Atul Anurag, Ph.D.

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EDUCATION

New Jersey Institute of Technology (NJIT), USA Sept 2019 – July 2025 (Defended)
Ph.D. in Applied Mathematics
Dissertation Advisor: Roy H. Goodman

National Institute of Technology (NIT), Warangal, India Aug 2015 – Jun 2017
M.Sc. in Applied Mathematics
Dissertation Advisor: Poosan Muthu Moopanar

Ramjas College, University of Delhi, New Delhi Jul 2012 – Jul 2015
B.Sc. (Honors) in Pure Mathematics

EXPERIENCE

Research Assistant, Prof. Roy H. Goodman, NJIT Spring 2022 – Summer 2025

- Developed MATLAB algorithms to analyze the global phase space of a three-point vortex problem on a sphere using a novel reduction technique.
- Designed computational methods for the generalization of leapfrogging orbits of point vortices using AUTO. My talk can be found here.
- Developed a new coordinate system to handle zero total vortex strength, overcoming conventional limitations.

Teaching Assistant & Adjunct Professor, NJIT Fall 2019 – Spring 2022

- Adjunct professor for calculus courses at NJIT's Educational Opportunity Program Summer Program.
- Led recitations and instructional support for Calculus I & II and MATLAB programming. Notes available here.
- Assisted students with problem-solving and computational techniques.

Research Co-Mentor, NJIT Summer 2023 – Present

- Supervised and guided undergraduate research students, including E. O'Grady, on mathematical modeling and computational projects.

Summer Researcher, Indraprastha Institute of Information Technology, New Delhi, India Summer 2018

- Applied operator theory to analyze nonlinear PDEs.
- Advisor: Prof. Ashish Kumar Pandey.

Indian Academy of Sciences Intern, Tata Institute of Fundamental Research, Bangalore, India Summer 2014

- Implemented image and digital signal processing algorithms using Laplace transforms.
- Advisor: Prof. Kayyunnapara Thomas Joseph.

PUBLICATIONS

- **Atul Anurag**, Roy H. Goodman, Ellison O' Grady, *A New Canonical Reduction of Three-Vortex Motion and its Application to Vortex-Dipole Scattering*, *Physics of Fluids*, 36, 067110 (2024). [Link]
- **Atul Anurag**, Roy H. Goodman, *The global phase plane analysis of the three-vortex interactions* (Manuscript submitted to *Nonlinearity*, 2025). [Link]
- **Atul Anurag**, Roy H. Goodman, *The four-vortex motion with zero total circulation* (In preparation, 2025).

SELECTED GRADUATE COURSEWORK

Asymptotic Methods, Optimization Theory, Applied Statistics, Computational Fluid Dynamics, Discrete Mathematics, Functional Analysis, Finite Volume Methods, Topology, Integral and Discrete Transforms, Finite Element Methods, Theoretical Operations Research, Number Theory, etc.

CONFERENCE AND SEMINAR PRESENTATIONS

- (Poster) The Global Phase Plane Analysis of Three Vortex Interactions, Frontiers in Applied & Computational Mathematics, NJIT, June 2025.
- (Joint work with Roy Goodman) The Phase Space of the Three-Vortex Problem and Its Application to Vortex-Dipole Scattering, SIAM DS25, Denver, May 2025.
- (Poster) The Global Phase Plane Analysis of Three Vortex Interactions, Board Day and Dana Knox Research Showcase, NJIT, April 2025.
- (Poster) Global Phase Plane Analysis of the three-vortex problem, SIAM-NNP, Rochester Institute of Technology, November 2024.
- (Talk) The Phase Space of the Three-Vortex Problem, NJIT, June 2024.
- (Talk) The Phase Space of the Three-Vortex Problem, SIAM Nonlinear Waves Conference, Baltimore, June 2024.
- (Poster) Point Vortex Dipole Scattering, SIAM New York – New Jersey – Pennsylvania (SIAM-NNP), NJIT, October (2023).
- (Talk) Continuation of Periodic Orbits in Symmetric Hamiltonian and Conservative Systems, Faculty and Student Summer Talks, Mathematics, NJIT, July (2023).
- (Problem Solver) Mathematical Problems in Industry Workshop, NJIT, June (2023).
- (Attendee) Second Drexel Waves Workshop, Drexel University, March (2023).
- (Thesis Proposal Defense) Generalization of Leapfrogging Orbits of Point Vortices, NJIT, January (2023).
- (Talk) Walking Droplet Dynamics Research, NJIT, June (2021).

SKILLS

Programming Languages: Python, MATLAB, Mathematica, Julia, FORTRAN, C++, HTML, R, SQL

Other Software: LaTeX, AUTO

Languages: Fluent in Hindi, English, and Sanskrit

AWARDS AND HONORS

- Research Fellowship at NJIT, supported by the NSF under DMS-2206016 — Oct 2022 - Aug 2025
- Teaching Fellowship at NJIT — Sep 2019 - Oct 2022
- CSIR Junior Research Fellowship, All India Rank 46 among 40,000 students
  Only top 200 students are fully funded in their PhD program — 2018
- Indian Institute of Technology, Joint Admission Test for M.Sc. (IIT–JAM)
  Secured All India Rank 354 among 15,000 (approx) students — 2015
- Indian Academy of Sciences Fellowship — Summer 2014

LEADERSHIP AND SERVICE

- Student Chapter of SIAM at NJIT, Vice-President — June 2022 – June 2024
- UCAN Executive Committee, Grad executive board member-at-large,
  A Union of Student Workers, Researchers, and Adjunct Instructors — June 2024 – June 2025
- (Volunteer, Attendee) Frontiers in Applied and Computational Mathematics, NJIT — 2022, 2023
- Class Representative (M.Sc.), Department of Mathematics, NIT, Warangal, India — July 2015 – May 2017

REFERENCES

Prof. Roy H. Goodman, Mathematical Sciences, NJIT, goodman@njit.edu (dissertation advisor)
Prof. David Shirokoff, Mathematical Sciences, NJIT, david.shirokoff@njit.edu (dissertation committee member)