi, Vietnam, March, 2012.
194. 2012 American Control Conference, Montreal, Canada, June, 2012.
195. The 2<sup>nd</sup> International High Performance Buildings Conference, Purdue University, July, 2012.
196. AFOSR Conference on Control, Arlington, VA, August, 2012.
197. 4<sup>th</sup> IFAC Workshop on Lagrangian and Hamiltonian Methods for Non Linear Control, Bertinoro, Italy, August 2012.
198. IEEE 51<sup>st</sup> Conference on Decision and Control, Maui, HI, December, 2012.
199. SIAM Conference on Computational Science & Engineering, Boston, MA, February, 2013.
200. International Conference on Computational Analysis of Inverse Problems and Partial Differential Equations, University of Central Florida, May, 2013.
201. 2013 American Control Conference, Washington, DC, June, 2013.
202. SIAM Annual Conference, San Diego, CA, July, 2013.
203. AFOSR Conference on Control, Arlington, VA, July, 2013.
204. AFOSR Conference on Computational Science, Arlington, VA, August, 2013.
205. The 26<sup>th</sup> IFIP Conference on Lagrangian and Hamiltonian Methods for Non Linear Control, Klagenfurt, Austria, September, 2013.
206. The 1<sup>st</sup> IFAC Workshop on Control of Systems Modeled by Partial Differential Equations, Paris, France, September 2013.
207. The Fourth International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems: Mathematical Modeling of Complex Dynamics from Cells to Ecosystems, Lubbock, Texas, October, 2013.
208. IEEE 52<sup>nd</sup> Conference on Decision and Control, Florence, Italy, December, 2013.

209. International Conference on Inverse Problems: Modeling and Simulation, Fethiye, Turkey, May 2014.
210. 2013 American Control Conference, Portland, OR, June, 2014.
211. 21<sup>st</sup> International Symposium on Mathematical Theory of Networks and Systems, Groningen, Netherlands, July, 2014.
212. 2014 SIAM Conference on the Life Sciences, Charlotte, NC, August, 2014
213. IEEE 53<sup>nd</sup> Conference on Decision and Control, Los Angeles, CA, December, 2014.
214. International Conference on Feedback Control, Graz, Austria, June, 2015
215. IFIP Conference on Optimization, Nice, France, July, 2015
216. SIAM Conference on Control, Paris, France, July, 2015
217. Advances in Scientific Computing and Applied Mathematics, Las Vegas, October, 2015
218. Mathematical Methods and Modeling in Engineering and Life Sciences, Buenos Aires, Argentina, November, 2015
219. Computational Methods for Control of Infinite-dimensional Systems, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN, March, 2016
220. The Fifth International Conference on Continuous Optimization, Tokyo, Japan, August, 2016
221. 10th IFAC Symposium on Nonlinear Control Systems, Monterey, CA, August, 2016
222. ALOP Workshop: Reduced Order Models in Optimization, Trier, Germany, September, 2016
223. Lloyd Roeling Mathematics Conference, University of Louisiana, Lafayette, LA, November, 2016.
224. Workshop on the Interface of Statistics and Optimization, SAMSI, Durham, NC, February, 2017.
225. VI Congress on Industrial, Computational and Applied Mathematics, Comodoro Rivadavia, Argentina, May, 2017.
226. International Workshop on Optimal Control of Dynamical Systems, Graz, Austria, May, 2017.

## **IX. Colloquia**

1. Brown University, Providence, RI, November 1973.
2. Virginia Polytechnic Institute and State University, Blacksburg, VA, October 1974.
3. State University of New York at Binghamton, Binghamton, NY, November 1975.
4. Institute of Automatic Control, Tech University of Warsaw, Warsaw, Poland, September 1977.
5. The University of Oklahoma, Norman, OK, March 1979.
6. Clemson University, Clemson, SC, April 1979.
7. West Virginia University, Morgantown, WV, June 1980.
8. The University of Tennessee, Knoxville, TN, October 1980.
9. The University of Arkansas, Fayetteville, AR, November 1980.
10. The University of Oklahoma, Norman, OK, April 1981.
11. Wake Forest University, Winston-Salem, NC, April 1981.
12. North Carolina State University, Raleigh, NC, November 1981.
13. Universidad Politecnica De Madrid, Madrid, Spain, March 1982.
14. Universidad Complutense De Madrid, Madrid, Spain, March 1982.

