CURRICULUM VITAE
Catalin S. Trenchea

March 30, 2012

Department of Mathematics
University of Pittsburgh
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Education

- **Ph.D.** in Mathematics, Iasi University, Romania, January 2001.
  Dissertation title: *Optimal Control of Some Periodic Systems with Distributed Parameter*.
  Thesis advisor: Professor Viorel Barbu
- **M.Sc.** in Evolution Equations and Applications, Iasi University, Romania, September 1996.
- **M.Sc.** in Numerical Analysis and Optimization, Iasi University, Romania, June 1995.
- **B.S.** in Mathematics, Iasi University, Romania, June 1994.

Mathematical Interests

Numerical Analysis, Control Theory, Partial Differential Equations

Research Grants Awarded

- PI (*Co-PI: William Layton*): Air Force Office of Scientific Research (AFOSR) - "Generalized Mathematical and Computational Methods for Predictive Simulation of Stochastic Turbulence Systems", 2011-2014, $404,448.
- PI: Air Force Office of Scientific Research (AFOSR) -"Advanced Numerical Methods for Computing Statistical Quantities of Interest from Solutions of SPDEs", 2009-2011, $140,821.
- PI: FY09 CRDF, University of Pittsburgh - "Computation and control of biological pattern formation", 2008.
- PI: Grant of Department of Education and Research, Romania 2001.
- PI: Grant of National Agency for Science, Technology and Information, Romania 2000.
- PI: Grant of National Agency for Science, Technology and Information, Romania 1999.

Research Grants submitted

- NSF - "Large Eddy Simulations in Magnetohydrodynamics Flows", 2011

Employment

- **Assistant Professor** at the Department of Mathematics, University of Pittsburgh, December 2006 - present.
- **Postdoctoral Research Associate** (Numerical Analysis) at the School of Computational Science, Florida State University, October 2003 - November 2006.
  Host: Professor Max D. Gunzburger
- **Postdoctoral Researcher** (Optimal Control Theory) at the Department of Mathematics, University of Bretagne Occidentale, Brest, France, January 2003–July 2003. Host: Professor Marc Quincampoix
- **Postdoctoral Fellow** (Fluid Mechanics and Control), Department of Mechanics and Aerospace Engineering, University of California, San Diego, May 2001–December 2001. Host: Professor Thomas R. Bewley
- **Research Scientist**, Institute of Mathematics of Romanian Academy, Iasi Romania, 1998-2000
- **Teaching Assistant**, Department of Mathematics, Iasi University, Romania, 1996–2000

* *Affiliated Faculty at the Department of Scientific Computing, The Florida State University.*
* *Member of the Steering Committee of the Southeastern Atlantic Regional Conference on Differential Equations.*
* *Member of the Editorial Board of the International Journal of Applied Nonlinear Science (IJANS).*

Publications since coming to the University of Pittsburgh

1. M. Gunzburger, C. Trenchea and C.G. Webster, A generalized stochastic collocation approach to constrained optimization for random data identification problems, *submitted* to International Journal for Uncertainty Quantification (2012).

2. C. Trenchea, Unconditional stability of a partitioned IMEX method for magnetohydrodynamic flows, *submitted* to Applied Mathematical Letters (2012).

3. C. Trenchea, Stability of partitioned IMEX methods for systems of evolution equations with skew-symmetric coupling, *submitted* to Journal of Computational and Applied Mathematics (2012).

4. C. Trenchea, Second order implicit for local effects and explicit for nonlocal effects is unconditionally stable, *submitted* to Electronic Transactions on Numerical Analysis (2012).

5. W. Layton, H. Tran and C. Trenchea, Analysis of stability and errors of IMEX methods for magnetohydrodynamics flows at small magnetic Reynolds number, submitted (2012).

6. W. Layton, N. Mays, M. Neda and C. Trenchea, Numerical analysis of modular regularization methods for the BDF2 time discretization of the NSE, *submitted* to ESAIM Mathematical Modelling and Numerical Analysis (2011).

7. W. Layton, H. Tran and C. Trenchea, Analysis of Long Time Stability and Errors of Two Partitioned Methods for Uncoupling Evolutionary Groundwater - Surface Water Flows, submitted to *SIAM Journal on Numerical Analysis*, revised 2/2012 in response to positive referee reports.

