

GRACIE CONTE | Curriculum Vitae

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EDUCATION

University of North Carolina, Chapel Hill (expected) May 2022
Ph.D. Applied Mathematics
Adviser: Dr. Jeremy Marzuola

California State University, Sacramento May 2014
B.A. Mathematics
B.A. Physics
Certificate: Scientific Computing and Simulation

RESEARCH INTERESTS

Partial Differential Equations • Quantum Mechanics • Fluid Dynamics • Numerical Analysis

DISSERTATION

My dissertation research studies the cubic nonlinear Schrödinger equation on quantum graphs from a dynamical perspective. In particular, I focus on how periodic solutions arise as a consequence of Hamilton-Hopf bifurcations. Analytically, I am working to find the necessary initial conditions. Numerically, I will use the initial conditions to find these periodic solutions with machine precision. To obtain machine precision, I have numerically defined the Laplacian operator on any given graph which gives our spatial component spectral accuracy. The time solver is complicated by the boundary conditions imposed by quantum graphs, but was resolved by developing our own numerical method with enhanced the stability and accuracy. I am now implementing the Adjoint Continuation Method so we will be able to search for time periodic solutions. All these numerical components are being adapted into a MATLAB software package jointly with Roy Goodman on Github.

PUBLICATIONS

- Thomas Beck, Isabel Bors, [Grace Conte](#), Graham Cox, Jeremy L. Marzuola, *Limiting eigenfunctions of Sturm–Liouville operators subject to a spectral flow*, *Annales mathématiques du Québec* (2020)
- [Grace Conte](#), Roy Goodman, Jeremy Marzuola, *QGLAB: a MATLAB package for computations on quantum graphs*, (preprint)

AWARDS / SCHOLARSHIPS / FELLOWSHIPS

Senior Teaching Fellowship	Fall 2019 - Spring 2020
J. Burton Linker Award for Excellence in Undergraduate Teaching · UNC-CH	Spring 2019
Initiative for Minority Excellence · UNC-CH	Fall 2016 - Spring 2017
Royal Vanderburgh Scholarship · CSU, Sacramento	Fall 2014 - Spring 2015
James Clark Maxwell Award · CSU, Sacramento	Spring 2012 - Fall 2013

TECHNICAL SKILLS

Programming Languages:

MATLAB • Python • Mathematica • FreeFem++ • FORTRAN • C++

Other:

L^AT_EX • GitHub • Labview

RESEARCH EXPERIENCE

Displacement Analysis of Neo-Hookean Elastic Materials • UNC, Chapel Hill

Derived and tested the behavior of finite element formulations for incompressible plastic materials at finite strains using Cook's Membrane and the Elasto-Plastic Strip in FreeFem++.

Wave Breaking Solutions to the Whitham Equation • UNC, Chapel Hill

Whitham's equation is a partial differential equation used to model shallow water waves. Due to a term that is defined purely in Fourier space, I had to implement the Fast Fourier transform and a 4th order Runge-Kutta solver to obtain a solution. I then used dealising to clean up the solution and a shock capturing scheme to study its wave-breaking behavior.

Flow Enhanced Diffusion in a Circular Pipe • UNC, Chapel Hill

Investigated the diffusion in an infinitely long pipe with a circular cross-section and parabolic flow at large time scales using multiscale and homogenization on the advection equation.

Calculating the Stark Effect Energy Shift for the Hydrogen Atom • UNC, Chapel Hill

Perturbed the Hamiltonian matrix associated with Schrödinger operator then utilized Lanczos methods, QR iterations and polynomial filtering to study numerical eigenvalues and the Stark Effect.

Heterojunction-Assisted Impact Ionization • University of Oregon REU

Experimentally determined the best method to deposit single crystal Zinc Sulfide on Silicon wafers so that two free electrons would be produced by the absorption of a single high-energy photon.

TALKS AND PRESENTATIONS

Searching for Time Periodic Solutions to the Nonlinear Schrödinger Equation [Slides]

- Triangle Area Graduate Mathematics Conference at UNC, Chapel Hill, 8 Dec. 2020

Introduction to Bifurcation Theory and its Applications to the NLS Equation [Slides]

- Mathematics Graduate Student Association Seminar at UNC, 29 Sept. 2020

Discretizing Schrödinger Type Operators on Quantum Graphs w/ Spectral Accuracy[Slides]

- Mathematics Graduate Student Applied Seminar at NCSU, 13 Mar. 2020
- Graduate Mathematics Association Seminar at UNC, Chapel Hill, 2 Mar. 2020
- Triangle Area Graduate Mathematics Conference at UNC, Chapel Hill, 9 Nov. 2019
- Graduate Mathematics Association Seminar at UNC, Chapel Hill, 25 Mar. 2019

Applying to Graduate School [Slides]

- Launch Point, 11 April 2021
- Diversity in Data Science and Machine Learning Conference by Samsi at Howard University, 17 Oct 2019

Introduction to Quantum Mechanics [Slides]

- Girls Talk Math at UNC, Chapel Hill, 12 July 2019
- Girls Talk Math at UNC, Chapel Hill, 10 July 2018
- Girls Talk Math at UNC, Chapel Hill, 14 July 2017

MINI SCHOOLS

Quantum Graphs and Their Spectra · Lake Como School of Advanced Studies	Aug 2019
From Symplectic Geometry to Chaos · MSRI	July 2018

MENTORING

Undergraduate Research Mentor Fall 2019 - Spring 2020

- Mentored an undergraduate student for her senior thesis by providing background on her problem and assisting her with the numerical analysis.

