Peter McGrath   pjmcgrat@ncsu.edu   919-515-2385   pjmcgrat.math.ncsu.edu

RESEARCH	Geometric Analysis, Minimal Surfaces, Partial Differential Equations

EMPLOYMENT

North Carolina State University, Department of Mathematics

Assistant Professor   2020-Present

University of Pennsylvania, Department of Mathematics

Hans Rademacher Instructor of Mathematics   2017-2020

EDUCATION

Brown University, Department of Mathematics

Ph.D. May 2017
Advisor: Nikolaos Kapouleas

Lafayette College

B.S. in Mathematics, Summa Cum Laude, May 2011

PREPRINTS AND
PUBLICATIONS

1. *Large topology asymptotics for spectrally extremal minimal surfaces in $\mathbb{B}^3$ and $\mathbb{S}^3$* (with M. Karpukhin, D. Stern)

2. *New minimal surface doublings of the Clifford torus and contributions to questions of Yau* (with N. Kapouleas)

3. *Embedded minimal surfaces in $\mathbb{S}^3$ and $\mathbb{B}^3$ via equivariant eigenvalue optimization* (with M. Karpukhin, R. Kusner, and D. Stern)

4. *On the areas of genus zero free boundary minimal surfaces embedded in the unit 3-ball* (with J. Zou). J. Geom. Anal 34 (2024), no. 9, Paper No. 274.

5. *Free boundary minimal annuli immersed in the unit 3-ball* (with N. Kapouleas).

6. *Generalizing the linearized doubling approach and new minimal surfaces and self-shrinkers via doubling*, (with N. Kapouleas). Camb. J. Math. 11 (2023), no. 11, 299-439

7. *Two-point functions and constant mean curvature surfaces in euclidean three-space* (with E. Meekins). Involve 16 (2023), no. 3, 467-482

8. *On the Canham problem: bending energy minimizers for any genus and isoperimetric ratio* (with R. Kusner). Arch Rational Mech Anal **247**, 10 (2023)

9. *On Steklov eigenspaces for free boundary minimal surfaces in the unit ball*, (with R. Kusner). Amer. J. Math. **146** (2024), no. 5, 1275-1293

10. *Symmetry and isoperimetry for riemannian surfaces*, (with J. Hoisington). Calc. Var. **61**, 6 (2022).

11. *An isoperimetric deficit formula*, J. Geom. Anal. (2020)

12. *Minimal surfaces in the round three-sphere by doubling the equatorial two-sphere II*, (with N. Kapouleas). Comm. Pure Appl. Math. **72** (2019), 2121-2195

13. *Area bounds for free boundary minimal surfaces in a geodesic ball in the sphere*, (with B. Freidin). J. Funct. Anal. **277** No. 11 (2019), 108276

14. *Sharp area bounds for free boundary minimal surfaces in conformally euclidean balls*, (with B. Freidin). International Mathematics Research Notices

15. *Rotational symmetry of asymptotically conical mean curvature flow self-expanders* (with F. Fong). Comm. Anal. Geom. **27** No. 3 (2019), 599-618

16. *A characterization of the critical catenoid*
    Indiana Univ. Math. J. **67** No. 2 (2018), 889-897.

17. *Free boundary minimal surfaces in the unit ball with low cohomogeneity*
    (with B. Freidin, M. Gulian). Proc. Amer. Math. Soc. **145** (2017), 1671-1683

OTHER
PUBLICATIONS

1. *On Liouville's theorem for conformal maps* (with M. Kushelman). Amer. Math. Mon. 131, No 7 619-623 (2024)

2. *Bases for second order linear ODEs*, Am. Math. Mon. 127, No 9 849 (2020)

3. *A note regarding Hopf's umlaufsatz*, Am. Math. Mon. 125, No. 6 541-544 (2018)

4. *Newton's shell theorem via Archimedes's hat box and single-variable calculus*,
   College Math. J. 49 (2018), no. 2, 109-113.
   2019 George Pólya award Winner

5. *On the smooth Jordan Brouwer separation theorem,* Am. Math. Mon. 123, No. 3 292-295 (2016).