8. M.R. Garvie, C. Trenchea, The identification of space-time distributed parameters in Gierer-Meinhardt reaction-diffusion systems, submitted (2011).

9. M.R. Garvie and C. Trenchea, A second-order, three level finite element approximation of an experimental substrate-inhibition model, submitted (2011).

10. A. Bowers, L. Rebholz, A. Takhirov and C. Trenchea, Improved accuracy in regularization models of incompressible flow via adaptive nonlinear filtering, to appear in *Int. J. Numer. Meth. Fluids.* (2012), appeared online DOI: 10.1002/fld.2732.

11. W. Layton, L. Rebholz and C. Trenchea, Modular Nonlinear Filter Stabilization of Methods for Higher Reynolds Numbers Flow, *J. Math. Fluid Mech.*, (2011), 1-30, appeared online DOI 10.1007/s00021-011-0072-z.

12. W. Layton and C. Trenchea, Stability of two IMEX methods, CNLF and BDF2-AB2, for uncoupling systems of evolution equations, *Applied Numerical Mathematics*, 62:2 (2012) 112-120.

13. W. Layton, I. Stanculescu and C. Trenchea, Theory of the NS-$\overline{\omega}$ model: A complement to the NS-α model, *Communications on Pure and Applied Analysis*, 10 (2011), 1763-1777.

14. W. Layton and C. Trenchea, The Das-Moser commutator closure for filtering through a boundary is well posed, *Mathematical and Computer Modelling*, 53 (2011), 566-573.

15. A. Labovsky and C. Trenchea, Large eddy simulation for turbulent MHD flows, *J. Math. Anal. Appl.*, 377 (2011) 516-533.

16. A. Labovsky and C. Trenchea, Approximate Deconvolution Models for Magnetohydrodynamics, *Numer. Funct. Anal. Optim.,* 31:12, 1362-1385 (2010).

17. M.R. Garvie, P. Maini, C. Trenchea, An efficient and robust numerical algorithm for estimating parameters in Turing systems, *Journal of Computational Physics*, 229 (2010) 7058-7071.

18. W. Layton, M. Sussman, C. Trenchea, Bounds on Energy, Magnetic Helicity and Cross Helicity Dissipation Rates of Approximate Deconvolution Models of Turbulence for MHD Flows, *Numer. Funct. Anal. Optim.*, 31:5, (2010) 577-595.

19. M. Gunzburger, E. Lee, Y. Saka, C. Trenchea and X. Wang, Analysis of Nonlinear Spectral Eddy-Viscosity Models of Turbulence, *J. Sci. Comp.* Vol. 45, No. 1-3 (2010) 294-332.

20. M.R. Garvie and C. Trenchea, Spatiotemporal dynamics of two generic predator-prey models, *Journal of Biological Dynamics*, 4:6, (2010) 559-570.

21. A. Labovschii, W. Layton, C. Manica, M. Neda, L. Rebholz, I. Stanculescu and C. Trenchea, "Mathematical Architecture of Approximate Deconvolution Models of Turbulence", J. Meyers, B. Geurts and P. Sagaut (Eds.) ERCOFTAC Series, Springer, (2008).

22. M. Gunzburger, J. Peterson, C. Trenchea, The velocity tracking problem for MHD flows with distributed magnetic field controls. *Int. J. Pure Appl. Math.* 42 (2008), no. 2, 289-296.

23. M.R. Garvie and C. Trenchea, Optimal control of a 'nutrient-phytoplankton-zooplankton-fish' system, *SIAM J. Control Optim.*, 46 (2007) 775-791.

24. M.R. Garvie and C. Trenchea, Finite element approximations of spatially extended predator-prey interactions with the Holling type II functional response, *Numer. Math.* 107 (2007), no.4, 641-667.

Publications before coming to the University of Pittsburgh

25. M. Gunzburger and C. Trenchea, Analysis of an optimal control problem for the three-dimensional coupled modified Navier-Stokes and Maxwell equations, *J. Math. Anal. Appl.*, no. 333 (2007), 295-310.

26. M. Gunzburger and C. Trenchea, Analysis and Discretization of an Optimal Control Problem for the Time-Periodic MHD Equations, *J. Math. Anal. Appl.* 308 (2005), no. 2, 440-466.

