

Lucas Bouck

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Research Interests

Numerical Analysis finite element methods (FEM) and discontinuous Galerkin (DG) methods for partial differential equations (PDEs), Γ -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 Γ -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

9. S. Bartels, L. Bouck, and C. Palus. “Unconstrained Scheme for Geometrically Constrained Gradient Flows.” <https://arxiv.org/abs/2607.08577>, 2026.
8. L. Bouck, R.H. Nochetto. “Projection Free Method for Full Frank-Oseen Model of Liquid Crystals” <https://arxiv.org/abs/2405.03145>, 2024.

Published

7. L. Bouck, R.H. Nochetto, M. Shkipov, V. Yushutin “Inf-Sup Stability of Parabolic TraceFEM.” *Foundations of Computational Mathematics*, 2026.
6. 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.” *Journal of Nonlinear Science*, 2026.
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

1. L. Bouck and N.J. Walkington. “Asymptotic Robustness of DG Methods for Advection Diffusion.” 2026.

Research Presentations

Seminar talks

48. Biophysical Modeling Seminar, Flatiron Institute, New York, NY, February 6, 2026.
47. Math Colloquium, Texas A&M University, College Station, TX, December 3, 2025.
46. Numerical Analysis Seminar, Texas A&M University, College Station, TX, October 15, 2025.
45. MOX Seminar, Politecnico di Milano, Milan, IT, June 9, 2025
44. Applied Math Seminar, University of Bologna, Bologna, IT, June, 6, 2025
43. Applied Math Seminar, University of Freiburg, Freiburg, DE, June 3, 2025
42. Modeling and Computation Seminar, University of Arizona, Tuscon, AZ, April 3, 2025
41. Computational and Applied Mathematics Colloquium, Penn State University, State College, PA, November 18, 2024
40. Center for Nonlinear Analysis Seminar, Carnegie Mellon University, Pittsburgh, PA, January 23, 2024
39. Numerical Analysis Seminar, University of Maryland, College Park, MD, October 17, 2023
38. Modeling, Computation, Nonlinearity, Randomness and Waves Seminar, University of Arizona (virtual), September 28th, 2023
37. Applied Mathematics Seminar at Courant Institute of Mathematical Sciences, New York, NY, May 5, 2023
36. Analysis and Applied Mathematics Seminar at University of Illinois, Chicago, Chicago, IL, April 24, 2023
35. Seminar at Sandia National Laboratories, Albuquerque, NM, January 25, 2023
34. UC Berkeley/Lawrence Berkeley Laboratory Applied Mathematics Seminar, Berkeley, CA, November 16, 2022
33. Analysis Seminar at University of Texas, Austin, TX, November 2, 2022
32. Numerical Analysis Seminar, University of Maryland, College Park, MD, September 2022
31. Applied Mathematics Seminar TU Dresden, DE May 31, 2022
30. Math Institute Seminar University of Freiburg, DE May 19, 2022
29. Institute for Numerical Simulation Seminar at University of Bonn, DE May 16, 2022
28. Naval Research Lab, Washington, D.C., May 2017

Invited conference talks

27. Geometric PDE Challenges in Science and Engineering at Brin Mathematics Research Center, College Park, MD, June 2-5, 2026.
26. Minisymposium at SIAM PDE, Pittsburgh, PA, November 17-20, 2026.
25. Minisymposium at SIAM NNP Section Conference, Pennsylvania State University, State College, PA, October 31 - November 2, 2025
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

Summer 2026: 21-122 Integration and Approximation

Fall 2025: 21-369 Numerical Methods (2 sections)

Student Course Evaluation: 4.28/5 and 4.65/5

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