15. Georgetown University, Washington, DC, February 1983.
16. Naval Research Laboratory, Washington, DC, May 1983.
17. University of Texas, Austin, TX, December 1983.
18. University of Maryland-Baltimore, Baltimore, MD February 1984.
19. University of Maryland, College Park, PA, March 1984.
20. MIT, Cambridge, MA, April 1984.
21. SUNY Buffalo, Buffalo, NY, April 1984
22. Penn State University, State College, PA, October 1984.
23. Brown University, Providence, RI, March 1985.
24. North Carolina State University, Raleigh, NC. April 1985.
25. U.C.L.A., Los Angeles, CA, August 1985.
26. Michigan State University, East Lansing, MI, November 1985.
27. Ohio State University, Columbus, OH, March 1986.
28. West Virginia University, Morgantown, WV, April 1987.
29. Worcester Polytechnic Institute, Worcester, MA, April 1987.
30. Universität Graz, Graz, Austria, June 1988.
31. Clemson University, Clemson, SC, January 1989.
32. Chemical Engineering - Virginia Tech, October 1989.
33. University of Southern California, Los Angeles, CA, November 1989.
34. C.N.E.A., Buenos Aires, Argentina, March 1990.
35. University of Santa Fe, Santa Fe, Argentina, March 1990.
36. Montana State University, Bozeman, Montana, May 1990.
37. UCLA, Los Angeles, CA, May 1990.
38. University of Minnesota - Duluth, Duluth, MN, September 1990.
39. University of Minnesota, Minneapolis, MN, February, 1991.
40. Texas A&M University, College Station, TX, April, 1991.
41. University of Texas at Dallas, Dallas, TX, April, 1991.
42. University of Sao Paulo, Sao Paulo, Brazil, April, 1991.
43. University of Delaware, Newark, DE, May, 1991.
44. Rice University, Houston, TX, January, 1992.
45. University of Tennessee, Knoxville, TN, May, 1992.
46. Texas Tech University, Lubbock, TX, September, 1992.
47. ICASE, Hampton, VA, November, 1992.
48. Montana State University, Bozeman, Montana, October, 1993.
49. Tektronix Graphics Printing and Imaging, Wilsonville, OR, January, 1994.
50. University of Minnesota, Minneapolis, MN, February, 1994.
51. Center for Research on Computation and its Application, Montreal, Quebec, September 1994.
52. Oregon State University, Corvallis, OR, October, 1994.
53. University of Minnesota - Duluth, Duluth, MN, November 1995.
54. Texas Tech University, Lubbock, TX, November, 1995.
55. University of Trier, Trier, Germany, September, 1996.

56. Nestles Research and Development Headquarters, Stuttgart, Germany, September, 1996.
57. Louisiana State University, Baton Rouge, LA, October, 1996.
58. St. Mary's College, St. Mary's, MD, October, 1996.
59. University of Arkansas, Fayetteville, AK, November 1996.
60. NRC Industrial Materials Institute, Montreal, Quebec, May, 1997.
61. Jiao Tong University, Shanghai, China, June, 1998.
62. North Carolina State University, Raleigh, NC, December, 1998.
63. Texas Tech University, Lubbock, TX, February, 1999.
64. University of California Santa Barbara, Santa Barbara, CA, November, 1999.
65. University of California Davis, Davis, CA, January, 2000.
66. AFRL Seminar, Control Science Center of Excellence, Dayton, OH, February, 2000.
67. Cornell University, Cornell, NY, March, 2000.
68. Texas Tech University, Lubbock, TX, April, 2000.
69. Boeing Seminar on Control and Design, Boeing Aerospace, Seattle, WA, September, 2000.
70. University of Trier, Trier, Germany, February, 2001.
71. Universität Graz, Graz, Austria, June 2001.
72. Georgia Tech, October, 2001.
73. Texas Tech University, Lubbock, TX, February, 2002.
74. Graduate Education and Research Center, University of Florida, Ft. Walton Beach, FL, May, 2002.
75. University of Pretoria, South Africa, April, 2003.
76. Texas Tech University, Lubbock, TX, October, 2003.
77. University of Buenos Aires, Buenos Aires, Argentina, December, 2003.
78. Oishei Foundation Lecture, Canisius College, Buffalo, NY, February 2004.
79. U. N. Gral Sarmiento, San Martin, Argentina, March, 2004.
80. Northern Illinois University, Dekalb, IL, April, 2004.
81. Ecole Polytechnique de Montreal, Montreal, Quebec, July, 2004.
82. Mathematics, Universität Graz, Graz, Austria, October, 2004.
83. Aerospace Engineering, Virginia Tech, Blacksburg, VA, January, 2005.
84. AFOSR, Arlington, VA, January, 2005.
85. University of Utah, Salt Lake City, UT, April, 2005.
86. Oregon State University, Corvallis, OR, May, 2005.
87. University of Trier, Trier, Germany, July, 2005.
88. Texas Tech University, Lubbock, TX, October, 2005.
89. Beijing Institute of Technology, Beijing, China, November, 2005.
90. Xi'an Jiaotong University, Xi'an, China, November, 2005.
91. Kungliga Tekniska Högskolan, Stockholm, Sweden, May, 2006.
92. Universität Karlsruhe, Karlsruhe, Germany, July, 2007.
93. Virginia Commonwealth University, Richmond, VA, September, 2007.
94. University of Alabama Huntsville Distinguished Lecture in Applied Mathematics, Huntsville, AL, November, 2008.

