Henry Adams

Colorado State University
Department of Mathematics
1874 Campus Delivery
Fort Collins, CO 80523

Office: Weber 125
henry.adams@colostate.edu
http://www.math.colostate.edu/~adams

Academic Employment

Assistant Professor at the Colorado State University Department of Mathematics, 2015–present.

Visiting Assistant Professor at the Duke University Department of Mathematics, 2014–2015

Postdoctoral Fellow at the Institute for Mathematics and its Applications, 2013–2015.

Education

Stanford University, Ph.D. Mathematics, August 2013.
Advisor: Gunnar Carlsson.
Thesis: *Evasion paths in mobile sensor networks*

Stanford University, B.S. Mathematics with honors and distinction, 2007.
Thesis: *Spaces of range image patches*. Minor in Economics.

Research

I am interested in computational topology and geometry, combinatorial topology, and applied topology, including applications to data analysis and to sensor networks.

Papers

Metric reconstruction via optimal transport, with Michał Adamaszek and Florian Frick. Available at arXiv:1706.04876, 2017.

On Vietoris–Rips complexes of ellipses, with Michał Adamaszek and Samadwara Reddy. Available as an Oberwolfach Preprint or at arXiv:1704.04956, 2017.

The Vietoris–Rips complexes of a circle, with Michał Adamaszek. Pacific Journal of Mathematics, 290:1–40, 2017.

Random cyclic dynamical systems, with Michał Adamaszek and Francis Motta. Advances in Applied Mathematics, 83:1–23, 2017.

Persistence images: A stable vector representation of persistent homology, with Sofya Chepushtanova, Tegan Emerson, Eric Hanson, Michael Kirby, Francis Motta, Rachel Neville, Chris Peterson, Patrick Shipman, and Lori Ziegelmeier. Journal of Machine Learning Research, 18(8):1–35, 2017.

Sweeping costs of planar domains, with Brooks Adams and Colin Roberts. To appear in the AWM-IMA Springer series. Available at arXiv:1612.03540, 2017.

Nerve complexes of circular arcs, with Michał Adamaszek, Florian Frick, Chris Peterson, and Corrine Previte-Johnson. Discrete & Computational Geometry, 56:251–273, 2016.

Nudged elastic band in topological data analysis, with Atanas Atanasov and Gunnar Carlsson. Topological Methods in Nonlinear Analysis, 45:247–272, 2015.

Evasion paths in mobile sensor networks, with Gunnar Carlsson. International Journal of Robotics Research 34:90–104, 2015.

On the nonlinear statistics of range image patches, with Gunnar Carlsson. SIAM Journal on Imaging Sciences 2:110–117, 2009.

Conference Proceedings

Javaplex: A research software package for persistent (co)homology, with Andrew Tausz and Mikael Vejdemo-Johansson. In Han Hong and Chee Yap, editors, Proceedings of ICMS 2014, Lecture Notes in Computer Science 8592: 129–136, 2014. Software available at `http://appliedtopology.github.io/javaplex`.

Research Talks

Metric reconstruction via optimal transport.

58th Cascade Topology Seminar, University of British Columbia, May 2017.

Applied Topology Seminar, Brown University, Mar 2017.

Vietoris–Rips complexes of circles, ellipses, and higher-dimensional spheres.

Topology, Geometry, and Data Analysis seminar, Ohio State University, Feb 2017.

Metric reconstruction via Vietoris–Rips complexes and optimal transport.

Florida International University Winter Conference on Geometry, Topology, and Applications, Jan 2017.

An introduction to applied and computational topology.

Florida International University Winter Conference on Geometry, Topology, and Applications, Jan 2017.

Cyclic polytopes and nerve complexes.

Rocky Mountain Algebraic Combinatorics Seminar, Colorado Sate University, Oct 2016.

An introduction to computational topology.

Computer Science Department Colloquium, Colorado State University, Oct 2016.

The theory of Vietoris–Rips complexes: What is known and what is open?

Mini-symposium on Applied and Computational Topology at the SIAM Central States Section Meeting, Oct 2016.

What is topology, and how is it applied to data analysis?

Front Range Computational & Systems Biology Symposium, Colorado State University, July 2016.

Vietoris–Rips complexes of circles and ellipses.

AMS Special Session on Applied and Computational Topology, Joint Meetings, Seattle, WA, Jan 2016.