TEACHING AND ACADEMIC EXPERIENCE

Graduate Teaching Fellow UNC, Chapel Hill

Aug. 2016 - Present

Senior Teaching Fellow:

2019/2020 Academic Year

Co-taught Math 920 which prepares incoming math graduate students to be successful course instructors. Checked syllabus, exams, and other class material of first-time instructors as well as observed their teaching during the semester. Assisted graduate students with creating class material on request. This position is awarded to a single graduate student each year.

Instructor of Record Class List:

Math 547	Linear Algebra	<i>Summer 2020</i>
Math 383	Differential Equations	<i>Summer 2019</i>
Math 381	Discrete Mathematics	<i>Spring 2021, Fall 2020</i>
Math 233	Calculus III (Recitation)	<i>Fall 2016</i>
Math 232	Calculus II (Recitation)	<i>Fall 2018, Fall 2017</i>
Math 231	Calculus I	<i>Summer 2017</i>
Math 130	Precalculus	<i>Spring 2019, Spring 2017</i>
Math 119	Mathematical Modeling	<i>Fall 2018</i>
Math 110	College Algebra	<i>Spring 2018, Fall 2017</i>

Graduate Assistant CSU, Sacramento

Aug. 2014 - July 2016

Duties: Taught classes. Proctored exams. Graded assignments. Taught review sessions for diagnostic testing. Tutored.

Instructor of Record Class List:

Math 11	Algebra for College Students	<i>Spring 2016</i>
Math 9	Essentials of Algebra and Trigonometry	<i>Fall 2015, Spring 2015</i>

Curriculum Developer and Instructor Brookfield School

July 2015 - June 2016

Taught math and physics summer camp classes for children ranging from 5th to 8th grade. Developed material that focused on experimentation and applied learning to teach students geometry, number theory, probability, and physics. Substituted for any teacher K-8th grade during regular school year.

PROGRAM CREATION

Directed Reading Program UNC, Chapel Hill

August 2018

- Founded a mentoring network where graduate students mentor undergraduate students.
- Designed a program to expose undergraduates to advanced level mathematics that is not found in a classroom setting to prepare them to think in an exploratory mindset rather than a regurgitative one.

Society of Industrial and Applied Mathematics - UNC Chapter UNC, Chapel Hill

August 2017

- Founding member of the UNC-CH student chapter of SIAM.

LEADERSHIP AND ADMINISTRATIVE EXPERIENCE

Girls Talk Math CO-DIRECTOR

August 2018 - Present

[\[Website\]](#)

- Annually organize a two-week day camp hosted in the Mathematics Department at the UNC-CH geared towards female and gender non-conforming high school students interested in mathematics.
- Obtain external funding so the program is free for all attendees.
- Guide students through high-level problem sets by helping them think critically about the material.
- Provide names of prominent female mathematicians in fields consistent with given problem sets for students to research for the purpose of writing blog posts.
- Coordinate activities to promote a sense of community, boosting collaboration amongst students.
- Adapted camp to a virtual environment for years 2020 and 2021.

Directed Reading Program - UNC Chapter August 2018 - Present
FOUNDING COMMITTEE MEMBER [\[Website\]](#)

- Recruit undergraduate student applicants and solicit graduate students to serve as mentors and provide project ideas on a semesterly basis.
- Organize the pairings of mentors and students each semester based on perceived mutual interests, with special care taken to pair students from underrepresented minorities with graduate mentors who were sensitive to their unique backgrounds.
- Obtain funding for books so program is free mentors and mentees.
- Coordinate end-of-semester presentations.
- Sole author of [presentation guidelines](#) for students to successfully give technical talks.

American Mathematical Society - UNC Chapter August 2019 - May 2020
PRESIDENT

- The AMS Student Chapters at UNC, NCSU and Duke created the Triangle Area Graduate Mathematics Conference (TAGMaC) and currently rotate hosting duties on a semesterly basis. As President of AMS Student Chapter at UNC-CH, I hosted and organized TAGMaC in November 2019.

Graduate Mathematics Association August 2019 - May 2020
PRESIDENT

- Fostered a sense of community amongst graduate students, faculty, staff, and postdoctoral students in the mathematics department by organizing a variety of social events including biannual picnics and a winter holiday party.
- Organized career panels that informed students of different career paths and how best to prepare for the transition out of graduate school.

Society of Industrial and Applied Mathematics - UNC Chapter August 2017 - May 2019
TREASURER [\[Website\]](#)

- The UNC-CH Student Chapter provides a forum where students can pursue mathematical research focused on applications in science and industry. Additionally, it facilitates interactions between students, faculty, and SIAM through official SIAM activities of the chapter.

UNC Science Exposition April 2017 - April 2019
EXHIBIT LEADER [\[Website\]](#)

- Managed an exhibit demonstrating how nature opts for minimizing surface area for a set volume with an interactive activity of making bubbles with a variety of shapes and sizes to share the magic of mathematics with young people.

Graduate Student Advisory Council - CSUS August 2015 - May 2016
COUNCIL MEMBER

- Conceptualized and presented the idea of a private study space for graduate students to work apart from undergraduates that was accepted by the university.
- Coordinated a formal winter social event for graduate students from all departments.

PROFESSIONAL SOCIETIES

Pi Mu Epsilon (National Math Honor Society)
Pi Sigma Pi (National Physics Honor Society)
Society of Industrial and Applied Mathematics (SIAM)
American Mathematical Society (AMS)

REFERENCES

Jeremy Marzuola	UNC, Chapel Hill	marzuola@email.unc.edu	<i>Research Advisor</i>
Roy Goodman	NJIT	goodman@njit.edu	<i>Research Collaborator</i>
Linda Green	UNC, Chapel Hill	greenl@email.unc.edu	<i>Teaching Reference</i>