95. Workshop on Computational Issues in High Performance Buildings, ORNL, Oak Ridge, TN, December, 2008.
96. Southwest Virginia Governor's School, Pulaski, VA, September, 2009.
97. University of Minnesota, Minneapolis, MN, October, 2009.
98. University of Trier, Trier, Germany, June, 2010.
99. Worcester Polytechnic Institute, Worcester, MA, October, 2010.
100. ISE Informs Lecture, Virginia Tech, November, 2010.
101. Auburn University, Auburn, AL, March, 2011.
102. Missouri University of Science and Technology, Rolla, MO, April, 2011.
103. University of Colorado, Boulder, CO, April, 2011.
104. University of Waterloo, Waterloo, Canada, April, 2012.
105. University of Illinois, Champaign, IL, October, 2012.
106. Texas A&M University, College Station, TX, April, 2013.
107. University of Southern California, Los Angeles, CA, April, 2013.
108. Carrier Research Center, Syracuse, NY, February, 2014.
109. UTC Buildings & Industrial Systems, Shanghai, China, April, 2014.
110. Texas Tech University, Lubbock, TX, October, 2014.
111. University of Washington, Seattle, WA, November, 2014.
112. Worcester Polytechnic Institute, Worcester, MA, April, 2015.
113. Texas Tech University, Lubbock, TX, November, 2015
114. INFORMS, Virginia Tech, Blacksburg, VA, January, 2016
115. Lawrence Livermore National Laboratory, Livermore, C, February, 2016
116. University of Graz, Graz, Austria, July, 2016
117. Air Force Research Lab, Dayton, OH, September, 2016
118. University of California Santa Barbara, November, 2016
119. Virginia Commonwealth University, February, 2017
120. University of Tokyo, Tokyo, March, 2017
121. Oklahoma State University, April, 2017

## **X. Honors**

- Elected Lifetime Fellow of the IEEE, 2015
- Elected Fellow of SIAM, 2013.
- Elected Honorary Member of the Argentinean Association for Applied, Computational and Industrial Mathematics, 2013.
- Awarded the 2010 W. T. and Idalia Reid Prize in Mathematics.
- Named Visiting Research Fellow – United Technologies Research Center, 2008.
- Named Honorary Professor of Mathematics – Beijing Institute of Technology, 2005.
- Elected Fellow of the IEEE, 2001.
- Elected Senior Member of the IEEE, 1995.
- Teaching Excellence Award, VPI&SU, 1978, 1981.
- American Men and Women of Science, 1975.
- NSF Postdoctoral Fellowship, 1974.

- Society of Sigma Xi, 1973.
- NDEA Graduate Fellowship, 1968.

## **XI. Professional Societies**

SIAM, IEEE

## **XII. Service to Profession**

### **Editorial Boards**

- Series Editor, - Monographs and Research Notes in Mathematics, 2013 – Present.
- Associate Editor – Mathematical Problems in Engineering, 2008 – 2013.
- Associate Editor - Journal of Dynamical and Control Systems, 1994-2000.
- Associate Editor - Applied and Computational Control, Signals and Circuits, 1996-1999.
- Associate Editor - Control, Optimization and Calculus of Variations, 1999-2004
- Editor - Advances in Design and Control, 2003-2005.
- Editor-in-Chief - Advances in Design and Control, 1998-2003.
- Editor - Proceedings of the American Mathematical Society, 1995-2000.
- Associate Editor - Progress in Systems and Control, 1988-1996.
- Corresponding Editor - Journal of Mathematical Systems, Estimation and Control, 1989-1998.
- Associate Editor - IEEE Transactions on Automatic Control, 1994-1996.
- Corresponding Editor - SIAM Journal on Control and Optimization, 1994-1996.
- Associate Editor - SIAM Journal on Control and Optimization, 1979-1990.
- Science and Engineering Editor - SIAM NEWS, 1982-1983.
- Associate Editor - SIAM Review, 1983-1989.
- Managing Editor - SIAM Review, 1984-1987.
- Associate Editor - Applied and Computational Mathematics, 1987-1990.

