

MATTHEW L. WRIGHT

St. Olaf College
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EDUCATION

- University of Pennsylvania** (Philadelphia, Pennsylvania) August 2011
Doctor of Philosophy in Mathematics
Thesis: *Hadwiger Integration of Definable Functions*
Advisor: Robert Ghrist
- Messiah College** (Grantham, Pennsylvania) May 2006
Bachelor of Arts
Major in Mathematics and Computer Science, Minor in Spanish

APPOINTMENTS

- St. Olaf College** (Northfield, Minnesota)
Director of Mathematics June 2022 – present
Associate Professor August 2021 – present
Assistant Professor August 2017 – August 2021
Visiting Assistant Professor August 2015 – August 2017
- Institute for Mathematics and its Applications** (Minneapolis, Minnesota)
Postdoctoral Fellow August 2013 – August 2015
- Huntington University** (Huntington, Indiana)
Assistant Professor of Mathematics August 2011 – May 2013

GRANTS AWARDED

- PI: NSF DMS-1606967, total award \$210,217** September 2015 – August 2019
Computation and Visualization of Multi-Parameter Topological Invariants of Data
Co-PI: Michael Lesnick (U. Albany)
- Inclusive Teaching and Active Learning in Calculus (ITALICs); \$10,920** 2018 – 2019
Collaborative project with MSCS faculty, funded by the *To Include is to Excel* Mellon Foundation grant to St. Olaf College.
- Co-PI: NSF DMS-1642637, total award \$34,300** January – December 2017
CBMS Regional Research Conference on Topological Data Analysis
PI: Lori Ziegelmeier (Macalaster); Co-PI: Matthew Richey (St. Olaf)

RESEARCH INTERESTS

The goal of my research is to develop mathematical tools for topological data analysis. My focus is on the computation and visualization of multiparameter persistent homology and its use in the analysis of complex data. I also study topological and geometric integrals and their applications.

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PUBLICATIONS

**denotes undergraduate coauthor*

Anway De*, Thong Vo*, and Matthew Wright (2023). “Value-Offset Bifiltrations for Digital Images.” *Computational Geometry*, 109, 101939. [doi:10.1016/j.comgeo.2022.101939](https://doi.org/10.1016/j.comgeo.2022.101939).

John Chase and Matthew Wright (2022). “Bacterial Growth: Not So Simple.” to appear in *Mathematics Magazine*.

Michael Lesnick and Matthew Wright (2022). “Computing Minimal Presentations and Bigraded Betti Numbers of 2-Parameter Persistent Homology.” *SIAM Journal on Applied Algebra and Geometry*, 6(2), 267 – 298. [doi:10.1137/20M1388425](https://doi.org/10.1137/20M1388425).

Gabriel Hale*, Bjorn Vogen*, and Matthew Wright (2021). “Magic Triangles.” *The Pi Mu Epsilon Journal*, 15(5), 265 – 273.

Matthew Wright and Xiaojun Zheng* (2020). “Topological Data Analysis on Simple English Wikipedia Articles.” *PUMP Journal of Undergraduate Research*, 3, 308 – 328. <https://journals.calstate.edu/pump/article/view/2410>.

Abdel-Rahman Madkour*, Philip Nadolny*, and Matthew Wright (2019). “Finding Minimal Spanning Forests in a Graph.” *Proc. of MICS 2019*. [arXiv:1705.00774](https://arxiv.org/abs/1705.00774).

Kristen Mazur, Mutiara Sondjaja, Matthew Wright, and Carolyn Yarnall (2018). “Approval Voting in Product Societies.” *The American Mathematical Monthly*, 125(1), 29 – 43. [doi:10.1080/00029890.2018.1390370](https://doi.org/10.1080/00029890.2018.1390370).

Michael Werman and Matthew Wright (2016). “Intrinsic Volumes of Random Cubical Complexes.” *Discrete and Computational Geometry*, 56(1), 93 – 113. [doi:10.1007/s00454-016-9789-z](https://doi.org/10.1007/s00454-016-9789-z).

Shilad Sen, Isaac Johnson*, Rebecca Harper*, Huy Mai*, Samuel Olsen*, Benjamin Mathers*, Laura Vonessen*, Matthew Wright, and Brent Hecht (2015). “Towards Domain-Specific SR: A Case Study from Geography.” *Proc. of IJCAI 2015*, 2362 – 2370.

Matthew Wright (2015). “Hadwiger Integration of Random Fields.” *Topological Methods in Nonlinear Analysis*, 45(1), 117 – 128. [doi:10.12775/TMNA.2015.007](https://doi.org/10.12775/TMNA.2015.007).

