Jonathan Goldfarb

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Education

Florida Institute of Technology **Melbourne, FL**
PhD *Spring 2016 (Expected)*
Applied Mathematics

Dissertation: *On the Optimal Control of Free Boundary Problems for Second Order Parabolic Equations*

Advisor: Dr. Ugur Abdulla

Florida Institute of Technology
BS *2009*
Environmental Sciences

Experience

Academic

Florida Institute of Technology **Melbourne**
Graduate Student Assistant *August 2009–May 2012, August 2015–Present*

- Instructional experience in partial differential equations, applied statistical analysis, and mathematical modelling
- Developed models in MATLAB, R, and Julia for applications in statistics and physics and delivered training on computational tools.
- Delivered a series of graduate seminars on a variety of topics, such as the theory of the nonlinear diffusion equation, Sobolev spaces, optimal control for ODE, and the Stefan problem.
- Graduate mentor for students working in Dr. Abdulla's research group on applications in optimization, differential equations, and dynamical systems.
- Organized MATLAB training workshop for the Florida Tech community, with sessions for a variety of levels.
- Administer and develop Sage (multi-language/Python) and WebWork (Perl) server applications for use in educational and research capacities.
- Cofounder and president of Florida Tech's SIAM Student chapter for 2012–2014. The chapter's main activities include: • A seminar series inviting speakers from mathematics and industry, • Outreach to Florida Tech and the surrounding community • Summer camp.
- Developed, organized, and taught the SIAM summer camp in MATLAB with applications to mathematical modeling in 2013, and co-organized the camp in 2014.
- Tutor students of all levels, up to and including advanced graduate and undergraduate courses in analysis, differential equations, and numerical/computational methods.

Florida Tech REU in PDEs and Dynamical Systems

Graduate Mentor *May 2014–August 2014, May 2015–August 2015*

- Lead NSF-supported research group working with PI Dr. Ugur Abdulla in the fields of Nonlinear PDEs, Inverse Free Boundary Problems, and Dynamical Systems and Chaos Theory.
- Develop high performance C, MATLAB, and Julia implementations of research codes.
- Created website and custom application management system implemented in PHP/SQL, with Python (back-end/data processing) and Javascript (front-end).

Instructor *August 2012–May 2015*

- Deliver instruction on partial differential equations, calculus, and statistics with applications to physical models.
- Coordinated labs, developed, and taught redesigned courses for Precalculus, Applied Calculus, and Statistics.
- SIAM Southeastern Atlantic Section conference organizer, under conference chair Dr. Ugur Abdulla. Organized registration, developed program generation software pipeline (in Python), decided groupings for contributed sessions, handled fund collection and budgeting, and arranged catering and attendee services.
- Organizer of the graduate student seminar, 2013–Present.
- Placement testing organizer and technical lead, 2012–Present.
- Project co-lead: implementation of placement testing using WebWork (in Perl), with campus IT service integration. Develop result data processing and statistical tests for quality of questions comparison with previous system.
- Service on hiring committees for several instructors, and course/curriculum planning committee for development of new Precalculus A/B two year course to replace remedial courses.

Professional

Florida Institute of Technology

Web Developer *2006–2009*

- Updated and developed software in PHP, Perl, and Python for gathering, processing, and formatting meteorological information and content for the web and end users.
- Maintained a database of high resolution real-time meteorological observations.
- Developed new products for users of atmospheric data using IDL.
- Troubleshooted software and hardware problems in a Linux-based computer lab for research purposes.

Core Skills

Platforms: Linux, Unix, and Windows

Languages: C, C ++, C#, FORTRAN, IDL, JavaScript, Julia, LaTeX, Maxima, Perl, PHP, Python, R, SQL

Tools & Libraries: IDV, Grads, Gempak, Mathematica, MATLAB, PETSc, Sage, SPSS, Sundials, ViSit

Research Experience and Interests

PDE: Inverse problems, mathematical physics and modeling, qualitative theory for nonlinear equations, free boundary problems, control problems, degenerate and non-uniformly parabolic equations

Optimization: Theoretical-numerical methods, applications of gradient-type methods in mathematical physics, PDE constrained optimization

Functional Analysis: Convergence of difference schemes for weak solutions, analysis and embeddings of function spaces

Computational Mathematics: High-order numerical schemes, algorithm development and optimization

Dynamical Systems: Structure of chaotic orbits, Sharkovskii ordering and fine classification of endomorphisms

