Sean McCurdy | Curriculum Vitae

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Employment and Visiting Positions

Post-doctoral Researcher

National Taiwan Normal University,   *2021–2024*
under the mentorship of Ulrich Menne

Post-doctoral Researcher

Carnegie Mellon University,   *2019–2021*
under the mentorship of Giovanni Leoni and Irene Fonseca

Visiting Position

University of Connecticut, Storrs,   *08/2018–12/2018*
under the mentorship of Matthew Badger

Education

Doctor of Philosphy in Mathematics

University of Washington, Seattle,   *2012–2019*
Thesis Advisor: Tatiana Toro

BA, Pure Mathematics; BA, Philosophy

University of California, Santa Cruz,   *2006–2010*
UCSC Regent Scholar

Research Interests

My research lies in the several areas of Geometric Measure Theory. I currently have long-term projects studying the geometric characterization of subsets of curves of finite length, varifold regularity, the study of the structure of singular sets for Free Boundary problems, and symmetrization inequalities for isoperimetric problems.

Keywords: *Geometric Measure Theory, Rectifiability, Analysts' Traveling Salesman problems, Elliptic PDEs on non-smooth domains, harmonic measure, Cauchy Problems, Bernoulli-type free boundary problems, $2D$ water waves, cusps, Allard-type regularity, symmetrization inequalities, Gaussian isoperimetric inequality*

Publications

- The Singular Strata of a Free-Boundary problem for harmonic measure. *Analysis and PDEs*. Accepted 2022. arXiv:1904.09361
- (with Max Goering) Wild Examples of Rectifiable Sets *Annales Academiæ Scientiarum Fennicæ*, 46(1), 553-570., 2021 arxiv:1905.01763
- Unique Continuation on Convex Domains *Revista Matemática Iberoamericana*, 39 (2023), no. 1, p. 1–28 arXiv:1905.02640
- (with Matthew Badger) Subsets of rectifiable curves in Banach spaces I: sharp exponents in traveling salesman theorems. *Illinois J. Math.* 67 (2023), no. 2, 203–274. arXiv:2002.11878v3

- (with Raghavendra Venkatraman) Quantitative stability for the Heisenberg–Pauli–Weyl inequality, *Nonlinear Analysis,* Volume 202 (2021), 112147. arXiv:2007.07111
- One-phase free-boundary problems with degeneracy. *Calculus of Variations and Partial Differential Equations.* Accepted (2023) arXiv: 2010.06726
- (with Matthew Badger) Subsets of rectifiable curves in Banach spaces II: universal estimates for almost flat arcs. *Illinois J. Math.* 67 (2023), no. 2, 275–331. arXiv:2208.10288

Preprints

- Conditions for Eliminating Cusps in One-Phase Free Boundary Problems with Degeneracy. Preprint (2021) arXiv: 2111.03150
- (with Lisa Naples) Non-existence of cusps for degenerate Alt-Caffarelli functionals. Preprint (2022). arXiv: 2202.00616
- Non-existence of cusps for a Free-boundary Problem for Water Waves. Preprint (2022), arXiv: 2208.01873
- (with Nicolau S. Aiex and Paul Minter) Quantitative Estimates on the Singular Set of Minimal Hypersurfaces with Bounded Index. Preprint (2022) arXiv: 2209.11992
- (with Kuan Ting Yeh) Structure of measures for which Ehrhard symmetrization is perimeter non-increasing. Preprint (2023) arXiv: 2310.00292.

Invited Mini-courses

- Western Washington University Jumpstart 2023. "What is Dimension?" August, 2023. 5 days, 5 hours lecture, $2\frac{1}{2}$ hours problem sessions. An event for undergraduates from under-served populations and first-generation students.

Invited Talks (in reverse chronological order)

- Nonlinear Analysis Seminar, National Taiwan Normal University. Taipei, Taiwan. May 2022.
- Differential Geometry Seminar, National Taiwan Normal University. Taipei Taiwan. November 2021.
- Harmonic Analysis and PDE Seminar, CCNY-CUNY. New York, New York. April 2021.
- Nonlinear Analysis Seminar, Carnegie Mellon University. Pittsburgh, Pennsylvania. October 2019.
- Northeastern Analysis Network 2019. Storrs, Connecticut. September 2019.
- AMS Special Session, "Regularity Theory of PDEs and Calculus of Variations on Domains with Rough Boundaries." Eastern Section. Hartford, Connecticut. April 2019.
- Geometric and Harmonic Analysis: A Graduate Student Conference. Storrs, Connecticut. March, 2019.
- Analysis Learning Seminar, UCONN. Storrs, Connecticut. October, 2018.
- SIGMA Seminar, University of Connecticut. Storrs, Connecticut. October 2018.
- Analysis and Probability Seminar, University of Connecticut. Storrs, Connecticut. October 2018.
- AMS Special Session, "Geometric Measure Theory and PDEs." Western Section. Portland, Oregon. April 2018.
- AMS Special Session, "Regularity of PDEs on Rough Domains." Eastern Section. Boston, Massachussets. April 2018.
- Analysis Seminar, Washington State University. Pullman, Washington. April 2015.

Teaching

CMU 21-355 (Principles of Real Analysis I)	1 semester	~ 20 people	(Instructor)
CMU 21-259 (Calculus in Three Dimensions)	1 semester	~ 100 people	(Instructor)
CMU 21-112 (Calculus II, Remote)	2 semesters	~ 30 people	(Instructor)
UW Math 309 (Intro to PDEs)	8 quarters	$\sim 20\text{-}50$ people	(Instructor)
UW Math 308 (Linear Algebra)	3 quarters	$\sim 30\text{-}50$ people	(Instructor)
UW Math 307 (Intro to ODEs)	4 quarters	$\sim 30\text{-}50$ people	(Instructor)
UW Math 124 (Differential Calculus)	3 quarters	~ 25 people	(TA)
Math 112 (Business Calculus)	2 quarters	~ 25 people	(TA)
Math 111 (Business Calculus)	3 quarters	~ 25 people	(TA)

Curriculum Development

○ UW Math 309, *Linear Systems of ODEs and Introduction to PDEs*. Authored a new textbook, worksheets reformatting the class for a "flipped Friday" schedule.

Mentorship

○ Yu Tong Liu, PhD student. Co-mentor with Ulrich Menne. National Taiwan Normal University (2022-Present).
○ Jon Kim, undergraduate student. Washington Directed Reading Program Spring 2019. University of Washington, Seattle.

Service

○ Organizer of Graduate Student Analysis Seminar, University of Washington, Seattle. 2015-2017
○ Organizer GMT Reading Seminar. National Taiwan Normal University, Taipei, Taiwan. Fall 2023.
○ Reviewer for *Revista Matemática Iberamericano*.
○ Volunteer Tutor, CAMP. University of Washington. 2017-2018.
○ Volunteer Tutor, Instructional Center. University of Washington. 2017-2018.