Jonathan Goldfarb

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Education

Florida Institute of Technology **Melbourne, FL**
PhD *Spring 2016*
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

Professional

Harris Corporation
Software Engineer *May 2016–December 2016*

- Develop distributed and parallel computing capabilities (Scala/Java/Python).

Academic

Florida Institute of Technology **Melbourne**
Assistant Professor and Director of Mathematics Advancement Center *August 2016–Present*

- Manage team of 20+ graduate teaching assistants, tutors, and administrative staff.
- Support advancement of mathematics at undergraduate and graduate levels.
- Develop computational tools to efficiently schedule and manage students and staff.

Florida Institute of Technology **Melbourne**
Graduate Student Assistant *August 2009–May 2012, August 2015–May 2016*

- Instructional experience in partial differential equations, applied statistical analysis, and mathematical modeling
- Developed MATLAB, R, and Julia models 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 intermediate and advanced level MATLAB training workshops for the Florida Tech community.
- Administer and develop Sage (multi-language/Python) and WebWork (Perl) server applications for use in educational and research capacities.

Florida Tech REU in PDEs and Dynamical Systems

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

- Lead NSF-supported research group working under 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).

Florida Institute of Technology

Instructor *August 2012–May 2015*

- Deliver instruction on partial differential equations, calculus, and statistics with applications to physical models.
- 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.
- Placement testing organizer and technical lead, 2012–2016.
- Project co-lead: implementation of placement testing using WebWork (in Perl), with campus IT service integration. Develop data pipeline and statistical tests for quality of questions compared to 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.

Skills

Languages: C, C ++, C#, FORTRAN, IDL, Java, Julia, LaTeX, Perl, PHP, Python, R, SQL, Scala

Platforms & Tools: Linux, Docker, IDV, Grads, Git, HDFS, Mathematica, MPI, MATLAB, PETSc, Sage, Spark, SPSS, Sundials, SWIG, ViSit

Research Interests

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

Data Analysis: Machine learning and functional data analysis, Signal and Image processing

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

Geophysical Fluid Dynamics: Atmospheric dynamics and climate modeling, data analysis and numerical simulation

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

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

Publications

Refereed Journal Articles

- U. G. Abdulla, E. Cosgrove, C. Earl, and J. Goldfarb. On the state constrained optimal control of the Stefan type free boundary problems. *Mathematical Control and Related Fields (Submitted)*, 2017.
- U. G. Abdulla, E. Cosgrove, and J. Goldfarb. On the Frechet differentiability in optimal control of coefficients in parabolic free boundary problems. *Evolution Equations and Control Theory*, 6(3):319–344, 2017.
- U. G. Abdulla and J. Goldfarb. Optimal control of coefficients in parabolic free boundary problems modeling laser ablation. *Optimal Control, Applications and Methods (Submitted)*, 2017.
- U. G. Abdulla and J. Goldfarb. Frechet differentability in Besov spaces in the optimal control of parabolic free boundary problems. *Journal of Inverse and Ill-Posed Problems*, 26(2), 2017. doi: 10.1515/jiip-2017-0014. URL `https://arxiv.org/abs/1604.00057`.

Invited Conference Talks

- Ugur G. Abdulla and Jonathan Goldfarb*. Frechet differentiability in Besov spaces in the optimal control of parabolic free boundary problems. *Joint Mathematics Meetings*, January 2017. URL `http://jointmathematicsmeetings.org/meetings/national/jmm2017/2180_program_friday.html#2180:SS45A`.
- Ugur G. Abdulla, Jim Jones, Dylanger Pittman*, Jessica Pillow, and Jonathan Goldfarb. Frechet differentiability in optimal control of free boundary problems for the second order parabolic PDE. *Joint Mathematics Meetings*, January 2016. URL `http://jointmathematicsmeetings.org/amsmtgs/2181_abstracts/1116-35-90.pdf`.
- Ugur G. Abdulla, Luke Andrejek, Christie Campbell, Jian Du, Jonathan Goldfarb, and Adam Prinkey. Evolution of free boundaries for the nonlinear Fokker-Planck equation. *Joint Mathematics Meetings*, January 2016. URL `http://jointmathematicsmeetings.org/amsmtgs/2181_abstracts/1116-35-101.pdf`.
- Ugur G. Abdulla, Jim Jones, Dylanger Pittman, Jessica Pillow*, and Jonathan Goldfarb. Frechet differentiability in optimal control of parabolic free boundary problems. *Young Mathematicians Conference*, August 2015. URL `http://ymc.math.osu.edu/2015/abstract-sched.php?ID_array=PJ20143951`.
- Ugur G. Abdulla, Luke Andrejek, Christie Campbell, Jian Du, Jonathan Goldfarb, and Adam Prinkey. Evolution of free boundaries for the nonlinear Fokker-Planck equation. *Young Mathematicians Conference*, August 2015. URL `http://ymc.math.osu.edu/2015/abstract-sched.php?ID_array=CC20140601`.

