Joshua Southerland

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Academic positions

Zorn Postdoctoral Fellow, Indiana University, Bloomington
MENTOR: Chris Judge

Research Interests

I work at the intersection of harmonic analysis and representation theory, geometry, and dynamics, and I study two primary objects: translation surfaces and metric graphs. Both objects are forms of a singular manifold, and I study the connection between the Laplacian and both *dynamical* and *algebraic* properties of these objects.

Education

2022 PHD in Mathematics, University of Washington
ADVISORS: Jayadev Athreya, Farbod Shokrieh
2019 MSC in Mathematics, University of Washington
ADVISOR: Jayadev Athreya
2009 BSC in Mechanical Engineering, Minor in Music, Columbia University

Work Experience

2009-2016 Senior Mechanical Engineer and Sustainability Consultant, BuroHappold Consulting Engineers, New York

Publications

2024+ Diophantine properties of affine diffeomorphisms of lattice surfaces, (with C. Judge), preprint
2024+ Effective weak-mixing of affine diffeomorphisms on lattice surfaces, (with C. Judge), preprint
2024+ A cylinder decomposition on geometric armadillo tails, (with D. Lee), preprint
2024+ d”-torsion on a metric graph, (with J. Hasan), in progress
2024 An effective slope gap distribution for lattice surfaces, (with T. Osman, J. Wang), arXiv:2409.15660,

submitted

2022 Superdensity and bounded geodesics in moduli space, arXiv:2201.10156, submitted

2024 Shrinking targets on square-tiled surfaces, New York Journal of Mathematics, pdf

2022 Quantitative density statements for translation surfaces, Doctoral Thesis: pdf

2019 The Laplacian: An Exploration and Historical Survey Tailored for Translation Surfaces, Master's Thesis: pdf

Talks

Invited

Oct 2024 *Diophantine properties of affine diffeomorphisms of a lattice surfaces*, Analysis Seminar, Oklahoma State University

Oct 2024 *Diophantine properties of affine diffeomorphisms of a lattice surfaces*, Everytopic Seminar, Brandeis University

Apr 2024 *Veech group action on a lattice surface*, Dynamics Seminar, University of Wisconsin Madison

Nov 2023 *Shrinking targets on translation surfaces*, Dynamics Seminar, IUPUI, Indianapolis

May 2023 *Shrinking targets on translation surfaces*, Dynamics Seminar, Seoul National University, Seoul

May 2023 *Shrinking targets on translation surfaces*, Geometry Seminar, Korea University, Seoul

Jan 2023 *Superdensity and bounded geodesics in moduli space*, Joint Mathematics Meetings, Boston

Sept 2022 *Superdensity and bounded geodesics in moduli space*, Nearly Carbon Neutral Geometric Topology Conference (NGNCT), videos

Sept 2022 *Superdensity and bounded geodesics in moduli space*, Geometry Seminar, Indiana University

Dec 2021 *Towards a shrinking target property for primitive square-tiled surfaces*, Group Actions Seminar, University of California, San Diego

Jun 2021 *A shrinking target property for primitive square-tiled surfaces*, Pacific Dynamics Seminar

Mentorship

Summer 2024 Indiana University Research Experience for Undergraduates: Kontsevich-Zorich Monodromy Groups, (jointly mentored with Dami Lee), Mentees: Felix Filizov, Jaedon Rich Indiana REU Site

Summer 2023 Indiana University Research Experience for Undergraduates: Spectra of Graphs, Mentee: Silo Murphy, Indiana REU Site

Winter 2022 Washington Directed Reading Program: Mostly Surfaces, Mentee: Hai Lin, sites.uw.edu/wdrp/winter-2022

Winter 2022 Washington Directed Reading Program: Mostly Surfaces, Mentee: Runchi Tan, sites.uw.edu/wdrp/winter-2022

Spring 2021 Washington Directed Reading Program: M.C. Escher and Hyperbolic Tesselations, Mentee: Emma Favier, sites.uw.edu/wdrp/spring-2021

Spring 2021 Washington Directed Reading Program: M.C. Escher and Hyperbolic Tesselations, Mentee: Zheng (James) Cao, sites.uw.edu/wdrp/spring-2021

Winter 2021 Washington Directed Reading Program: M.C. Escher and Hyperbolic Tesselations, Mentee: Haley Riggs, sites.uw.edu/wdrp/winter-2021

Service to the Community

2024 - 2025	Founder and Organizer, Math Circles in Rural Indiana, coordinated with the Center for Rural Engagement at IU (planned for November 2024 start)
2024 - 2025	Co-Organizer, Bloomington Geometry Workshop at Indiana University, https://bgw.sitehost.iu.edu/2024/
2022 - present	Co-Organizer, Geometry Seminar at Indiana University, math.indiana.edu/seminars/index.html
2019 - 2022	Co-Organizer, Washington Directed Reading Program, sites.uw.edu/wdrp

Honors & awards

2023-2024	Zorn Teaching Award, Indiana University Department of Mathematics
2021-2022	Nominated for Excellence in Teaching Award, University of Washington
2020-2021	Nominated for Excellence in Teaching Award, University of Washington
2018-2019	Excellence in Teaching, University of Washington Mathematics Departmental Award

Teaching

Indiana University

Spring 2025	Instructor, Math M-533 Graduate Differential Geometry I (scheduled)
Fall 2024	Instructor, Math M-365 Introduction to Probability & Statistics (2 sections)
Spring 2024	Instructor, Math M-212 Calculus II (2 sections)
Fall 2023	Instructor, Math M-212 Calculus II
Spring 2023	Instructor, Math M-330 Exploring Mathematical Ideas
Fall 2022	Instructor, Math M-211 Calculus I (2 sections)

University of Washington, Instructor of Record

Summer 2021	Instructor, Math 300 Mathematical Reasoning: Introduction to Proofs *(Remote)*
Summer 2020	Instructor, Math 308 Linear Algebra *(Remote)*
Spring 2020	Instructor, Math 308 Linear Algebra *(Remote)*
Winter 2020	Instructor, Math 308 Linear Algebra
Fall 2019	Instructor, Math 308 Linear Algebra
Summer 2019	Instructor, Math 308 Linear Algebra
Spring 2019	Instructor, Math 324 Multivariable Calculus
Winter 2019	Instructor, Math 324 Multivariable Calculus
Summer 2018	Instructor, Math 324 Multivariable Calculus

University of Washington, Teaching Assistant

Spring 2022	Teaching Assistant, Math 533 Complex Analysis (Graduate)
Winter 2022	Teaching Assistant, Math 542 Topology and Geometry of Manifolds
Spring 2021	Teaching Assistant, Math 308 Linear Algebra *(Remote)*
Winter 2021	Teaching Assistant, Math 308 Linear Algebra *(Remote)*
Fall 2020	Teaching Assistant, Math 308 Linear Algebra *(Remote)*
Fall 2018	Teaching Assistant, Math 441 Topology
Spring 2018	Teaching Assistant, Math 120, Precalculus

Winter 2018	Teaching Assistant, Math 126 Introductory Multivariable
Fall 2017	Teaching Assistant, Math 124 Differential Calculus
Summer 2017	Teaching Assistant, Math 327 Introductory Real Analysis
Spring 2017	Teaching Assistant, Math 126 Introductory Multivariable
Winter 2017	Teaching Assistant, Math 124 Differential Calculus
Fall 2016	Teaching Assistant, Math 125 Integral Calculus

Last updated: October 28, 2024