MATTHEW L. WRIGHT

St. Olaf College
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Northfield, Minnesota USA

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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 – June 2025
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

Kristen Mazur, Mutiara Sondjaja, Matthew Wright, and Carolyn Yarnall (2024). "Illuminating Illustration: Interesting Intersections and Helly's Theorem." *Math Horizons*, 32(1), 8 – 11. [doi:10.1080/10724117.2024.2368378:](doi:10.1080/10724117.2024.2368378:).

Kristen Mazur, Mutiara Sondjaja, Matthew Wright, and Carolyn Yarnall (2024). "Piercing Numbers in Circular Societies." In *Mathematical Analyses of Decisions, Voting, and Games*, edited by Michael A. Jones, David McCune, and Jennifer M. Wilson. *Contemporary Mathematics*, Volume 795. American Mathematical Society. doi:10.1090/conm/795/15966.

Sara Barrows*, Emily Noye*, Sarah Uttormark*, and Matthew Wright (2023). "Subprime Tribonacci Sequences." *The College Math Journal*, 54(5) 464 – 475. [doi:10.1080/07468342.2023.2263109](doi:10.1080/07468342.2023.2263109).

John Chase and Matthew Wright (2023). "Bacterial Growth: Not So Simple." *Mathematics Magazine*, 96(4), 433 – 441. [doi:10.1080/0025570X.2023.2232259](doi:10.1080/0025570X.2023.2232259).

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.

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](doi: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.

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](doi: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](doi: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.

Brian Bargh, John Chase, and Matthew Wright (2014). "Colorful Symmetries." *Math Horizons*, 21(4), 14 – 17. doi: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.

PREPRINTS

Michael Lesnick and Matthew Wright (2015). "Interactive Visualization of 2-D Persistence Modules." preprint. arXiv:1512.00180.

P. Christopher Staecker and Matthew Wright (2014). "A Hadwiger Theorem for Simplicial Maps." preprint. arXiv: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/2PSqWBIrn90.

AWARDS AND HONORS

Carl B. Allendoerfer Award, Mathematical Association of America	2024
For "Bacterial Growth: Not So Simple" (with John Chase) in *Mathematics Magazine*	
Best New Software Award, ATMCS7	2016
For the *RIVET* software (with Michael Lesnick)	
Postdoctoral Fellowship, Institute for Mathematics and its Applications	2013 – 2015
Ben Franklin Fellowship, University of Pennsylvania	2006 – 2011
Good Teaching Award, Penn Math Department	2008, 2011
Penn Prize for Excellence in Teaching by Graduate Students	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

MATTHEW L. WRIGHT

MSCS 390: Mathematics Practicum — January 2020

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

MATH 384: Advanced Computational Mathematics — Spring 2024

A computationally-focused study of advanced mathematical topics such as combinatorial optimization and simplicial topology.

MATH 348: Topology — Fall 2024

An introduction to topology: point-set topology with a bit of algebraic topology, computation, and applications.

MATH 330: Partial Differential Equations — Fall 2017, Fall 2018, Fall 2019, Fall 2023

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.

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 2023 and eight 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 — Fall 2024 and seven 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 Python.

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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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.

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 MathFest 2024 (Indianapolis, IN)
  "Computational Inquiry in Undergraduate Math Courses"   August 2024

MAA North Central Section Spring Meeting (Minneapolis, MN)
  "Computational Mathematics: A Way of Thinking"   April 2024

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)
"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)
"Hadwiger Integrals of Random Fields" October 2012

SELECTED CONFERENCES AND WORKSHOPS ATTENDED

MAA MathFest (Indianapolis, IN) August 2024

Bridges 2023 (Halifax, Nova Scotia, Canada) July 2023

Applied Homological Algebra Beyond Persistence Diagrams (AIM, San Jose, CA) June 2023

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

Algebraic and Geometric Methods in Applied Discrete Mathematics June 2014
AMS Mathematics Research Community (Snowbird, UT)

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

INSTITUTIONAL SERVICE

Assistant Director of External Fellowships, St. Olaf College	June 2023 – May 2026
Tenure-Track Hiring Committee, St. Olaf MSCS Department	Fall 2023
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

Co-organizer of minicourse *Computational Exploration in Undergraduate Mathematics Courses* at MAA MathFest 2024 (with Matt Richey)	August 2024
Mathematics Magazine Editorial Board	January 2024 – present
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 *Multiparameter Persistence: Algebra, Algorithms, and Applications* at SIAM Applied Algebraic Geometry 2019	July 2019
Co-organizer of *Tutorial on Multiparameter Persistence, Computation, and Applications*, at the IMA (with Michael Lesnick)	August 2018
Co-organizer of *Topological Data Analysis: Theory and Applications*, at Macalaster College (with Lori Ziegelmeier and Matt Richey)	June 2017
Co-organizer of *AMS Special Session on Applied and Computational Topology* at the 2016 JMM (with Nick Scoville and Paweł Dlotko)	January 2016
Co-organizer of *AMS Special Session on Algebraic and Geometric Methods in Applied Discrete Mathematics* 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