- Ugur G. Abdulla and Jonathan Goldfarb*. On the optimal control of the stefan problem. *SIAM Conference on Analysis of PDE*, December 2015. URL http://meetings.siam.org/sess/dsp_talk.cfm?p=72655andhttp://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=21681.

- Ugur G. Abdulla, Jian Du, Jonathan Goldfarb*, Kev Johnson, Lauren Lanier, and Taylor Schluter. Analysis of interfaces for the nonlinear diffusion equation with linear convection. *Joint Mathematics Meetings*, January 2015.

- Ugur G. Abdulla, Nicholas Crispi, Jonathan Goldfarb, Daniel Kassler*, Paige Williams, Scott Pelton-Stroud, and Bruno Poggi. On some inverse free boundary problems for second order parabolic PDE's. *Joint Mathematics Meetings*, January 2015. URL http://jointmathematicsmeetings.org/amsmtgs/2168_abstracts/1106-35-116.pdf.

- Ugur G. Abdulla, Jian Du, Jonathan Goldfarb, Kev Johnson, Lauren Lanier, and Taylor Schluter. On some inverse free boundary problems for second order parabolic PDE's. *Young Mathematicians Conference*, August 2014. URL http://ymc.math.osu.edu/2014/abstract-sched.php?ID_array=ST21110525.

- Ugur G. Abdulla, Nicholas Crispi, Jonathan Goldfarb, Daniel Kassler, Paige Williams, and Bruno Poggi. On some inverse free boundary problems for second order parabolic PDE's. *Young Mathematicians Conference*, August 2014. URL http://ymc.math.osu.edu/2014/abstract-sched.php?ID_array=CN21103218.

- Ugur G. Abdulla and Jonathan Goldfarb*. On the optimal control of free boundary problems for the second order parabolic PDEs. *SIAM Conference on Analysis of PDE*, December 7–10, 2014.

Contributed Conference Talks

- U.G. Abdulla and J. Goldfarb*. On the optimal control of free boundary problems for the second order parabolic PDEs. *Society for Industrial and Applied Mathematics, Southeastern Atlantic Section Conference*, March 29–30, 2014. (J. Goldfarb won Best Student Presentation Award).

- U.G. Abdulla and J. Goldfarb*. Numerical methods for solving optimal control problems for the second order parabolic PDEs. *Joint Mathematics Meetings*, January 2015.

∗ denotes presenter.

Professional Affiliations

- **American Mathematical Society** — AMS
- **Society for Industrial and Applied Mathematics** — SIAM
- **Mathematics of Climate Research Network** — MCRN

Academic Awards

- Outstanding Graduate in Applied Mathematics at Florida Institute of Technology, 2011–2012, 2013–2014, 2015–2016.
- SIAM student chapter award for outstanding efforts, 2012–2013 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.

Additional Activities

- Cofounder and president of Florida Tech Society for Industrial and Applied Mathematics Student chapter, 2012–2014.
  The chapter's main activities include:
  • A seminar series inviting speakers from mathematics and industry, and
  • Outreach to Florida Tech and the surrounding community.
- Developed, organized, and taught the SIAM summer camp in MATLAB with applications to mathematical modeling in 2013, and co-organized the camp in 2014.
- Organizer of the graduate student seminar, 2013–2016.