27. C. Trenchea, Optimal control of an elliptic equation under periodic conditions, *Mem. Secţ. Ştiint. Acad. Române* Ser. IV 25 (2002), 23–35 (2005).

28. C. Trenchea, Periodic optimal control of the Boussinesq equation, *Nonlinear Anal., Theory Methods Appl.* 53A, No.1, 81-96 (2003), 81-96.

29. C. Trenchea, "Internal optimal control of the periodic Euler-Bernoulli equation", *Commun. Appl. Anal*. 7 (2003), no. 1, 115–125.

30. M. Quincampoix and C. Trenchea, Hamilton-Jacobi equation and optimality conditions for control systems governed by semilinear parabolic equations with boundary control, tech. rep., Université de Bretagne Occidentale, 2003.

31. C. Moroşanu and C. Trenchea, Identification for nonlinear periodic wave equation, *Appl. Math. Optimization,* 44 (2001), 87–104.

32. C. Trenchea, Optimal control of the periodic string equation with internal control, *J. Optim. Theory Appl.*, 101 (1999), 429–447.

Papers in Conference Proceedings

33. M. Garvie and C. Trenchea, 'Biomanipulation of food-webs in eutrophic lakes', *Proceedings of the 46th IEEE Conference on Decision and Control*, (2007), pp. 3460-3465.

34. M. Gunzburger and C. Trenchea, Optimal control of time-periodic MHD equations, *Nonlinear Anal., Theory Methods Appl.*, 63 (2005), no. 5-7, e1687-e1699, Proceedings for the Fourth World Congress of Nonlinear Analysis WCNA-2004.

35. T. Bewley and C. Trenchea, Noncooperative optimization of controls for time periodic Navier-Stokes systems with multiple solutions, *AIAA 2002-2754*.

Conferences organized

1. Co-organized the SIAM Student Conference 2012, held at Virginia Tech, March 2012.

2. Co-organized with Xiaoming Wang (FSU) and Yanzhao Cao (Auburn U) the Special Session on Analysis and Control under Uncertainty, held at the Joint Mathematics Meeting, San Francisco, January 13-16, 2010.

3. Co-organized the SIAM Student Conference 2010, held at Virginia Tech, February 2010.

4. Co-organized the Clemson/Pitt/UTK/VT Graduate/Post Graduate Conference 2009, held at ICAM, Virginia Tech, February 2009.

5. Co-organized with Marcus Garvie (University of Guelph) at the SIAM Conference on Computational Science and Engineering, the Minisymposium - MS149 "Distributed Parameter Identification Problems", Miami FL, March 2009.

Conferences and Presentations

- *Truncation of scales by time relaxation in MHD turbulence*, SIAM Annual Meeting (invited talk), Minneapolis, Minnesota, July 2012.

- *A stochastic collocation approach to constrained optimization for random data estimation problems*, SIAM Conference on Uncertainty Quantification, Raleigh, NC, April 2012.

- *Generalized Methodology for Inverse Modeling Constrained by SPDEs*, SIAM Conference on Uncertainty Quantification (invited talk), Raleigh, NC, April 2012.

- *A stochastic collocation approach to constrained optimization for random data estimation problems*, Computational Mathematics Seminar, University of Pittsburgh, January 24, 2012.

- *A stochastic collocation approach to constraint optimization for random data estimation problems*, Fields Industrial Optimization Seminar, Fields Institute for Research in Mathematical Sciences (invited), Toronto, Ontario, Canada, December 6, 2011.

- *A stochastic collocation approach to constraint optimization for random data estimation problems*, Department of Mathematics & Statistics Seminar, McMaster University, Ontario, Canada, December 5, 2011.

- *Modular regularization methods for Higher Reynolds Numbers flow*, Department of Mathematical Sciences Colloquium, Michigan Technological University, Mi, October 24, 2011.

- *Stability of two IMEX methods, CNLF and BDF2-AB2, for uncoupling systems of evolution equations*, Applied Mathematics, Modeling and Computational Science (invited), Waterloo, Canada, July 2011.

- *Analysis of long time stability and errors of two stable partitioned methods for uncoupling evolutionary groundwater-surfacewater flows*, Applied Mathematics, Modeling and Computational Science (invited), Waterloo, Canada, July 2011.