6. *An extremely short proof of the hairy ball theorem,* Am. Math. Mon. 123, No. 5 502-503 (2016).

7. *Another proof of Clairaut's theorem,* Am. Math. Mon. 121, No. 2, 165-166 (2014).

8. *The Poincaré-Hopf index theorem and the fundamental theorem of algebra,*
   The Princeton Undergraduate Mathematics Journal, Summer 2016, pp. 34-38.

9. *Trigonometric derivatives made easy,*
   The College Mathematics Journal, vol. 47, no. 5, 2016, pp. 365-366.
   In Hebrew: Aléh - Bulletin for the Mathematics Teacher (Israel), 55, pp. 60-61.

10. *An alternative approach to the product rule,* Am. Math. Mon. 123, No. 5 470 (2016).

11. Problem 361 (with Brian Freidin) Math Horizons Vol. 25, Issue 1 pp. 28. (2017)

12. Problem 1889 (with Gary Gordon) *Mathematics Magazine, 85*, 61-68 (2012).

13. Problem 11593, Am. Math. Mon. 118, No. 8 747-754 (2011).

SERVICE

- Contributor, Mathematical Reviews (Mathscinet)

- Referee: Advances in Differential Equations, Advances in Mathematics, Annali SNS, Communications in Analysis and Geometry, Duke, Crelle, GAFA, IMRN, Journal of Differential Geometry, Journal of Computational Dynamics, Journal of Geometric Analysis, Memoirs of the AMS, Notices of the AMS, Math. Nachrichten, Proceedings of the AMS, American Mathematical Monthly.

- Organizer: graduate student geometry-topology seminar.   2018-2019.

- Committee assignments: Advanced Placement exam, Preliminary exam

TEACHING

• Math 518 (Curves and Surfaces)	Fall 2024
• Math 426 (Analysis II)	Spring 2024
• Math 225 (Intro to Proofs)	Fall 2022, Fall 2023
• Math 755 (Differential Geometry)	Spring 2021, Spring 2023
• Math 241 (Calculus III)	Spring 2022
• Math 555 (Manifolds)	Fall 2020, Fall 2021
• Math 420 (Differential Equations)	Fall 2019

- Math 114E (Multivariable Calculus)   Fall 2019
- Math 240 (Linear Algebra + ODE)   Spring 2019, Fall 2018
- Math 661 (Topics in Differential Geometry)   Spring 2019
- Math 241 (Calculus IV)   Spring 2018, Fall 2017
- Math 360 (Advanced Calculus)   Spring 2018

HONORS AND
AWARDS

- Simons Collaboration Grant ($40,000)   2021-2025
- AMS-Simons Travel Grant ($4,000)   2017-2019
- George Pólya Award (Mathematical Association of America, $1,000)   2019
- Brown Graduate International Colloquium Fund ($10,000)   2015-2016
  - Organizer: "Connections in Geometric Analysis and PDE"
  - Speakers: Simon Brendle, William Minicozzi, Robert Kusner, Renato Bettiol, Roice Nelson, Galina Perelman, Mohsen Zayernouri
- Wesley Mitman Prize (Lafayette College)   2011
  - Awarded to the senior most outstanding in Mathematics.
- James P. Crawford Prize in Mathematics (Lafayette College)   2011
  - Awarded to a student who has made a special contribution to the mathematics community.