Brian Bargh, John Chase, and Matthew Wright (2014). “Colorful Symmetries.” *Math Horizons*, 21(4), 14 – 17. [doi:10.4169/mathhorizons.21.4.14](https://doi.org/10.4169/mathhorizons.21.4.14).

Robert Ghrist, Matthew Wright, and Yuliy Baryshnikov (2013). “Hadwiger’s Theorem for Definable Functions.” *Advances in Mathematics*, 245, 573 – 586. [doi:10.1016/j.aim.2013.07.001](https://doi.org/10.1016/j.aim.2013.07.001).

PREPRINTS

**denotes undergraduate coauthor*

Kristen Mazur, Mutiara Sondjaja, Matthew Wright, and Carolyn Yarnall (2022). “Piercing Numbers in Circular Societies.” under review, [arXiv:2008.01749](https://arxiv.org/abs/2008.01749).

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Sara Barrows*, Emily Noye*, Sarah Uttormark*, and Matthew Wright (2021). “Subprime Tribonacci Sequences.” under review.

Michael Lesnick and Matthew Wright (2015). “Interactive Visualization of 2-D Persistence Modules.” preprint. [arXiv:1512.00180](https://arxiv.org/abs/1512.00180).

P. Christopher Staecker and Matthew Wright (2014). “A Hadwiger Theorem for Simplicial Maps.” preprint. [arXiv:1402.6391](https://arxiv.org/abs/1402.6391).

Matthew Wright (2013). “Cycles of Digits.” preprint. www.mlwright.org/docs/cycles.pdf.

STUDENT PAPER SUPERVISED

**denotes undergraduate coauthor*

So Mang Han*, Taylor Okonek*, Nikesh Yadav*, and Xiaojun Zheng* (2020). “Distributions of Matching Distances in Topological Data Analysis.” *SIURO*, 13. doi.org/10.1137/18S017302.

SOFTWARE AND MULTIMEDIA

RIVET: software for computing, visualizing, and exploring two-parameter persistent homology; developed with Michael Lesnick; github.com/rivetTDA/rivet.

Introduction to Persistent Homology: video, appeared in the 25th Multimedia Exposition in Computational Geometry (2016); youtu.be/2PSqWBIn90.

AWARDS AND HONORS

Best New Software Award, ATMCS7, for the <i>RIVET</i> software	2016
Awarded jointly with Ripser (Ulrich Bauer)	
Postdoctoral Fellowship, Institute for Mathematics and its Applications	2013 – 2015
Ben Franklin Fellowship, University of Pennsylvania	2006 – 2011
Good Teaching Award, Penn Math Department	Spring 2011, 2008
Penn Prize for Excellence in Teaching by Graduate Students	April 2008
William Lowell Putnam Mathematics Exam	
Scored 30 on the 2005 Putnam Exam (rank 256 nationally)	2005
Scored 31 on the 2004 Putnam Exam (rank 287 nationally)	2004

BOOK EDITED

Heather A. Harrington, Mohamed Omar, and Matthew Wright, editors (2017). *Algebraic and Geometric Methods in Discrete Mathematics*, Contemporary Mathematics vol. 685, American Mathematical Society.

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TEACHING EXPERIENCE AT ST. OLAF COLLEGE

MSCS 390: Mathematics Practicum

January 2020

Supervised teams of students working on applied math and data science consulting projects for off-campus organizations.

Math 330: Partial Differential Equations

Fall 2017, Fall 2018, Fall 2019

A study of partial differential equations: how they arise from physical principles and conservation laws, how they model physical behavior, and how to construct and interpret solutions to them.

Math 282: Introduction to Computational Geometry

Spring 2019, Spring 2021, Jan. 2023

A study of theorems, proofs, algorithms, and applications of discrete and computational geometry. Topics include convex hulls, triangulations, Voronoi diagrams, polyhedra, and more.

Math 262: Probability Theory

Fall 2022 and seven previous semesters

An introduction to the mathematical theory of probability, including sample spaces and events, random variables, discrete and continuous distributions, and joint distributions.

Math 242: Modern Computational Math

Spring 2023 and five previous semesters

A course about computation (using computer algebra systems and programming languages) as a means of mathematical exploration and discovery.

Math 234: Discrete Mathematical Reasoning

Fall 2022

A study of the key concepts of discrete mathematics (logic, set theory, functions, and more) and an introduction to formal proof. Required for the computer science major.

Math 230: Differential Equations

Fall 2020 and four previous semesters

An introduction to qualitative, analytic, and numerical approaches to differential equations, including linear and nonlinear systems of differential equations.

Math 126: Calculus II

Fall 2015, Spring 2017, Fall 2019

A study of integration techniques and applications, concepts of sequences and series, and partial derivatives and multiple integrals.

