



J. Darby Smith

Curriculum Vitæ (October 31, 2018)

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SUMMARY

Detailed-oriented researcher accomplished in applied stochastic differential equations, stochastic analysis, and Bayesian inference on stochastic systems. Mathematics PhD candidate at the University of Florida, anticipating graduation in May 2019.

EDUCATION

PhD Mathematics 2014–2019

University of Florida

Committee chair/advisor: Scott McKinley (OSU).

Dissertation title: “Molecular motor models: analysis, inference, and applications.”

GPA: 4.0.

Courses taken include: stochastic differential equations; functional analysis; ergodic theory and dynamical systems; applied differential equations.

Leadership: treasurer of the Graduate Math Association for the 2016 calendar year.

MS Mathematics, Operations Research 2011–2012

College of Charleston

Thesis advisor: G. W. Harrison (MSU).

Thesis: “[Modeling Fluctuations in a Hospital’s Census.](#)”

GPA: 4.0.

Courses taken include: operations research; linear model theory; partial differential equations; stochastic processes.

BS Physics and BA Mathematics 2007–2011

Wofford College

Undergraduate research: completed projects on mesoscopic resistors and photonic crystals.

GPA: 3.60; Cum Laude.

Leadership: treasurer of the Math Society for the 2010–2011 academic year; treasurer of Pi Kappa Phi fraternity for the 2007–2008 academic year; president of Pi Kappa Phi for the 2008–2009 and 2009–2010 academic years.

RESEARCH INTERESTS

Stochastic differential equations

- PhD dissertation research involves applications of stochastic differential equations to molecular motor transport models. In particular, using Langevin dynamics to explore the potential cost of allowing processive motor transport to be rescued by a tethering mechanism.
- Currently researching applying Bayesian estimation techniques to a stochastic differential equation approximation to optical trapping and tensiometer experiments used to infer motor parameters.

Queuing theory/operations research

- Master's research in applications of queuing theory to management of hospital occupancy numbers. In particular, utilized server queues and wait times to create a hospital occupancy profile. Analyzed both a stochastic and deterministic model for hospital admissions and discharges to determine which department contributed most to occupancy variability.

Stochastic and biological modeling

- Completed internship in Juiz de Fora, Brazil working with biological scientists. Worked closely with biologists to implement and perform model sensitivity and sensibility analysis on an immunological model of tuberculosis in humans.
- Stochastic and biological modeling heavily influence my research projects and modeling decisions. Biological systems, particularly where observations are noisy or influenced by random events, are oftentimes unexplainable by known models. I seek out these situations to produce new stochastic models and provide qualitative and quantitative predictions.

Stochastic processes

- The area of stochastic processes remains a passion for me. Stochasticity is inherent in many observable phenomena, producing fluctuations in economic pricing, adding noise to microscopic observations, and creating variance in vector based models. I am drawn to all of these scenarios with the desire to create qualitative, realistic models using stochastic processes as a base.

Probability

- Given my deep interest in stochastic modeling, the field of probability is an immediate co-interest. In all aspects of my research, I utilize and apply probability. Specifically, I have used probability to prove convergence of a series of stochastic differential equations describing transient binding events for molecular motors as well as for the stochastic averaging of various molecular motor systems.

HONORS AND AWARDS

5. 2017–2018 Graduate Student Teaching Award (University of Florida)
4. 2016–2017 Graduate Student Teaching Award (University of Florida)
3. 2015–2016 Excellence in Teaching Award (University of Florida)
2. 2010–2011 Elanor Naylor Dana Physics Scholar (Wofford College)
1. 2010–2011 Greek Senior Scholar (Wofford College)

PAPERS

2. J. D. Smith, S. A. McKinley, “Molecular motor tensiometer experiments: inference and limitations”, *Manuscript in progress*.
1. J. D. Smith, S. A. McKinley, “[Assessing the role of electrostatic drag on processive molecular motor transport](#)”, *Bulletin of Mathematical Biology* **80**, 2088–2123 (2018).