Geophysical Fluid Dynamics: Atmospheric dynamics, data analysis and numerical simulation, experimental and computational analysis of structure in microscale-mesoscale systems

Publications

Invited Conference Talks

- Joint Mathematics Meetings, January 2016: *Frechet Differentiability in Optimal Control of Free Boundary Problems for the Second Order Parabolic PDE*, Dr. Ugur Abdulla, Dr. Jim Jones, Dylanger Pittman*, and Jessica Pillow
- Joint Mathematics Meetings, January 2016: *Evolution of Free Boundaries for the Nonlinear Fokker-Planck Equation*, Dr. Ugur Abdulla, Luke Andrejek, Christie Campbell, Dr. Jian Du, Jonathan Goldfarb, and Adam Prinkey
- Young Mathematicians Conference, August 2015: *Frechet Differentiability in Optimal Control of Parabolic Free Boundary Problems*, Dr. Ugur Abdulla, Dr. Jim Jones, Dylanger Pittman*, and Jessica Pillow
- Young Mathematicians Conference, August 2015: *Evolution of Free Boundaries for the Nonlinear Fokker-Planck Equation*, Dr. Ugur Abdulla, Luke Andrejek, Christie Campbell, Dr. Jian Du, Jonathan Goldfarb, and Adam Prinkey
- SIAM Conference on Analysis of PDE, December 2015: *On the Optimal Control of the Stefan Problem*, Dr. Ugur Abdulla and Jonathan Goldfarb*.
- Joint Mathematics Meetings, January 2015: *Analysis of Interfaces for the Nonlinear Diffusion Equation with Linear Convection*, Dr. Ugur Abdulla, Dr. Jian Du, Jonathan Goldfarb*, Kev Johnson, Lauren Lanier, and Taylor Schluter.
- Joint Mathematics Meetings, January 2015: *On Some Inverse Free Boundary Problems for Second Order Parabolic PDE's*, Dr. Ugur Abdulla, Nicholas Crispi, Jonathan Goldfarb, Daniel Kassler*, Paige Williams, Scott Pelton-Stroud, and Bruno Poggi
- Young Mathematicians Conference, August 2014: *Analysis of Interfaces for the Nonlinear Diffusion Equation with Linear Convection*, Dr. Ugur Abdulla, Dr. Jian Du, Jonathan Goldfarb, Kev Johnson, Lauren Lanier, and Taylor Schluter.
- Young Mathematicians Conference, August 2014: *On Some Inverse Free Boundary Problems for Second Order Parabolic PDE's*, Dr. Ugur Abdulla, Nicholas Crispi, Jonathan Goldfarb, Daniel Kassler, Paige Williams, and Bruno Poggi.
- SIAM Conference on Analysis of PDE, December 2014: *On the Optimal Control of Free Boundary Problems for the Second Order Parabolic PDEs*, Dr. Ugur Abdulla and Jonathan Goldfarb*.

Contributed Conference Talks

- Joint Mathematics Meetings, January 2015: *Numerical Methods for Solving Optimal Control Problems for the Second Order Parabolic PDEs*, Dr. Ugur Abdulla and Jonathan Goldfarb*.

- SIAM Southeastern Atlantic Section Conference, May 2014: *On the Optimal Control of Free Boundary Problems for the Second Order Parabolic PDEs*, Dr. Ugur Abdulla and Jonathan Goldfarb*. **Talk won Student Presentation Award**.

Conference Posters

- SIAM Annual Meeting, Summer 2012: *Analysis of Interfaces for Nonlinear Diffusion-Convection Equations*, Dr. Ugur Abdulla, Jonathan Goldfarb*, and Nathan Mertins.
- MAA Mathfest, 2011: *Numerical Analysis of Interface Evolution for the Nonlinear Degenerate Diffusion-Convection Equation*, Dr. Ugur Abdulla and Jonathan Goldfarb*

∗ denotes presenter.

Academic Awards

- SIAM Student chapter award for outstanding efforts, 2012–2013 and 2013–2014.
- Outstanding Graduate in Applied Mathematics at Florida Institute of Technology, 2011–2012 and 2013–2014.
- SIAM SEAS Conference Student Presentation Award, 2014 (selected by independent committee)
- Joint work with Nathan Mertins and Dr. Ugur Abdulla on the Nonlinear Diffusion-Convection Equations was an invited presentation at the Young Mathematicians Conference in 2012 and won honorable mention, as well as Best of Student Showcase at the Northrop Grumman Engineering & Science Student Design Showcase, 2012.