

Education

Cornell University, Ithaca NY – Ph.D. Applied Mathematics, **GPA 4.03**, Expected Graduation May 2021
Rensselaer Polytechnic Institute (RPI), Troy NY - B.S. Physics/Math Dual, **GPA 3.96**, May 2016
Hudson Valley Community College, Troy NY - A.S. Engineering Science, **GPA 3.95**, December 2013
New Visions Engineering (HS) – Valedictorian, June 2010

Research Interests

Numerical analysis and scientific computing, with an emphasis on eigenvalue and infinite dimensional spectral problems. Analysis of nonlinear problems, uncertainty quantification, and mathematical modeling.

Graduate Research

Algorithms and software to accurately extract spectral properties of differential and integral operators, including eigenvalues, spectral densities and measures, and continuous spectra. These algorithms use a mix of functional analysis and approximation theory to preserve and exploit the structure of the continuous operator, regardless of the underlying discretization used for numerical computation. <https://github.com/SpecSolve/>

Internships

Jet Propulsion Laboratory, Pasadena CA

JPL Summer Internship

Summer 2018

- Studied the uncertainty in exoplanet orbital parameters inferred from astrometric data. Constructed Bayesian models incorporating astrometry and photometry in an uncertainty quantification framework and developed efficient Monte Carlo simulations for further study.

Praxis Technology Inc., Queensbury NY

Research and Development Technician/Intern

Summer 2010, May 2011 – August 2012, Summer 2013

- Worked closely with metallurgists, materials scientists, and engineers, participating on a weekly basis in discussion of materials development and application. Developed innovative material processing techniques.

Undergraduate Research

Summer Undergraduate Research Program at RPI, Troy, NY

June 2015 – September 2015

- Constructed a probabilistic model to describe steric disinhibition, a newly proposed activation mechanism for competing teams of molecular motors in intracellular bidirectional transport. Developed analytical approximations for quantities of interest using probabilistic and geometric tools and constructed a Monte Carlo simulation for numerical computations.

Innovative Computational Materials Physics (ICMP) at RPI, Troy NY

January 2015 – June 2015

- Used a novel Monte Carlo approach to study irradiated graphene nanostructures, particularly possibilities for forming new graphene devices/structures.

Electronics Characterization Lab, RPI, Troy NY

April 2014 – December 2014

- Measured temperature dependent resistivity in ultrathin copper films. Identified and characterized effects of reduced film thickness on scattering sources.

Publications

- Colbrook, M. J., Horning, A., and Townsend, A. "Computing spectral measures of self-adjoint operators." Submitted. *arXiv preprint arXiv:2006.01766* (2020).
- Horning, A., and Townsend, A. "FEAST for differential eigenvalue problems." *SIAM Journal on Numerical Analysis* 58.2 (2020): 1239-1262.
- Horning, A., Morgan, R., and Nielson, E. "Minimum number of observations for exoplanet orbit determination." *Techniques and Instrumentation for Detection of Exoplanets IX*. Vol. 11117. SPIE (2018).
- Timalsina, Y. P., et al. "Effects of nanoscale surface roughness on the resistivity of ultrathin epitaxial copper films." *Nanotechnology* 26.7 (2015): 075704.
- Daniels, Colin, et al. "Elastic, plastic, and fracture mechanisms in graphene materials." *Journal of Physics: Condensed Matter* 27.37 (2015): 373002.

Invited and Contributed Talks

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| • SIAM Annual Meeting, Toronto, CA (virtual conference platform)
How to diagonalize differential and integral operators with continuous spectrum | July 2020 |
| • Complex Analysis Workshop, Isaac Newton Institute, Cambridge, UK
Computing spectral measures of differential and integral operators | Dec. 2019 |
| • CAKE, University of Cambridge, Cambridge, UK
Computing the spectrum of a differential operator: a resolvent-based approach | Jul. 2019 |
| • The 28 th BNAC, University of Strathclyde, Glasgow, Scotland
Computing the spectrum of a differential operator: a resolvent-based approach | Jun. 2019 |
| • SCAN Seminar, Cornell University, Ithaca, NY
A continuous analogue of FEAST for differential eigenvalue problems | Sept. 2018 |
| • ICOSAHOM, Imperial College, London, UK
A continuous analogue of FEAST for differential eigenvalue problems | Jul. 2018 |
| • Applied Math Days, RPI, Troy, NY
A continuous analogue of FEAST for differential eigenvalue problems | April 2018 |
| • American Vacuum Society, RPI, Troy, NY
Electrical resistivity in thin copper films. | Oct. 2014 |
| • Mathematical Biosciences Institute Capstone Event, Ohio State, Columbus OH
Mathematical model for steric disinhibition. | Aug. 2015 |

Honors and Awards

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| • NSF GRFP 2018 Honorable Mention | • Kenneth M. Barber Award for Excellence in Experimental Physics |
| • Cornell Graduate School Fellowship | • Phi Theta Kappa Honor Society |
| • Richard Madey '43 Physics Prize | • Archimedean Society |
| • Sigma Pi Sigma Honor Society | |
| • Rensselaer Leadership Award | |

Teaching Experience

Linear Algebra - Course Development and Teaching Assistant	Fall 2019
Multivariable Calculus – Teaching Assistant	Fall 2018
Numerical Analysis and Differential Equations – Teaching Assistant	Fall 2017
Electromagnetic Theory – Undergraduate Mentor	Spring 2016
Theoretical Mechanics – Undergraduate Mentor	Fall 2015
Math in Biology and Medicine – Grader	Fall 2015

Professional Affiliations

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| • American Mathematical Society | • American Physical Society |
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Skills

Numerical methods, theory, and application for eigenvalues and spectral densities. Polynomial and rational approximation theory with applications in fast numerical linear algebra and infinite-dimensional spectral problems. Spectral methods for PDE. Uncertainty quantification, construction and analysis of mathematical models. Analytical methods for studying nonlinear and chaotic systems.

Relevant Coursework

Data Sparse Matrix Computations, Numerical Analysis & Differential Equations, Applied Functional Analysis, Applied Dynamical Systems, Partial Differential Equations, Perturbation Methods, Real Analysis, Complex Analysis, Probability, Mechanics, EM Theory, Statistical Mechanics, Quantum Mechanics

Interests

Writing, recording, and performing music; contemporary Russian literature; team athletics; snowboarding; dynamics on social and political networks; history of physics and mathematics.