

# Lucas Bouck

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## Research Interests

**Numerical Analysis** finite element methods (FEM) and discontinuous Galerkin (DG) methods for partial differential equations (PDEs),  $\Gamma$ -convergent FEM for calculus of variations problems, gradient flows for numerical minimization, robust DG methods for fluid dynamics. unfitted FEM and TraceFEM for surface PDEs

**Continuum Modeling and Applied Analysis:** solid mechanics of thin sheets, liquid crystals and liquid crystal elastomers, formal asymptotics and  $\Gamma$ -convergence, thermodynamic modeling methods

## Education

**University of Maryland** Ph.D. in Applied Mathematics, August 2018- August 2023

Advisor: Prof. Ricardo H. Nochetto

Thesis: Liquid Crystal Variational Problems: Modeling, Analysis, and Numerics

**George Mason University** B.S., Mathematics, August 2014 - May 2018

Honors in the Major and Summa Cum Laude

Advisor: Prof. Harbir Antil

## Employment

Postdoctoral Associate, Carnegie Mellon University, September 2023 - current

Mentor: Prof. Noel Walkington

Research Assistant, University of Maryland January 2020-August 2020

Supervisor: Prof. Ricardo H. Nochetto

Teaching Assistant, University of Maryland, August 2019- December 2019

Summer Undergraduate Research Fellowship, National Institute of Standards and Technology May 2017-August 2017

Supervisor: Dr. Ian H. Bell

## Grants/Fellowships/Funding

Hausdorff Research Institute for Mathematics Junior Trimester Program Fellowship, March 2026, Amount: €2,430

NSF Graduate Research Fellowship Program (NSF GRFP), September 2018-August 2023, Amount: \$138,000

## Publications

### Submitted/In Review

8. K. Boehnlein, L. Bouck, S. Neukamm, D. Padilla-Garza, and K. Richter. “Commutativity and noncommutativity of limits in the nonlinear bending theory for prestrained microheterogeneous plates.” <https://arxiv.org/abs/2410.15679>, 2024.
7. L. Bouck, R.H. Nochetto, M. Shkipov, V. Yushutin “Inf-Sup Stability of Parabolic TraceFEM.” <https://arxiv.org/abs/2409.13944>, 2024.
6. L. Bouck, R.H. Nochetto. “Projection Free Method for Full Frank-Oseen Model of Liquid Crystals” <https://arxiv.org/abs/2405.03145>, 2024.

### Published

5. L. Bouck, D. Padilla-Garza, and P. Plucinsky. “Plate theory for metric-constrained actuation of liquid crystal elastomer sheets.” *Journal of Elasticity*, 2025.
4. L. Bouck, R.H. Nochetto, S. Yang. “Reduced Membrane Model for Liquid Crystal Polymer Networks: Asymptotics and Computation.” *Journal of Mechanics and Physics of Solids*, 2024.
3. L. Bouck, R.H. Nochetto, V. Yushutin. “A hydrodynamical model of nematic liquid crystal films with a general state of orientational order” *Journal of Nonlinear Science*, 2024.
2. L. Bouck, R.H. Nochetto, S. Yang. “Convergent FEM for a membrane model of liquid crystal polymer networks.” *SIAM Journal on Numerical Analysis*, 2023.

1. I.H. Bell, B.K. Alpert, and L. Bouck. “ChebTools: A C++11 (and Python) Library for Working with Chebyshev Expansions.” *Journal of Open Source Software*. 2018.

## Manuscripts in Preparation

2. S. Bartels, L. Bouck, and C. Palus. “Operator Splitting Method for Geometrically Constrained PDEs.” 2025.
1. L. Bouck and N.J. Walkington. “Asymptotic Robustness of DG Methods for Advection Diffusion.” 2025.