SEMINARS AND COLLOQUIA

3. SIAM Conference on the Life Sciences, Minneapolis, MN, *Invited minisymposium session, “Intracellular Transport: Velocity, Diffusivity, and Drag,”* August 2018
2. Tulane University Probability Seminar, *Invited, “Assessing the role of electrostatic drag in processive molecular motor transport,”*, November 2015
1. Universidade Federal Juiz de Fora, 2010 Winter Conferences, *Invited, “Analysis of an immunological model for human response to tuberculosis,”* August 2010

TEACHING

Summary of Teaching Philosophy

- The essence of my teaching philosophy is to create a welcoming community within the classroom which fosters learning and where students feel comfortable to ask questions at any point during a lecture. I accomplish this through an unrivaled enthusiasm for each lecture and encourage my students using a positive attitude and constant constructive feedback.

Lecturer

- Spring 2018 (UF) – Lecturer for a stadium-style section Business Calculus (MAC 2233).
- Duties included lesson planning, creation of daily multiple choice lecture questions, assisting with creation of exams, oversight of TAs, and holding three office hours per week.

Instructor

- Fall 2018 (UF) – Instructor for Achievements in Mainstreaming (AIM) section of College Algebra (MAC 1105).
 - The AIM program targets minorities, first generation college students, and other students who are at risk for completing college based on their background.
 - AIM courses meet 5 days a week and move at a slower and more detailed pace.
- Fall 2017 (UF) – Instructor for AIM section of Pre-calculus (MAC 1140).
- Summer 2016 (UF) – Instructor for AIM section of College Algebra (MAC 1105).
 - This particular section was a “flipped” section. Students were expected to watch pre-taped lectures and read their textbook before coming to class. In class, we worked on homework problems, completed activities, and took quizzes.
- Summer 2015 (UF) – Instructor for AIM section of College Algebra (MAC 1105).
- Fall 2012 (CofC) – Instructor for College Algebra (Math 101).
- Duties included lesson planning, quiz and test creation, activity planning, grading, coordinating with the Office of Academic Support and the AIM program to ensure students succeed and have all necessary resources, and holding three office hours per week.

Discussion Leader

- Spring 2017 (UF) – Discussion leader for two sections of Calculus III (MAC 2313).
- Fall 2016 (UF) – Discussion leader for three sections of Calculus III (MAC 2313).
- Spring 2016 (UF) – Discussion leader for two sections of Calculus II (MAC 2312).
- Fall 2015 (UF) – Discussion leader for three sections of Calculus I (MAC 2311).
- Spring 2014 (UF) – Discussion leader for two sections of Calculus I (MAC 2311).
- Fall 2014 (UF) – Discussion leader for three sections of Pre-calculus with Trig (MAC 1147).
- Duties included creating and administering quizzes, proctoring and grading exams, and holding two to three office hours per week.

Tutoring

- In addition to the above duties for the University of Florida, I worked one hour per week in a tutoring lab. Here students from all math courses from Calculus III and below come for tutoring and homework help.
- While at the College of Charleston I had the opportunity to work both as a supplemental instructor and as a tutor for students in the South Carolina Assisting Minorities Program (SCAMP). Similar to the AIM program previously described, this program assists minorities and first generation college students.

OTHER EXPERIENCE

Mathematics Courseware Specialist

2012-2014

Hawkes Learning Systems, Charleston

- QA lead for 2013; created and maintained scripts to automate testing of implemented software programs.
- Product owner of Liberal Arts Mathematics from January 2014 to departure. Organized the creation and release structure of a new software product.
- Created predictive algorithm for question selection. The algorithm was designed to give a student the question they are most likely to succeed in solving given the history of answers submitted so far. In the process of creation, developed database skills and handled large amounts of student response data.
- Designed new math problems for a variety of subjects; created basic algorithms for implementation of designs.

Biological Science Intern

2010

Universidade Federal Juiz de Fora, Brazil

- Numerically implemented and analyzed a model of the immune system's response to mycobacterium.
- One particular challenge that I overcame during this internship was the language barrier. I did not know any Portuguese before starting this internship and needed to be able to communicate through the use of impeccable mathematics and code.

COMPUTER SKILLS

- Intimate knowledge using Matlab, L^AT_EX, Python, Mathematica, and R
- Basic working knowledge using C++, STAN, STELLA, C, Perl, MySQL, HTML, VBScript, VB6, OpenGL, and embedded systems/assembly languages (specifically working with m6800 and i8086).