### **National Committees and Boards**

- Member, International Federation of Automatic Control - Technical Committee TC 2.6. Distributed Parameter Systems, 2011 – Present.
- Member of SIAM Committee on Science Policy, 2010 – Present.
- Member of SIAM Fellows Selection Committee, 2015 – 2017
- Member, Advisory Committee for the SIAM Activity Group on Control and Systems, 2014 – 2017.
- Member of Review Panel for CRSC Center, NC State University, April, 2016.
- Member of Computational Sciences Review Panel for INRIA, Research Assessment of 2012, 2012 - 2013
- Member of Mathematical Sciences Review Panel for the KTH Research Assessment of 2012, 2012 - 2013.
- Member, FTC Proposal Review Panel Member, Lisbon, Portugal, 2010 – 2011.
- Member, Steering Committee for the Southeastern-Atlantic Regional Conference on Differential Equations, 2009-2010.
- Member, National Academy Panel to Review the NSF VIGRE Program. 2007 - 2009.

- SIAM Committee on Publications, 2004 – 2009.
- Chair, The Reid Prize Committee, 1993 - 2005.
- Chair, SIAM Activity Group on Control and Systems, 1995-1998.
- Member, SIAM Committee on Publications, 1984-1986, 1991-1996.
- Member, Conference Editorial Board for the 1995 CDC, 1995.
- Member, Conference Editorial Board for the 1994 CDC, 1994.
- Member, Nominations Committee, SIAM Activity Group on Control, 1994-1995.
- Member, International Program Committee for the Third Nonlinear Control System Design Symposium, 1994-1995.
- Member, AMS - IMS - SIAM Joint Committee on Summer Workshops, 1988-1992.
- Vice President Programs - SIAM, 1987-1992.
- Member, SIAM Council, 1987-1992.
- Member, Board of Trustees of SIAM, 1985-1988.
- Member, SIAM Committee on Applied Mathematics Education, 1979-1984.
- Member, SIAM Programs Committee, 1982-1984. Chairman, 1987-1992.
- Chairman, 1983 SIAM National Meeting Committee.
- SIAM Visiting Lecturer for 1981-1983.
- Member, Advisory Board for the Collaborative Center of Control Science, 2001-2002.
- Member, Organizing Committee for the Conference on Adaptive Materials and Structures, 1990-1991.
- Member, Administrative Board, Center for Intelligent Materials Systems and Structures, 1990-1995.
- Member, U.S. National Committee for Mathematics, Board of Mathematical Sciences, National Research Council, 1988-1991.
- Member, International Program Committee for the Fifth IFAC Symposium on Control of Distributed Parameter Systems, 1988-1989.
- Member, Scientific Advisory Board, Brown Center for Distributed Parameter Control, 1986-1989.
- Member, Advisory Board for SIAM Activities Group on Control, 1986-1989.
- Member, NSF Panel on Future Directions in Control, 1986-1988.
- Member, Virginia Department of Education Mathematics Curriculum and Technology Committee, 1984-1985.
- Member, Steering Committee for the Southeastern-Atlantic Regional Conference on Differential Equations, 1981-1983.

## **IX. Service to VPI & SU**

### **Departmental Committees**

- Personnel Advisory Committee, 1979-1980, 1982-1984, 1986, 1987, 1991-1992, 1996-1998, 1999-2001, 2005 – 2007, 2009 – 2012, 2015 - Present
- Graduate Program Committee, 1975-1981, 1982, 1984, 1986-1989, 1991-2003, 2004-Present.
- Computing Committee, 2008 – 2015.
- Graduate Admissions Committee, 1979-1980, 1981-1982, 1987, 1991-2000.
- Numerical Analysis Search Committee, 1996-2003.
- Computational Mathematics Search Committee, 1997-2000, 2003-2005.
- Research Planning Committee, 1988-1990 (Chairman), 1992-1994 (Chair), 1995.
- Service Committee, 1979 (Chair), 1987-1989.