## Research Presentations

### Seminar talks

42. MOX Seminar, Politecnico di Milano, Milan, IT, June 9, 2025
41. Applied Math Seminar, University of Bologna, Bologna, IT, June, 6, 2025
40. Applied Math Seminar, University of Freiburg, Freiburg, DE, June 3, 2025
39. Modeling and Computation Seminar, University of Arizona, Tuscon, AZ, April 3, 2025
38. Computational and Applied Mathematics Colloquium, Penn State University, State College, PA, November 18, 2024
37. Center for Nonlinear Analysis Seminar, Carnegie Mellon University, Pittsburgh, PA, January 23, 2024
36. Numerical Analysis Seminar, University of Maryland, College Park, MD, October 17, 2023
35. Modeling, Computation, Nonlinearity, Randomness and Waves Seminar, University of Arizona (virtual), September 28th, 2023
34. Applied Mathematics Seminar at Courant Institute of Mathematical Sciences, New York, NY, May 5, 2023
33. Analysis and Applied Mathematics Seminar at University of Illinois, Chicago, Chicago, IL, April 24, 2023
32. Seminar at Sandia National Laboratories, Albuquerque, NM, January 25, 2023
31. UC Berkeley/Lawrence Berkeley Laboratory Applied Mathematics Seminar, Berkeley, CA, November 16, 2022
30. Analysis Seminar at University of Texas, Austin, TX, November 2, 2022
29. Numerical Analysis Seminar, University of Maryland, College Park, MD, September 2022
28. Applied Mathematics Seminar TU Dresden, DE May 31, 2022
27. Math Institute Seminar University of Freiburg, DE May 19, 2022
26. Institute for Numerical Simulation Seminar at University of Bonn, DE May 16, 2022
25. Naval Research Lab, Washington, D.C., May 2017

### Invited conference talks

24. Minisymposium at Biennial Numerical Analysis Conference, Glasgow, SC, June 26, 2025
23. AMS Special Session at Joint Math Meetings, Seattle, WA, January 9, 2025
22. Mini-symposium at SIAM Annual Meeting, Spokane, WA, July 8 - 12, 2024
21. Mini-symposium at SIAM Mathematical Aspects of Material Science Meeting, Pittsburgh, PA, May 19 - 23, 2024
20. Special Session at AMS Spring Eastern Sectional Meeting, Howard University, Washington DC, April 6-7, 2024.
19. Frontiers of Numerical PDEs: Fractional Differential Equations, Geometric Evolution, Liquid Crystals, Optimal Transport, and Adaptivity, College Park, MD, May 16-19, 2023
18. AMS Special Session at Joint Math Meetings, Boston, MA, January 5, 2023
17. Mini-symposium at SIAM Texas/Louisiana Section Meeting, Houston, TX, November 4-6, 2022
16. Mini-symposium at International Conference on Continuous Optimization, Bethlehem, PA July 25-28 2022
15. Mini-symposium at SIAM Annual Meeting, Pittsburgh, PA July 11-15, 2022
14. Mini-symposium at SIAM Central States Section Meeting, Ft. Collins, CO, September 2017

### Contributed talks

13. 59th Meeting of Society for Natural Philosophy, Heraklion, GR, June 11, 2025
12. Workshop on Nonlinear Bending II, University of Freiburg, DE, May 26, 2025
11. Sayas Numerics Day, Newark, DE, May 3, 2025.

10. East Coast Optimization Meeting, Arlington, VA, April 17-18, 2025.
9. Finite Element Circus, Catonsville, MD, October 18-19, 2024.
8. East Coast Optimization Meeting (virtual), Fairfax, VA, April 14, 2023.
7. Finite Element Circus, Bridgewater, MA, March 17-18, 2023.
6. Mid Atlantic Numerical Analysis Day, Philadelphia, PA, October 28, 2022
5. Finite Element Circus, Pittsburgh, PA, October 21-22, 2022
4. Sayas Numerics Day, University of Maryland, Baltimore County September 17, 2022
3. Workshop on Nonlinear Bending, University of Freiburg, DE May 23-25, 2022
2. Finite Element Circus (virtual), Gainesville, FL, April 8-9, 2022
1. Finite Element Circus, State College, PA, November 5-6, 2021

## Other Awards

### From University of Maryland

Ivo and Renata Babuska Endowed Student Award for Graduate Research in Mathematics, UMD, May 2024. Awarded for an outstanding Ph.D. student dissertation in computational math.

Mark E. Lachtman Award, UMD, May 2022. Awarded for excellence in research

Aziz-Osborn Gold Medal in Teaching, UMD, May 2020.

