Sreeram Venkat

Computational Science · Data Science · HPC

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Education

Oden Institute, University of Texas Austin — Austin, Texas

Ph. D. in Computational Science, Engineering, and Mathematics — August 2021 - Present

Relevant Courses Include: Partial Differential Equations, Functional Analysis, Numerical Linear Algebra, Numerical PDEs, Mathematical Modeling (fluid/solid mechanics, electromagnetism, quantum mechanics, statistical mechanics)

North Carolina State University — Raleigh, North Carolina

B.S. in Applied Mathematics, B.S. in Physics — August 2017 - Present

Relevant Courses Include: (*graduate level)**:** Mathematical Modeling*, Numerical Analysis*, Partial Differential Equations*, Functional Analysis and Measure Theory*, Linear and Lie Algebra*, Topology and Smooth Manifolds*, Riemannian Geometry*, Algebraic Topology*, Uncertainty Quantification*, Complex Analysis*, Abstract Algebra*, Data-Driven Methods*, Inverse Problems*, Probability Theory, Mechanics, Electromagnetism, Quantum Mechanics, Thermodynamics, General Relativity*.

North Carolina School of Science and Mathematics — Durham, North Carolina

High School Diploma — August 2015 - May 2017

Relevant Courses Include: Research in Mathematics, Mathematical Modeling Complex Systems Analysis, Numerical Analysis, Network Theory, Advanced Combinatorics and Game Theory, Graph Theory, Mechanics, Electromagnetism, Fluids/Thermodynamics/Optics.

Research Experience

Research Assistant — Austin, Texas

Center for Computational Geosciences and Optimization — Advisors: Omar Ghattas — August 2021 - Present

- Developing reduced-order models to improve the efficiency of the inverse problem for gravitational wave detection.
- Training Gaussian Process surrogates on Numerical Relativity data.
- Applying Markov Chain Monte Carlo methods for Bayesian inversion.

Research Assistant — Los Alamos, New Mexico

Los Alamos National Laboratory XCP Summer Workshop on Computational Physics — Advisors: Bertrand Rouet-Leduc and Christopher Ren — June 2021 - August 2021

- Trained Generative Adversarial Networks (GANs) for generating synthetic InSAR data.
- Studied several architectures including Wasserstein GANs and Cycle GANs.
- Application to denoising networks for InSAR data.

Research Assistant — Raleigh, North Carolina

NSF Research Training Group, Applied Mathematics, North Carolina State University — Advisors: Tim Kelley and Ralph Smith — October 2018 - May 2021

- Developing reduced-order models that preserve conservation laws using linear and nonlinear projection methods.
- Creating software packages to enable easy implementation and reproduction of research methods.
- Working with several faculty members and graduate students in the Applied Mathematics department to discuss and learn methods for mathematical modeling, numerical analysis, and uncertainty quantification.

Summer Research Assistant — Los Angeles, California

Computational and Applied Mathematics REU, UCLA — Advisors: Andrea Bertozzi, Weiqi Chu, Wen Li — June 2020 - August 2020

- Studied how the addition of nanopores in a silicon-based anode would affect the mechanical stress and strains underwent by Lithium-Ion batteries.
- Created a finite-element solver for fourth-order, nonlinear, time-dependent system of PDEs.
- Analyzed hysteresis loops from numerical simulations to determine that the addition of nanopores increases the mechanical stability of the batteries over time (see Publications [2]).

Summer Research Assistant

Ithaca, New York

Summer Program for Undergraduate Research in Mathematics, Cornell University — Advisors: Kasso Okoudjou (Tufts University), Robert Strichartz (Cornell)

June 2019 - August 2019

- Studied orthogonal polynomials on fractal domains such as the Sierpinski Gasket using analytical and numerical methods.
- Derived recurrence relations, interpolation rules, quadrature rules for Sobolev Orthogonal Polynomials on the Sierpinski Gasket (see Publications [1]).
- Created a comprehensive software package in Python that was used to study the properties of these polynomials and enable fast numerical implementations (`https://e.math.cornell.edu/sites/op_on_sg/html/`).

Summer Research Assistant

Raleigh, North Carolina

Research in Mathematical Modeling, North Carolina State University — Advisor: Ralph Smith

May 2018 - August 2018

- Developed numerical algorithms for using Mean Fischer Information Matrices for Global Sensitivity Analysis.
- Learned numerical analysis and linear algebra techniques using software libraries in Python and MATLAB.

Research Assistant

Durham, North Carolina

Research in Mathematics, North Carolina School of Science and Mathematics and Duke University — Advisors: William Pardon (Duke University) and Dan Teague (NCSSM)

August 2016 - May 2017

- Studied abstract algebra topics (group, ring, and field theory) to understand cryptology algorithms such as RSA.
- Implemented numerical algorithms for prime number tests and number-field sieves.

Research Assistant

Raleigh, North Carolina

Research in Physics, North Carolina State University — Advisor: Thomas Schaefer

May 2015 - February 2017

- Studied models of spintronic transistors and associated PDE models of spin diffusion.
- Learned how to search for, review, and analyze scientific literature as contextual information for research.

Publications

1. Venkat, S., Smith, R. C., & Kelley, C. T. (2021). Convolutional Autoencoders for Reduced-Order Modeling. arXiv preprint arXiv:2108.12453.
2. Jiang, Q., Lan, T., Okoudjou, K. A., Strichartz, R. S., Sule, S., **Venkat, S.**, & Wang, X. (2021). Sobolev Orthogonal Polynomials on the Sierpinski Gasket. *Journal of Fourier Analysis and Applications*, 27(3), 1-38.
3. Bertozzi, A., Chu, W., Fromcke, T., Li, W., Schreiber, I., & **Venkat, S.** Phase-Separation and Volume Expansion in Lithium-Ion Batteries. *In Preparation.*
4. **Venkat S**, Milind N, and Reddy, N. "Migration to Mars." The UMAP Journal 38, no. 2 (2017): 197-232.
5. **Venkat S.** "Developing a Flight Plan to Reduce Aircraft Noise Exposure in Cities ." AAAS 2017 Annual Meeting. February 16-20, 2017.