- Extension Committee, 1976-1978.
- Freshman-Sophomore Committee, 1976-1978.
- Teacher Evaluation Committee, 1977-1979.
- Colloquium Committee, 1977-1979, 1981-1982(Chair), 1984, 1987.
- Program Advisory Committee, 1979-1982.
- Undergraduate Program Committee, 1981-1982.
- Budget Advisory Committee, 1995.

#### College / University Committees

- Search Committee for Director of Virginia Tech Energy Initiatives, 2010.
- Aerospace Engineering Department Head Review Committee, 1997-1998.
- Research Planning Committee, College of Arts and Sciences, 1990-1992, (Chair), 1991, 1996.
- College of Engineering Committee on Mathematics, 1979-1982, 1984.
- College Steering Committee, College of Arts and Sciences, 1991-1992.
- Personnel Committee, College of Arts and Sciences, 1994-1996.

#### **XIV. Teaching Experience**

- Undergraduate courses in Calculus, Algebra, Applied Engineering Mathematics and Differential Equations, 1968-1972 (at the University of Oklahoma).
- Graduate Seminar on Generalized Inverses of Linear Operations, 1973-1974 (at Brown University).
- Undergraduate courses in Mathematics As a Liberal Art, Linear Algebra, Calculus, Ordinary Differential Equations, Applied Engineering Mathematics and Partial Differential Equations, (at VPI & SU).
- Graduate courses in Real Analysis, Calculus of Variations, Topics in Hilbert Spaces, Differential Equations, Optimal Control Theory, Functional Analysis, Optimization Theory (at VPI & SU).
- Introduced computer techniques in a special course on Ordinary Differential Equations, 1976, (at VPI & SU).
- Assisted in the development of Math 3241-3242, a new undergraduate course on Ordinary Differential Equations (at VPI & SU).
- Gave a one-week short course at the graduate level on Differential and Integral Equations at the Naval Research Laboratory (with T. L. Herdman), March 1977.
- Assisted in the revision of Math 5560 and the development of an applied linear analysis course for graduate students in Engineering (at VPI & SU).
- Taught a graduate course in Optimization at the Naval Weapons Laboratory, Dahlgren, VA , Fall 1980, and Advanced Calculus in Washington, D.C., Fall 1982.
- Taught a 4 week short course on Distributed Parameter Control, Clemson University, Clemson, SC, January 1990
- Gave a short course on “Optimal Design” at the Southeastern SIAM Conference, Clemson, SC., March, 1996.
- Gave a short course on “Optimal Design and Control” at Louisiana State University, Baton Rouge, LA, October, 1996.
- Gave a short course on “Sensitivities in Optimal Design and Control” at Canadian NRC Industrial Materials Institute, Montreal, Quebec, March, 1998.



- Gave a short course on “Sensitivity Analysis” at Gadjah Mada University, Yogyakarta, Indonesia, July, 1999.
- Gave a short course on “Flow Control” at Air Force Research Labs, Dayton, OH, February, 2001.
- Gave a short course on “Sensitivity Analysis” at the Universität Graz, Graz, Austria, June 2001.
- Developed course on Continuous Mathematical Models in the Biological Sciences, 2003.
- Gave a short course on “Modeling in the Physical and Biological Sciences” Canisius College, Buffalo, NY, February, 2004.
- Gave short course on modeling in the biological sciences for the ICAM – VBI NSF REU, June, 2008.
- Gave short course on modeling in the biological sciences for the ICAM – VBI NSF REU, June, 2009.
- Gave one week short course on Control of PDE Systems at Lawrence Livermore national Lab, Livermore, CA, April, 2011.

