Joshua Southerland

University of Bristol
School of Mathematics
Fry Building
Woodland Road
Bristol, BS8 1UG
United Kingdom

Email: jwsouthe@iu.edu
URL: sub.mersion.cc

Academic positions

Heilbronn Research Fellow, University of Bristol
MENTOR: Jens Marklof

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 numerous objects: translation surfaces, negatively curved surfaces, discrete groups, and metric graphs. I study the connection between *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), in preparation

2024+ Effective weak-mixing of the group of affine diffeomorphisms on a lattice surface, (with C. Judge), in preparation

2024+ A cylinder decomposition on geometric armadillo tails, (with D. Lee), arXiv:2412.03535, submitted

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), Discrete and Continuous Dynamical Systems pdf

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

Feb 2025 *Rigid spines on geometric armadillo tails*, Geometry and Geometric Analysis Seminar, Purdue University

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

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: November 11, 2025