CSCI 121: Principles of Computer Science

Spring 2016, Spring 2017

An introduction to the fundamental concepts of computer programming, using the Python language.

CSCI 125: Computer Science for Scientists and Mathematicians

Fall 2020

An introduction to programming in Python, with a focus on writing programs to solve quantitative problems and for data analysis.

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MENTORING EXPERIENCE

- Summer Research Mentor (St. Olaf College) Summer 2022
Supervised three students exploring concepts in computational mathematics; in particular, seeking to understand certain identities for generalized Fibonacci sequences.
- Domain Expert (Center for Interdisciplinary Research, St. Olaf College) F 2020 – S 2021
Worked with three students studying properties of degree-Rips bifiltrations constructed from random point clouds.
- Summer Research Mentor (St. Olaf College) Summer 2019
Worked with two students on improving the graphical interface and documentation for the RIVET software for topological data analysis.
- Summer Research Mentor (St. Olaf College) Summer 2018
Worked with two students on applying two-parameter persistent homology to the data and developing statistical techniques.
- Domain Expert (Center for Interdisciplinary Research, St. Olaf College) F 2017 – S 2018
Worked with four students studying notions of distance between persistence modules and applications to data analysis.
- Summer Research Mentor (St. Olaf College) Summer 2017
Worked with two students on applying two-parameter persistent homology to the study of real-world data.
- Summer Research Mentor (St. Olaf College) Summer 2016
Worked with two students on mathematical and algorithmic problems necessary for the implementation of parallel computation of multiparameter persistent homology.
- Research Mentor for the MAXIMA REU (IMA) Summer 2014
Worked with a group of students investigating geographic proximity and semantic relatedness by mining data from Wikipedia and conducting a survey.

SELECTED LECTURES PRESENTED

- MAA North Central Section Fall Meeting (Grand Forks, ND)
“Polynomial Identities for Generalized Fibonacci Sequences” October 2022
- Creighton University Mathematics Colloquium (Omaha, NE)
“Persistent Homology: Discerning the Shape of Data” September 2019
- Southeastern Undergraduate Mathematics Workshop at Georgia Tech (Atlanta, GA)
Four-lecture minicourse on Topological Data Analysis August 2019
- SIAM Applied Algebraic Geometry 2019 (Bern, Switzerland)
“Multiparameter Persistence: Brief Background and Current Challenges” July 2019
- MSU Computational Math, Science, & Engineering Colloquium (E. Lansing, MI)
“Visualizing Multiparameter Persistent Homology” October 2018
- Applied Algebraic Topology 2017 (Sapporo, Japan)

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"Multidimensional Persistence: Computation and Applications"	August 2017
Computational and Statistical Aspects of Topological Data Analysis (London, UK)	
"Computing Multidimensional Persistent Homology"	March 2017
SIAM Central States Section Meeting, Applied and Computational Topology Mini-Symposium	
"Computing Multidimensional Persistent Homology"	October 2016
Applications and Statistics of Multidimensional Persistence (Lausanne, Switzerland)	
"Efficiently Computing the Bigraded Betti Numbers"	August 2016
Symposium on Computational Geometry (Boston, MA)	
"Visualizing Multidimensional Persistent Homology"	June 2016
Section NExT Invited Lecture; MAA North Central Section Meeting (St. Paul, MN)	
"Introduction to Persistent Homology"	April 2016
Applied Topology and High-Dimensional Data Analysis, University of Victoria (Victoria, Canada)	
"Euler Characteristic and Data Analysis"	August 2015
"Computing Multidimensional Persistent Homology"	August 2015
Algebraic Topology: Computation, Data Analysis, and Applications, U. Oxford (Oxford, UK)	
"Introduction to Persistent Homology"	February 2015
"Multidimensional Persistence Computation"	February 2015
Math, Stats, and CS Seminar, Macalester College (Minneapolis, MN)	
"How many ways are there to juggle?"	February 2015
School on Topological Data Analysis and Stochastic Topology, CIMAT (Guanajuato, Mexico)	
"Computing Persistent Homology"	January 2015
"Visualizing Multidimensional Persistent Homology"	January 2015
Computer Science and Mathematics Lecture, Bryn Mawr College (Philadelphia, PA)	
"Euler Characteristic and Data Analysis"	November 2014
Industrial and Applied Mathematics Seminar, University of Oxford (Oxford, UK)	
"Visualizing Multi-Dimensional Persistent Homology"	November 2014
Math Department Colloquium, University of Mary Washington (Fredericksburg, VA)	
"Euler Integration and Applications"	October 2014
Statistics and Topology Seminar, Technion (Haifa, Israel)	
"Intrinsic Volumes of Random Cubical Complexes"	May 2014
Postdoc Seminar, Institute for Mathematics and its Applications (Minneapolis, MN)	
"Intrinsic Volumes of Random Cubical Complexes"	April 2014
"Hadwiger and Lefschetz: Valuations on Simplicial Maps"	December 2013
Geometry, Topology, and Data Seminar, The Ohio State University (Columbus, OH)	
"Hadwiger Integration and Applications"	November 2013
Plenary Talk, Applied Topology Conference (Będlewo, Poland)	
"Hadwiger Integration and Applications"	July 2013
Geometry Seminar, University of Illinois at Urbana-Champaign (Urbana, IL)	