- *A new algorithm for estimating parameters in reaction-diffusion systems that display pattern formation*, Applied Mathematics, Modeling and Computational Science (invited), Waterloo, Canada, July 2011.

- *Stability of two IMEX methods, CNLF and BDF2-AB2, for uncoupling systems of evolution equations*, "Advances in modeling, numerical analysis and computations of fluid flow problems", AMS Spring Western Section Meeting (invited), Las Vegas, NV, April 2011.

- *An efficient and robust numerical algorithm for estimating parameters in Turing systems*, AMS-SIAM Joint Mathematics Meetings, Special Session on Control and Inverse Problems for Partial Differential Equations (invited), New Orleans LA, January 2011.

- *An efficient and robust numerical algorithm for estimating parameters in Turing systems*, SEARCDE (invited), Blacksburg, VA, October 2010.

- *An efficient and robust numerical algorithm for estimating parameters in Turing systems*, SIAM Annual Meeting & Conference on Life Sciences (invited), Pittsburgh PA, July 2010.

- *Bounds on Energy, Magnetic Helicity and Cross Helicity Dissipations Rates of Approximate Deconvolution Models of Turbulence for MHD Flows*, SIAM meeting "Emerging Topics in DYnamical Systems and Partial Differential Equations" (contributed), Barcelona Spain, June 2010.
- *Bounds on Energy, Magnetic Helicity and Cross Helicity Dissipations Rates of Approximate Deconvolution Models of Turbulence for MHD Flows* and *Optimal Control of MHD Flows*, Naval Postgraduate School (invited), Monterey CA, May 2010.
- *Optimal Control under SPDE constraint*, Minisymposium on inverse problems (invited), University of Guelph, August 19-20, 2009.
- *Optimal Control under SPDE constraint*, SIAM Conference on Control and Its Applications (CT09), (invited) Denver CO, July 6-8, 2009.
- *A Controllability Problem in Pattern Formation*, Conference on Computational Science and Engineering (invited), March 6, 2009, Miami FL.
- *Computational Methods for SPDE Control Problems* 8th World Congress on Computational Mechanics, 5th European Congress on Computational Methods in Applied Sciences and Engineering (contributed), Venice, Italy, June 30 - July 4, 2008.
- *Magnetohydrodynamics: control and large eddy simulations*, Department of Mathematics and Statistics Colloquium, University of Guelph, April 17, 2008.
- *Control and parameter identification in reaction-diffusion equations*, School of Mathematics and Physics Seminar, University of Queensland, Australia, March 20, 2008.
- *Control and parameter identification in reaction-diffusion equations*, School of Mathematics and Statistics, Applied Mathematics Seminar, University of Sydney, Australia, March 19, 2008.
- *Magnetohydrodynamics: optimal control and turbulence*, Department of Mathematics Colloquia, University of Toledo, OH, February 22, 2008.
- *Biomanipulation of Food-Webs in Eutrophic Lakes*, 46th IEEE Conference on Decision and Control (invited), December 12-14, 2007, New Orleans, Louisiana.
- *Velocity tracking for MHD flows with magnetic field controls*, Fourth International Conference of Applied Mathematics and Computing (invited), August 12-18, 2007, Plovdiv, Bulgaria.
- *Parameter identification for reaction-diffusion equations modeling pattern formation* SIAM Conference on Control and Its Applications (invited), June 29 - July 1, 2007, in San Francisco, California.
- *Optimal control of time-periodic MHD equations*, Mathematical Association of Americam 85th Annual Meeting (invited), 31 March - 1 April 2006, Auburn, Alabama.
- *Velocity and magnetic field tracking for MHD flows with distributed controls*, ICAM Workshop on Mathematics as an Enabling Science (invited), 30 September - 02 October 2005, Virginia Tech, Blacksburg, VA.
- *Optimal Control of a Plankton-Fish System*, SIAM Conference on Control and its Applications (invited), July 11-14, 2005, New Orleans, LA.
- *Analysis and discretization of an optimal control problem for the time-periodic MHD equations*, SIAM Conference on Computational Science and Engineering (invited), February 12-15, 2005, Orlando Florida.
- *Analysis and discretization of an optimal control problem for the time-periodic MHD equations*, (invited) Colorado State University, February 10, 2005.
- *Analysis and discretization of an optimal control problem for the time-periodic MHD equations*, (invited) University of Nebraska-Lincoln, January 20, 2005.