## **XV. Other Professional Activities**

- Presented talks at various professional meetings organized by AMS, SIAM, AIAA, IEEE, IEEE/IFIP, SPIES.
- Assisted in the founding of the Virginia Tech SIAM Student Chapter, 1980.
- Assisted in the organization of the Conference on Volterra and Functional Differential Conference held at Virginia Tech, June 10-13, 1981.
- Assisted in the organization of the Southeastern-Atlantic Regional Conference on Differential Equations held at Virginia Tech, November 13-14, 1981.
- Participated in the NSF/CBMS meeting on the Mathematical Science Curriculum K-12, Washington, D.C., September 1982.
- Organized 1983 National SIAM meeting, Denver, CO, June 1983.
- Co-organized conference on Distributed Parameter Control, Tampa, FL, March 1985.
- Represented the Board of Mathematical Sciences of the National Research Council at the AAAS Intersociety Working Group, January 1985-December 1985.
- Co-organized the Second Conference on Distributed Parameter Control, Val David, Quebec, October 1986.
- Co-organized the Interdisciplinary Center for Applied Mathematics at Virginia Tech, 1987.
- Co-organized the Virginia Tech - ICAM Conference on Numerical Solutions of Partial Differential Equations, September 1988.
- Chairman, NSF Committee to Review the Institute for Mathematics and Its Applications, 1988-1989.
- Co-organized the DOD URI Center for Optimal Design and Control at Virginia Tech, 1993.
- Co-organized the Virginia Tech - ICAM Conference on Optimal Design and Control, held April 8-9, 1994.
- Made a presentation at the Rayburn House Office Building on “Basic Research in the National Defense”, May, 1996.
- Co-organized the Air Force Workshop on Optimal Design, Arlington, VA., September 29 - October 3, 1997.
- Member of the External Review Committee for the Cal Tech Program in Control, December, 1997.
- Member of the DOD MURI Review Panel for Material Processing and Control, December, 1997 - February, 1998.

- Co-organized 1998 SIAM Conference on Systems and Control, Jacksonville, FL, May 1998.
- Member of the NSF Review Panel for the Institute for Applied Mathematics, Minneapolis, MN, October, 1998.
- Member of Review Panel for the Control Sciences Center of Excellence, 2000 – 2001.
- Member of the MASC Advisory Board for United Technologies, Hartford, CT, 2001 – 2002.
- Co-organized the Air Force Workshop on Dynamics and Control, Arlington, VA., April, 2002.
- Co-organized the ICAM Workshop on Control and Identification, Blacksburg, VA., September, 2002.
- Made a presentation to the Governor’s Panel on Computational Science and Engineering, October, 2003.
- Co-organized the First International Conference on Approximation Methods for Design and Control, Buenos Aires, Argentina, March, 2004.
- Co-organized the International Workshop on Mathematics as an Enabling Science, Blacksburg, VA, September, 2005.
- Co-organized the Second International Conference on Approximation Methods for Design and Control, Buenos Aires, Argentina, March, 2009.
- Co-organized the First Atlantic Coast Conference on Mathematics in the Life and Biological Sciences, Blacksburg, VA, May, 2007.
- Mathematics Judge for the International Science Fair, Albuquerque, NM, May, 2007.
- Co-organized the Second Atlantic Coast Conference on Mathematics in the Life and Biological Sciences, Raleigh, NC, April, 2008.
- Mathematics Judge for the International Science Fair, Atlanta, GA, May, 2008.
- Co-organized the Third International Conference on Approximation Methods for Design and Control, Buenos Aires, Argentina, March, 2009.
- Co-organized the Workshop on Computational Science for Building Energy Efficiency, Arlington, VA, July, 2010.
- Proposal evaluation meeting, Portuguese Foundation for Science and Technology, Lisbon, Portugal May, 2011.
- Short Course on Distributed Parameter Control, Lawrence Livermore National Lab, June, 2011.
- Visit to KTH as part of the Mathematical Sciences Review Panel for the KTH Research Assessment of 2012, Stockholm, Sweden, June, 2012.
- Invited Participant in the DOE Workshop on Grand Challenges of Advanced Computing for Energy Innovation, Reston, Virginia, July, 2012.
- Member, Review Panel for the INRIA Research Assessment of 2013, Paris, France, March, 2013
- Co-organized the IMA Workshop on Mathematical and Computational Challenges in the Control, Optimization, and Design of Energy-Efficient Buildings June 11-14, 2013.
- Member of the International Organizing Committee for the 1<sup>st</sup> IFAC Workshop on Control of Systems Modeled by Partial Differential Equations, held in Paris, France, September, 2013.
- Member of the panel on exascale computing for the Secretary of Energy Advisory Board (SEAB) Exascale Computing Fact Finding Meeting, Washington DC, November, 2013.
- Co-organized the IMA Workshop on Computational Methods for Control of Infinite-dimensional Systems, March 14 - 18, 2016.
- Co-organized 2017 CCS – ICAM Workshop on Optimization Methodology for Thermal Management Systems s, May 31—June 2, 2017.