Random cyclic dynamical systems.

Rocky Mountain Algebraic Combinatorics Seminar, Colorado Sate University, Sept 2015.

The Vietoris–Rips complexes of a circle.

University of Rochester Data Science Colloquium, Apr 2015.

Applied Algebraic Topology Research Network, Online Seminar Series, Mar 2015.

Department Colloquium, Colorado State University, Jan 2015.

Geometry and Topology Seminar, Tulane University, Nov 2014.

Applied Topology Seminar, University of Pennsylvania, Nov 2014.

Department Colloquium, University of North Carolina at Greensboro, Oct 2014.

Geometry and Topology Seminar, North Carolina State University, Sept 2014.

IMA Postdoc Seminar, University of Minnesota, May 2014.

Evasion paths in mobile sensor networks.

Colorado State University Pattern Analysis Lab, Oct 2015.

Duke University Graduate & Faculty Seminar, Feb 2015.

IMA Workshop on Topological Systems: Communication, Sensing, and Actuation, University of Minnesota, Mar 2014.

Rocky Mountain Algebraic Combinatorics Seminar, Colorado Sate University, Nov 2013.

SIAM Conference on Applied Algebraic Geometry, Colorado Sate University, Aug 2013.

IM PAN (Institute of Mathematics, Polish Academy of Sciences) Applied Topology, Będlewo, Poland, July 2013.

MSRI Workshop on Algebraic Topology, Berkeley, CA, June 2013.

Ayasdi Topology Day, Palo Alto, CA, June 2013

CompTop Seminar, Stanford University, May 2013.

Special Session on Applied and Computational Topology at MAA MathFest, Madison, WI, Aug 2012.

Algebraic Topology: Applications and New Directions, Stanford University, July 2012.

Minisymposium on Applied Algebraic Topology at SIAM Annual Meetings, Minneapolis, MN, July 2012.

Schloss Dagstuhl Seminar on Applications of Combinatorial Topology to Computer Science, Dagstuhl, Germany, Mar 2012.

AMS Special Session on Computational and Applied Topology, Joint Meetings, Boston, MA, Jan 2012.

SIAM Conference on Applied Algebraic Geometry, North Carolina State University, Oct 2011.

Nudged elastic band in topological data analysis.

SIAM Conference on Applied Algebraic Geometry, North Carolina State University, Oct 2011.

CompTop Seminar, Stanford University, Jan 2010.

AMS-SIAM Special Session on Applications of Algebraic Geometry, Joint Meetings, San Francisco, CA, Jan 2010.

Topological data analysis: Understanding optical flow.

IMA Short Course on Applied Algebraic Topology, University of Minnesota, June 2009.

Software Talks and Demonstrations

Introduction to Javaplex software for persistent homology.

Applied Algebraic Topology Research Network, Student Online Seminar Series, Oct 2015.

Young Topologists' Meeting, EPFL, Lausanne, Switzerland, July 2015.

AMS Mathematical Research Community on Computational and Applied Topology, Snowbird, UT, June 2011.

Introduction to JPlex software for persistent homology.

AMS Short Course on Computational Topology, Joint Meetings, New Orleans, LA, Jan 2011.

CSRI Workshop on Combinatorial Algebraic Topology, Sandia National Laboratories, Aug 2009.

IMA Short Course on Applied Algebraic Topology, University of Minnesota, June 2009.

Expository Talks

Introduction to discrete Morse theory. Student Topology Seminar, University of Minnesota, Dec 2013.

Applied topology. Stanford University Mathematics Camp, Guest Lecture Series, Stanford University, July 2013.

Applied topology. Stanford University Mathematics Camp, Guest Lecture Series, Stanford University, July 2011.

Coverage problems in sensor networks. Stanford Undergraduate Mathematical Organization, Speaker Series, Stanford University, May 2010.

Teaching

Colorado State University

Instuctor, Math 580A2, Topological Data Analysis, Spring 2017. Developed as a new course.

Instructor, Math 435, Projects in Applied Mathematics, Spring 2016 and Spring 2017.

Instructor, Math 472, Introduction to Topology, Fall 2016.

Instructor, Math 301, Introduction to Combinatorial Theory, Fall 2016 and Fall 2015.

Duke University

Instructor, Math 431, Introduction to Analysis, Spring 2015.