- *Optimal control of time-periodic MHD equations*, Fourth World Congress of Nonlinear Analysis (invited), June 30 - July 7, 2004, Orlando Florida.
- *Optimal control of the time-periodic MHD equations*, University of Wyoming Mathematics Department Colloquium, May 6th, 2004.
- *Value function and optimality conditions for a boundary control problem*, Evolution Equations for Deterministic and Stochastic Systems (invited), TMR Workshop, Roscoff, May 19-23, 2003, France.
- *Noncooperative optimization of controls for time periodic Navier-Stokes systems with multiple solutions,* 1st AIAA Flow Control Conference, June 24-26, 2002, St. Louis, MO.
- *Optimal control of some periodic systems with distributed parameter,* Workshop on Analysis and PDEs (invited), Iasi University, January 2001, Romania.
- *Parameter identification for nonlinear time–periodic wave equation,* 5th French-Romanian Colloquium on Applied Mathematics (invited), August 2000, Constanta, Romania.
- *Time–periodic optimal control for the Euler–Bernoulli equation,* Annual Meeting of the Iasi Division of Romanian Academy (invited), October 2000, Romania.
- *Time periodic optimal control for the Boussinesq equation,* Conference on Fixed Point Theory and Applications (invited), "Babes Bolyai" Cluj-Napoca University, November 1999, Romania.
- *Optimal control of time periodic wave equations,* Annual Meeting of the Iasi Division of Romanian Academy (invited), October 1999, Romania.

Professional Membership

- *Society for Industrial and Applied Mathematics*
- *American Mathematical Society*

Advisor to Graduate Students

- Hoang Tran, (Primary advisor, co-advisor William Layton), 4th year at Pitt.
- Mark Tronzo, (co-advised with Ivan Yotov), 2010-2012, Ph.D., University of Pittsburgh.
- Roxana Tanase, (co-advised with Ivan Yotov), since 2011, Ph.D., University of Pittsburgh.
- Andrew Jorgenson, **M.Sc.**, April **2012**, University of Pittsburgh.

I also helped mentor two of William Layton's students, with whom I have published work:

- Iuliana Stanculescu, 2007-2008, Ph.D., University of Pittsburgh, (now at Nova Southeastern University in FL).
- Alexander Labovsky, 2006-2007, Ph.D., University of Pittsburgh, (now at Michigan Tech).

Teaching Experience
Undergraduate Courses taught

- Lecturer for *Differential Equations* (MATH 0290), University of Pittsburgh, Fall 2011
- Lecturer for *Differential Equations* (MATH 0290), University of Pittsburgh, Fall 2010
- Lecturer for *Numerical Mathematical Analysis* (MATH 1070), University of Pittsburgh, Fall 2010
- Lecturer for *Numerical Mathematical Analysis* (MATH 1070) University of Pittsburgh, Fall 2009
- Lecturer for *Numerical Linear Algebra* (MATH 1080), University of Pittsburgh, Spring 2009
- Lecturer for *Numerical Mathematical Analysis* (MATH 1070) University of Pittsburgh, Fall 2008

- Lecturer for *Differential Equations* (MATH 0290), University of Pittsburgh, Fall 2007
- Lecturer for *Numerical Linear Algebra* (MATH 1080), University of Pittsburgh, Spring 2007
- Lecturer for *Differential Equations* (MATH 0290), University of Pittsburgh, Spring 2007
- Lecturer for *Differential Equations* (MAP 2302), Florida State University, Fall 2004
- Teaching Assistant for *Calculus, Differential Equations, Partial Differential Equations*, Iasi University, 1996-2000