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“Hawdiger Integrals of Random Fields”

October 2012

SELECTED CONFERENCES AND WORKSHOPS ATTENDED

MAA MathFest (Philadelphia, PA)	August 2022
MAA MathFest (online)	August 2021
Symposium on Computational Geometry (online)	June 2021
Symposium on Computational Geometry (online)	June 2020
Mastery Grading Conference (online)	June 2020
SIAM Applied Algebraic Geometry 2019 (Bern, Switzerland)	July 2019
Symposium on Computational Geometry (Portland, OR)	June 2019
Persistence, Representation, and Computation (Raitenhaslach, Germany)	February 2018
Applied Algebraic Topology 2017 (Sapporo, Japan)	August 2017
Topological Data Analysis: Developing Abstract Foundations (Banff, Canada)	July 2017
Computational and Statistical Aspects of Topological Data Analysis (London, UK)	March 2017
Applications and Statistics of Multidimensional Persistence (Lausanne, Switzerland)	August 2016
Symposium on Computational Geometry (Boston, MA)	June 2016
Applied Topology and High-Dimensional Data Analysis (Victoria, Canada)	August 2015
Algebraic Topology: Computation, Data Analysis, and Applications (Oxford, UK)	February 2015
Discrete, Computational, and Algebraic Topology (Copenhagen, Denmark)	November 2014
Generalized Persistence and Applications (AIM, Palo Alto, CA)	September 2014
Teaching a Science of Information Course (San Diego, CA)	August 2014
Algebraic and Geometric Methods in Applied Discrete Mathematics AMS Mathematics Research Community (Snowbird, UT)	June 2014
Algebra and Topology: Methods, Computation, & Science (Vancouver, Canada)	May 2014
IMA Thematic Year on Scientific and Engineering Applications of Algebraic Topology (6 workshops, Minneapolis, MN)	Sept. 2013 – June 2014
Applied Topology (Będlewo, Poland)	July 2013
Algebra and Topology: Methods, Computation, & Science (Münster, Germany)	June 2010
Sensor Topology and Minimal Planning (Austin, TX)	February 2010
Geometric & Topological Methods in Computer Science (Aalborg, Denmark)	January 2010

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INSTITUTIONAL SERVICE

Faculty Governance Committee, St. Olaf College	September 2022 – May 2024
Tenure-Track Hiring Committee, St. Olaf MSCS Department	Fall 2022
Health Professions Committee, St. Olaf College	March 2019 – June 2022
Assessment Committee, St. Olaf College	September 2018 – May 2020
Tenure-Track Hiring Committee, St. Olaf Physics Department	Fall 2019
Tenure-Track Hiring Committee, St. Olaf MSCS Department	Fall 2018 – Spring 2019
Tenure-Track Hiring Committee, St. Olaf MSCS Department	Fall 2017 – Spring 2018

PROFESSIONAL SERVICE

MAA Classroom Resource Materials Editorial Board	January 2023 – December 2025
Organizer of invited and contributed paper sessions on computational mathematics at MAA MathFest 2021	August 2021
Organizer of minisymposium <i>Multiparameter Persistence: Algebra, Algorithms, and Applications</i> at SIAM Applied Algebraic Geometry 2019	July 2019
Co-organizer of <i>Tutorial on Multiparameter Persistence, Computation, and Applications</i> , at the IMA (with Michael Lesnick)	August 2018
Co-organizer of <i>Topological Data Analysis: Theory and Applications</i> , at Macalaster College (with Lori Ziegelmeier and Matt Richey)	June 2017
Co-organizer of <i>AMS Special Session on Applied and Computational Topology</i> at the 2016 JMM (with Nick Scoville and Paweł Dlotko)	January 2016
Co-organizer of <i>AMS Special Session on Algebraic and Geometric Methods in Applied Discrete Mathematics</i> at the 2015 JMM (with Heather Harrington and Mohamed Omar)	January 2015

LANGUAGE AND COMPUTER SKILLS

English: complete fluency

Spanish: near fluency; studied in Quito, Ecuador for the Fall 2003 semester

Experience in Mathematica, R, Unix, Java, JavaScript, C++, Python, HTML, CSS, PHP, and MySQL