Andrew Horning **518-605-4844**
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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, Queensbury NY – 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 uncertainty in exoplanet orbital parameters inferred from astrometric data, constructing Bayesian models incorporating astrometry and photometry for uncertainty quantification. Findings contributed to NASA ExSDET's final report on exoplanet yield analysis (see sec. 3.a.vi Orbit Determination). **https://exoplanets.nasa.gov/exep/studies/sdet/**

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.

Additional Research Experience

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

- A. Horning and Y. Nakatsukasa, "Twice is enough for dangerous eigenvalues." Submitted Oct. 2020. *arXiv preprint arXiv:2010.09710*.
- M.J., Colbrook, A. Horning, and A. Townsend, "Computing spectral measures of self-adjoint operators." *SIAM Review*, to appear.
- A. Horning, and A. Townsend, "FEAST for differential eigenvalue problems." *SIAM Journal on Numerical Analysis* 58.2 (2020): 1239-1262.
- A. Horning, R. Morgan, and E. Nielson, "Minimum number of observations for exoplanet orbit determination." *Techniques and Instrumentation for Detection of Exoplanets* IX. Vol. 11117. SPIE (2018).
- Y.P. Timalsina, et al. "Effects of nanoscale surface roughness on the resistivity of ultrathin epitaxial copper films." *Nanotechnology* 26.7 (2015): 075704.

- C. Daniels, et al. "Elastic, plastic, and fracture mechanisms in graphene materials." *Journal of Physics: Condensed Matter* 27.37 (2015): 373002.

Invited and Contributed Talks

- CMS Winter Meeting, Montreal, CA (virtual conference platform) Dec. 2020
  Twice is enough for dangerous eigenvalues
- NLA Seminar, University of Manchester, Manchester, UK (remote) Nov. 2020
  Twice is enough for dangerous eigenvalues
- SIAM Annual Meeting, Toronto, CA (virtual conference platform) July 2020
  How to diagonalize differential and integral operators with continuous spectrum
- Complex Analysis Workshop, Isaac Newton Institute, Cambridge, UK Dec. 2019
  Computing spectral measures of differential and integral operators
- CAKE, University of Cambridge, Cambridge, UK Jul. 2019
  Computing the spectrum of a differential operator: a resolvent-based approach
- The 28th BNAC, University of Strathclyde, Glasgow, Scotland Jun. 2019
  Computing the spectrum of a differential operator: a resolvent-based approach
- SCAN Seminar, Cornell University, Ithaca, NY Sept. 2018
  A continuous analogue of FEAST for differential eigenvalue problems
- ICOSAHOM, Imperial College, London, UK Jul. 2018
  A continuous analogue of FEAST for differential eigenvalue problems
- Applied Math Days, RPI, Troy, NY April 2018
  A continuous analogue of FEAST for differential eigenvalue problems

Honors and Awards

- NASA Group Achievement Award
- NSF GRFP 2018 Honorable Mention
- Cornell Graduate School Fellowship
- G. Howard Carragan Award
- Richard Madey '43 Physics Prize
- Sigma Pi Sigma Honor Society
- Rensselaer Leadership Award
- Kenneth M. Barber Award for Excellence in Experimental Physics
- Phi Theta Kappa Honor Society
- Archimedean Society

Teaching Experience

Cornell REU – Graduate Research Mentor Summer 2020
Linear Algebra - Course Materials 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

- American Mathematical Society
- American Physical Society

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. **MATLAB, Julia, C++, Python.**

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