Graduate Courses taught

- Lecturer for *Numerical Methods in Scientific Computing II* (MATH 2071), University of Pittsburgh, Spring 2012
- Lecturer for *Numerical Methods in Scientific Computing I* (MATH 2070), University of Pittsburgh, Fall 2011
- Lecturer for *Finite Element Method* (MATH 3072), University of Pittsburgh, Spring 2011
- Lecturer for *Numerical Methods in Scientific Computing II* (MATH 2071), University of Pittsburgh, Spring 2010
- Lecturer for *Numerical Methods in Scientific Computing I* (MATH 2070), University of Pittsburgh, Fall 2009
- Lecturer for *Numerical Methods in Scientific Computing III. Optimal Control Theory* (MATH 2603) University of Pittsburgh, Fall 2008
- Lecturer for *Numerical Methods in Scientific Computing II* (MATH 2071), University of Pittsburgh, Spring 2008
- Lecturer for *Numerical Methods in Scientific Computing I* (MATH 2070), University of Pittsburgh, Fall 2007
- Directed study with Haomin Lin, on Optimal Control Theory at School of Computational Science, Florida State University, 2006.

New Courses developed

- *Numerical Methods in Scientific Computing III. Control of deterministic/stochastic PDEs and uncertainty quantification.* (MATH 2603) University of Pittsburgh, Fall 2012
- *Numerical Methods in Scientific Computing III. Optimal Control Theory* (MATH 2603) University of Pittsburgh, Fall 2008

Faculty Service

- Colloquium Chair for 2008-2010, University of Pittsburgh
- Organizer of the Computational Mathematics Seminar, University of Pittsburgh, Spring 2007- Spring 2011
- Member of the Hiring Search Committee in Scientific Computing 2008-2010, University of Pittsburgh
- Member of the Graduate Committee, University of Pittsburgh, 2009-2012
- Computer Committee member, University of Pittsburgh, 2008-2012

Service on Graduate Student Committees

- Ph.D. comprehensive exam
  - Nick Hurl, comprehensive exam on FEM, University of Pittsburgh, May 15, 2011
  - Michaela Kubacki, comprehensive exam on FEM, University of Pittsburgh, May 15, 2011
  - Marina Moraiti, comprehensive exam on FEM, University of Pittsburgh, May 15, 2011
  - Aziz Takhirov, comprehensive exam on FEM, University of Pittsburgh, May 15, 2011
  - Xin Xiong, comprehensive exam on FEM, University of Pittsburgh, May 15, 2011
  - Jin Li, comprehensive exam on Scientific Computing, University of Pittsburgh, May 15, 2011
  - Evan Jenkins, MA exam on Scientific Computing, University of Pittsburgh, May 15, 2011
  - Ming Zhong, comprehensive exam on Scientific Computing, University of Pittsburgh, September 30, 2010
  - Hoang Tran, comprehensive exam on Advanced Scientific Computing, University of Pittsburgh, April 20, 2010
  - Bo Shi, comprehensive exam on Scientific Computing, University of Pittsburgh, August 26, 2008
  - Nathaniel Mays, comprehensive exam on Scientific Computing, University of Pittsburgh
  - Ross N. Ingram, comprehensive exam on Scientific Computing, University of Pittsburgh, August 29, 2008
  - Mark Tronzo, comprehensive exam on Scientific Computing, University of Pittsburgh, September 2008
- Ph.D. overview examination & Ph.D. thesis defense
  - Nathaniel Mays, Ph.D. thesis committee member, University of Pittsburgh, May 2011
  - Ross N. Ingram, Ph.D. thesis committee member, University of Pittsburgh, April 2011
  - Collin Otis, Ph.D. thesis committee member, University of Pittsburgh, School of Engineering, July 2010
  - Danail Vassilev, Ph.D. thesis committee member, University of Pittsburgh, July 2010
  - Jeffrey Connors, Ph.D. thesis committee member, University of Pittsburgh, April 2010
  - Alexander Lozovskiy, Ph.D. thesis committee member, University of Pittsburgh, April 2010
  - Benjamin Ganis, Ph.D. thesis committee member, University of Pittsburgh, April 2010
  - Alexandr Labovschii, Ph.D. thesis committee member, University of Pittsburgh, May 2008
  - Haomin Lin, Ph.D. thesis committee member, Florida State University, July 2008
- MS examination
  - Evan Jenkins, April 2011
  - Steven Skopinski, April 2011
  - Michelle Baker, July 2010

Service on Ph.D. Preliminary Examination Committee

- member on the Linear Algebra Prelim Committee, 2008
- member on the Analysis Prelim Committee, 2010-2011