Presentations

Oral Presentation

Atlanta, Georgia

SIAM UQ 2022

April 2022

Venkat, S., Smith, R. C., & Kelley, C. T. (2021). Convolutional Autoencoders for Reduced-Order Modeling.

Oral Presentation

Los Angeles, California

UCLA Summer Research Exhibition

July 2020

Bertozzi, A., Chu, W., Fromcke, T., Li, W., Schreiber, I., & **Venkat, S.** Phase-Separation and Volume Expansion in Lithium-Ion Batteries. Presented virtually at the UCLA Summer Research Exhibition for REU programs.

Oral and Poster Presentations

Various Locations

Young Mathematicians Conference 2019, NCSU Summer Research Symposium 2019, SUMS Conference 2019, Joint Mathematics Meeting 2020, Brown University SUMS Conference 2021

2019 - 2021

Jiang, Q., Lan, T., Okoudjou, K., Strichartz, R., Sule, S., **Venkat, S.**, & Wang, X. (2020). *Sobolev Orthogonal Polynomials on the Sierpinski Gasket.* Presented at the Young Mathematicians Conference 2019, NCSU Summer Research Symposium 2019, SUMS Conference 2019, Joint Mathematics Meeting 2020, and Brown University SUMS Conference 2021.

Poster Presentation

Raleigh, North Carolina

NCSU Summer Research Symposium

August 2018

Venkat, S. *Global Sensitivity Analysis Using Fisher Matrices.* Presented at the NCSU Summer Research Symposium 2018.

Extracurricular Activities

Ambassador
Raleigh, North Carolina

North Carolina Science Olympiad
October 2017 - Present

- Organize regional, state, and national tournaments by writing tests, volunteering at events, and working at outreach programs.
- Work with teams and schools in urban areas to help rural areas increase awareness and support for Science Olympiad.
- Advocate interdisciplinary thinking to young scientists in my community and beyond.

Goodnight Scholar
Raleigh, North Carolina

North Carolina State University
August 2017 - Present

- The Goodnight Scholarship at NC State University is a highly selective, merit scholarship awarded on the basis of outstanding accomplishments and potential in STEM.
- Participating in programs to increase STEM awareness and accessibility in NC; engaging in leadership and communication workshops; working with the NC Rural Center to address issues in health, broadband, and economy.
- Participating in programs to increase STEM awareness and accessibility in NC.

Service Raleigh Web Committee
Raleigh, North Carolina

North Carolina State University
August 2018 - Present

- Service Raleigh is an organization that holds an annual day of service to empower nonprofit organizations and charities in the community.
- Maintaining and upgrading the website for the Service Raleigh organization which allows volunteers and partner organizations to become a part of the initiative.

Undergraduate Research Club Outreach Coordinator
Raleigh, North Carolina

North Carolina State University
August 2018 - Present

- Lead workshops and information sessions to help new undergraduate students find research projects, learn research etiquette, and present their work.
- Work with faculty mentors to develop a mentor matching program to match undergraduates with research programs.
- Increase awareness for research programs by working with other on-campus organizations.

Broad Street Scientific Journal — Chief Editor
Durham, North Carolina

North Carolina School of Science and Mathematics
August 2016 - May 2017

- Reviewed and selected research papers for publishing in the NCSSM student journal.

Honors & Awards

International

2021	**Recipent**, CSEM Fellowship, UT Austin Oden Institute	Austin, TX
2017	**1st Place**, COMAP International Mathematical Modeling Competition	Boston, MA

National

2021	**Recipient**, NCSU College of Sciences Senior Award for Outstanding Scholarship	Raleigh, NC
2021	**Recipent**, NSF Graduate Research Fellowship	Alexandria, VA
2021	**Recipient**, NCSU Outstanding Scholarship Award in Mathematics	Raleigh, NC
2021	**Recipient**, Dean's Circle Scholarship	Raleigh, NC
2020	**Member**, Phi Beta Kappa Honor Society	Raleigh, NC
2017	**Recipient**, US Presidential Scholar	Washington D.C.
2017	**Recipient**, Goodnight Scholarship	Raleigh, NC
2017	**Recipient**, Solomon Scholarship	Raleigh, NC
2017	**Recipient**, National Merit Scholarship	Raleigh, NC
2017	**1st Place**, COMAP Mathematical Competition in Modeling	Durham, NC
2017	**1st Place**, COMAP High School Mathematical/Interdisciplinary Competition in Modeling	Durham, NC
2017	**Semifinalist**, US National Astronomy, Chemistry, and Biology Olympiad	Durham, NC
2017	**Regional 1st Place and National Top 16**, National Science Bowl	Washington D.C.
2016	**1st Place**, Conrad Spirit of Innovation Challenge Power Pitch	Orlando, FL

Regional

2017 **Recipient**, NCSSM Mathematics Department Award Durham, NC

2016 **1st Place**, Mathematics Research award from the NC Student Academy of Sciences Durham, NC

Technical Skills

- **Computer Languages**: Python, Julia, MATLAB, Java, HTML/CSS/JavaScript, Netlogo, Maple, Mathematica, LabVIEW.
- **Software**: Microsoft Office, Google Apps, Vernier Logger Pro/Vernier Lab Software, LaTeX.
- Able to use Digital Oscilloscopes, Arduinos, and NI DAQ cards for data collection and processing.