Cole Gruninger

Department of Mathematics, Fordham University
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Education

Peter M. Curran Visiting Assistant Professor, Fordham University — August 2025 – Present

Ph.D. in Mathematics, University of North Carolina at Chapel Hill — August, 2025
Advisor: Professor Boyce E. Griffith and Mark Gregory Forest

B.S. Chemistry (Honors), **B.A. Mathematics**, University of North Carolina at Chapel Hill — June, 2020

Research Interests

Numerical methods for solving partial differential equations; immersed boundary methods for fluid-structure interaction; viscoelastic and non-Newtonian fluids; electrochemical modeling.

Publications

Published

1. C. Gruninger, B.E. Griffith, "Composite B-spline regularized delta functions for the immersed boundary method: Divergence-free interpolation and gradient-preserving force spreading" *Journal of Computational Physics*, 2025.

2. L. Li, C. Gruninger, J.H. Lee, B.E. Griffith, "Local Divergence-Free Immersed Finite Element-Difference Method Using Composite B-Splines." *Advances in Computational Science and Engineering*, 2025.

3. A. Barrett, A.L. Fogelson, M.G. Forest, C. Gruninger, S. Lim, and B.E. Griffith. "Flagellum pumping efficiency in shear-thinning viscoelastic fluids." *Journal of Fluid Mechanics*, 999:A2, 2024.

4. C. Gruninger, A. Barrett, F. Fang, M.G. Forest, B.E. Griffith, "Benchmarking the immersed boundary method for viscoelastic flows," *Journal of Computational Physics*, 506, 112888, 2024.

5. D.P. Isaacs, C.T. Gruninger, T. Huang, A.M. Jordan, G. Nicholas, C.H. Chen, "Visible light induced formation of a tungsten hydride complex," *Dalton Transactions*, 52 (10), 3210–3218, 2023.

6. T. Huang, T.M. Rodriguez, C.T. Gruninger, D.A. Kurtz, A.M. Jordan, C.H. Chen, "Electrosynthetic route to cyclopentadienyl rhenium hydride complexes enabled by electrochemical investigations of their redox-induced formation," *Organometallics*, 39 (10), 1730–1743, 2020.

7. K.J. Lee, K.M. Lodaya, C.T. Gruninger, E.S. Rountree, J.L. Dempsey, "Redox mediators accelerate electrochemically-driven solubility cycling of molecular transition metal complexes," *Chemical Science*, 11 (36), 9836–9851, 2020.

8. K.J. Lee, C.T. Gruninger, K.M. Lodaya, S. Qadeer, B.E. Griffith, J.L. Dempsey, "Analysis of multi-electron, multi-step homogeneous catalysis by rotating disc electrode voltammetry: theory, application, and obstacles," *Analyst*, 145 (4), 1258–1278, 2020.

Preprints

1. C. Gruninger, B.E. Griffith, "Composite B-spline current deposition and interpolation operators for thin-wire finite-difference time-domain simulations," *arXiv preprint* arXiv:2605.21450, 2026.

Undergraduate Honors Thesis

C. Gruninger, "The Search For Photon-Induced Metal Hydride Formation and Modeling of Multi-Step Multi-Electron Electrocatalytic Reactions at the Rotating Disc Electrode," 2020.

Awards and Honors

National Defense Science and Engineering (NDSEG) Fellowship, Department of Defense, 2022.
James H. Maguire Memorial Award, Chemistry Department, University of North Carolina at Chapel Hill, 2019.
Summer of Undergraduate Research Fellowship, University of North Carolina at Chapel Hill, 2019.

Talks

"Orthogonality Preserving Regularized Delta Functions for Staggered Grid Discretizations: Theory and Applications to Fluid-Structure and Electromagnetic Problems" AMCS Colloquium. University of Pennsylvania. April 6, 2026.

"The Math of Market Madness" Fordham Math Club. Bronx, New York, February 11, 2026.

"Orthogonality Preserving Regularized Delta Functions for Staggered Grid Discretizations: Theory and Applications to Fluid-Structure and Electromagnetic Problems" Modeling and Simulation Group Meeting. NYU Courant. November 6, 2025.

"Elucidating Connections Between Geometry and Mechanics." Fordham Math Club. Bronx, New York, October 1, 2025.

"Benchmarking the immersed boundary method for viscoelastic flows." SIAM Conference on Computational Science & Engineering. Fort Worth, Texas, U.S. March 3–7, 2025.

"Advancing the immersed boundary method: viscoelastic applications and volume conservation improvements." Colloquium, Department of Mathematics, Fordham University, Bronx, New York, 2025.

"Improving the volume conservation properties of the immersed boundary method using composite B-spline regularized delta functions." The 16^{th} World Congress on Computational Mechanics and 4^{th} Pan American Congress on Computational Mechanics. Vancouver, British Columbia, Canada. July 21–26, 2024.

"Benchmarking the immersed boundary method for viscoelastic flows and improving the volume conservation properties of the immersed boundary method using composite B-spline regularized delta functions." The Fifth Annual NDSEG Conference. New Orleans, July 14–18, 2024.

"Benchmarking the immersed boundary method for viscoelastic flows." The AIMS Conference on Dynamical Systems, Differential Equations and Applications. UNC-Wilmington, May 31 – June 4, 2023.

Poster Presentations

"Benchmarking the immersed boundary method for viscoelastic flows and improving the volume conservation properties of the immersed boundary method using composite B-spline regularized delta functions." Computational Tools for PDEs with Complicated Geometries and Interfaces. Flatiron Institute, June 10 – June 14, 2024.

Teaching

Peter M. Curran Visiting Assistant Professor, Fordham University, 2025 – Present
Spring 2026: Math 1100. Finite Mathematics
Spring 2026: Calculus II Recitation Leader
Fall 2025: Math 1108. Finite Mathematics for Business
Fall 2025: Math 1108. Finite Mathematics for Business
Graduate Teaching Assistant, University of North Carolina at Chapel Hill, 2020 – 2021
Fall 2020: MATH 383. A First Course in Differential Equations
Spring 2021: MATH 381. Discrete Mathematics
Summer 2021: MATH 233. Calculus of Functions of Several Variables

Skills

Programming: Python, MATLAB, C++, LaTeX, Julia

References

Available upon request.
Website: https://sites.google.com/view/colegruninger/about