Brin Fellowship, UMD, April 2018

## Teaching

### Carnegie Mellon University (CMU)

#### Instructor

Fall 2024: 21-369 Numerical Methods (2 sections)

*Student Course Evaluation: 4.38/5 and 4.52/5*

Spring 2024: 21-369 Numerical Methods

*Student Course Evaluation: 4.52/5*

Fall 2023: 21-469 Computational Introduction to PDEs

*Student Course Evaluation: 4.8/5*

#### Research Mentor in Summer Undergraduate Research Apprentice Program

Summer 2025: Ayush Kumar *Topic: Neural Operators for Conservation Laws*

Summer 2024: Eric Li *Topic: Variable Step Sizes in Riemannian Optimization*

**Next Position:** MS student in Data Science at Columbia University

Summer 2024: Feliks Ma *Topic: Variable Step Sizes in Riemannian Optimization*

#### Research Mentor in CMU SUAMI Program

Summer 2024: Jordan Banks *Topic: Global Optimization with Application to PDEs*

**Next Position:** PhD student in Applied Mathematics at Johns Hopkins University

Summer 2024: Stephanie Wang *Topic: Global Optimization with Application to PDEs*

### University of Maryland (UMD)

#### Teaching Assistant

Fall 2019: Calculus I

#### Directed Reading Program

Spring 2023: Chris Jose *Topic: Numerical Optimization*

Spring 2022: Daniel Schug *Topic: Mathematical Image Processing*

**Next Position:** MS student in Computer Science at The University of Maryland

Fall 2021: Sophia Hu *Topic: Matrix Factorization for Data Science*

Spring 2020: Zhenyu Yue *Topic: Quadrature for Highly Oscillatory Integrals*

**Next Position:** PhD student in Applied Statistics at The University of Maryland

## George Mason University (GMU)

### Undergraduate Learning Assistant

Spring 2017: Calculus III

### Tutor at Math Learning Center

Fall 2016 - Spring 2018

### Grader

Fall 2015: Discrete Mathematics

## Professional Service

### Seminars Organized at Conferences

AMS Special Session “Advances in Numerical Methods for Fluid Dynamics”

at Joint Math Meetings, Seattle, WA, January 8-11, 2025

*co-organized with Rebecca Durst (Argonne National Laboratory)*

Mini-symposium “Role of Numerics and Optimization in Materials Science”

at SIAM Conference on Mathematical Aspects of Materials Science, Pittsburgh, PA, May 19-23, 2024

*co-organized with Harbir Antil (George Mason University)*

### Seminars Organized at UMD

Spring 2023: Research Interaction Team (RIT) on Nonlinear and Nonlocal PDEs

*co-organized with Ricardo H. Nochetto, Celine Torres, and Guillaume Bonnet*

Spring 2021: RIT on Liquid Crystal Elastomers

*co-organized with Ricardo H. Nochetto and Shuo Yang*

Fall 2020: RIT on Liquid Crystals: Modeling, Theory, and Numerics

*co-organized with Ricardo H. Nochetto*

Spring 2020: RIT on Liquid Crystals: Modeling, Theory, and Numerics

*co-organized with Ricardo H. Nochetto*

### Volunteering at UMD

Introductory Activities Coordinator for Girls Talk Math Program June 17-18, 2019

### Student Seminar Talks at CMU

Graduate Student and Postdoc Seminar February 22, 2024

### Student Seminar Talks at UMD

Student PDE Seminar September 26, 2022

Student PDE Seminar March 9, 2022

### Other Student Seminars

Student Research Talks, GMU, Fairfax, VA, September 23, 2022

Student Research Talks, GMU, Fairfax, VA, April 15, 2022

Student Research Talks, GMU, Fairfax, VA, February 2018

Applied and Computational Math Seminar Talk, GMU, Fairfax, VA, September 2017

Summer Undergraduate Research Fellowship Colloquium Talk, NIST, Boulder, CO, August 2017

Extreems-Qed Undergraduate Research Conference, University of William and Mary, Williamsburg, VA, March 2017

Shenadoah Undergraduate Math and Statistics Conference, James Madison University, Harrisonburg, VA, September 2016

### Refereeing

Mathematics of Computation, SIAM Journal on Numerical Analysis, Interfaces and Free Boundaries, Computers & Mathematics with Applications, Computer Methods in Applied Mechanics and Engineering, Advances in Differential Equations