ACADEMIC
ACTIVITIES

Invited Talks:

- Geometry and Topology Seminar, Caltech,   November 8, 2024
- Geometric Analysis Seminar, MIT,   April 17, 2024
- Spectral Geometry in the Clouds Online Seminar,   April 8, 2024
- Geometric Analysis Seminar, Lehigh University,   March 21, 2024
- Colloquium, Lafayette College,   February 22, 2024
- Analysis and PDE Seminar, UNC Chapel Hill,   February 7, 2024
- Geometry and Topology Seminar, NC State,   January 31, 2024
- Colloquium, Auburn University,   December 1, 2023
- UNC Online Undergraduate Seminar, UNC   October 10, 2023
- Analysis Seminar, Cornell University   October 2, 2023
- International Conference on Differential Geometry, Korea   June 26-30, 2023
- Minimal Surfaces Topics Class, Brown University   April 25, 2023
- Undergraduate Math Club, NC State   April 10, 2023
- Geometry Topology Seminar, Duke University   April 3, 2023
- Geometric Analysis Seminar, University of Copenhagen   March 2, 2023
- Spectral Geometry in the Clouds   Feb 13, 2023
- Mathematics Career Panel, NC State SUM club   Nov 10, 2022
- Analysis, Logic and Physics Seminar, VCU   Oct 28, 2022
- AMS Special session on Minimal Surfaces, UMass Amherst   Oct 1, 2022

- Geometric Analysis Seminar, Caltech — June 10, 2022
- Geometric Analysis Seminar, University of Massachussetts — May 6, 2022
- Geometric Analysis Seminar, University of Chicago — April 19, 2022
- Geometric Analysis Seminar, Brown University — February 8, 2022
- Geometry and Topology Seminar, Wake Forest University — January 26, 2022
- PDE and Geometric Analysis Seminar, University of Utah — November 2, 2021
- Colloquium, NC State University — October 22, 2021
- Geometry Seminar, University of Georgia — October 8, 2021
- Geometry Topology Seminar, University of Massachussetts — March 5, 2021
- Geometry Topology Seminar, University of Georgia — December 4, 2020
- Geometry Topology Seminar, Duke University — November 16, 2020
- First Year Graduate Student Seminar, NC State — September 4, 2020
- Geometric Analysis Seminar, University of Pittsburgh — September 1, 2020
- Geometry Topology Seminar, North Carolina State University — August 19, 2020
- Differential Geometry Seminar, University of Muenster — June 22, 2020
- Texas Geometry and Topology Conference — April 25, 2020
- Geometric Analysis Seminar, University of Chicago — February 25, 2020
- North Carolina State University Colloquium — January 13, 2020
- Rutgers Geometric Analysis Seminar — November 12, 2019
- CUNY Geometric Analysis Seminar — October 10, 2019
- Syracuse Geometry Seminar — September 27, 2019
- PIMS Geometry Workshop — May 18, 2019
- Lafayette-Lehigh Geometry-Topology Seminar, — March 30, 2019
- Geometry Topology Seminar, University of Pennsylvania — Jan. 31, 2019
- Geometry Seminar, Dartmouth College — October 9, 2018
- Geometric Analysis Seminar, University of Tennessee — September 20, 2018
- Analysis and PDE Seminar, Johns Hopkins University — March 12, 2018
- Geometric Analysis Seminar, Princeton University — Dec. 13, 2017
- Minimal Surfaces Seminar, University of Pennsylvania — Oct. 17, 2017
- Geometry Topology Seminar, University of Pennsylvania — Sept. 7, 2017
- Colloquium, Lafayette College — April 5, 2017
- Geometric Analysis Seminar, University of Chicago — Nov. 15, 2016
- Geometry and PDE Seminar, University of Connecticut — Nov. 7, 2016
- Geometric Analysis Seminar, Brown University — Oct. 10, 2016
- Differential Geometry Seminar, Fordham University — Oct. 5, 2016
- Graduate Student Seminar, Brown University — Sept. 21, 2016
- Differential Geometry Seminar, UC San Diego — Mar. 1, 2016
- Differential Geometry Seminar, UC Irvine — Jan. 19, 2016
- Geometric Aspects of Capillary Problems Conference, Granada — Dec. 14, 2015
- AMS special session on Geometric Analysis, Rutgers University — Nov. 15 2015
- Graduate Student Geometry Seminar, Brown University — Sep. 16, 2015

- AMS Graduate Student Math Conference, Brown University   Feb. 21, 2015
- Informal PDE Seminar, Brown University   Sep. 26, 2014