Stanford University

Teaching Assistant, Math 51, Linear Algebra and Calculus of Several Variables,
Winter 2013, Spring 2011, Winter 2011.

Instructor, Stanford Summer Engineering Academy Math 41 and 51, Summer 2012.

The goal of the Stanford Summer Engineering Academy is to attract women and minority students to engineering majors. I taught a course on calculus and a course on linear algebra.

Course Assistant, Math 215a, Graduate Level Complex Analysis, Fall 2013.

Course Assistant, Math 147, Differential Topology, Spring 2012.

Course Assistant, Math 151, Introduction to Probability Theory, Winter 2012.

Course Assistant, Math 171, Fundamental Concepts of Analysis, Spring 2010 and Fall 2009.

California Institute of Technology

Teaching Assistant, Math 2b, Probability and Statistics, Winter 2009.

Head Teaching Assistant, Math 2a, Differential Equations, Fall 2008.

Teaching Assistant, Math 1c, Calculus of One and Several Variables and Linear Algebra, Spring 2008.

Teaching Assistant, Math 1b, Linear Algebra, Winter 2008.

Teaching Assistant, Math 1a, Calculus of One and Several Variables, Fall 2007.

Awards, Fellowships, and Grants

DARPA-BAA-16-42 “Prometheus" grant, *Geometric, Topological and Dynamic Features of Early Warning of Contagious Respiratory Infection.* Senior Investigator. (Principal Investigator is Professor Michael Kirby)

Research in Pairs Grant from the Mathematical Research Institute of Oberwolfach, on *Behavior of geometric complexes as the scale increases*, with Michał Adamaszek, 2015.

Postdoctoral Fellowship at the Institute for Mathematics and its Applications, 2013-2015.

Ric Weiland Graduate Fellowship, Stanford University, 2012-2013.

Stanford Centennial Teaching Assistant Award, 2011.

Undergraduate Research Award, Stanford Mathematics Department, 2007.

Service and Outreach

Associate Director of the IMA-sponsored Applied Algebraic Topology Research Network, 2016-present.

Coach for the Putnam Mathematical Competition at Colorado State University, 2015-present.

Advisor for the Mathematical Contest in Modeling team at Colorado State University, 2016 and 2017.

Author and maintainer of tutorials for the Javaplex and JPlex software packages for applied topology.

Undergraduate students mentored:

Samadwara Reddy via the Duke PRUV Fellowship. Bachelor's thesis *The Vietoris–Rips complexes of finite subsets of an ellipse of small eccentricity* and research paper *On Vietoris–Rips complexes of ellipses*, 2017.

Colin Roberts. Bachelor's thesis *Sweeping costs of simply-connected domains* and research paper *Sweeping costs of planar domains*, 2017.

Brooks Adams, research paper *Sweeping costs of planar domains*, 2017.

John Obuch, undergraduate research paper *Crystallization processes in 1-D*, 2016.

Mini-symposia or special sessions organized:

AMS special session on *Topological Data Analysis* at the Joint Mathematics Meetings in San Diego CA, 2018, with Mikael Vejdemo–Johansson.

Minisymposium on *Symmetric Simplicial Complexes and Polytopes* at the SIAM Conference on Applied Algebraic Geometry, Atlanta GA, 2017, with Florian Frick.

Special session on *Recent Advances in Applied Algebraic Topology* at the AMS Spring Western Sectional Meeting, Washington State University, 2017, with Bala Krishnamoorthy.

Minisymposium on *Applied and Computational Topology* at the SIAM Central States Section Meeting, University of Arkansas at Little Rock, 2016, with Patrick Shipman.

I am a reviewer for the *Mathematical Reviews* (MathSciNet).

Organizer of Stanford's Computational Topology Reading Group, 2011-2013.

Teaching Assistant Mentor for the Stanford Mathematics Department, 2011-2013.

I observed and gave feedback to math department graduate student teachers.

Consultant for Stanford's Center for Teaching and Learning, 2011–2012.

I observed and gave feedback to graduate student teachers from all departments, served on Q&A panels, and ran mid-quarter student evaluations.

Teaching Assistant and Counselor for the Stanford University Mathematics Camp, Summer 2007.

Teaching Assistant and Head Counselor for the Mathematical Logic program at Stanford's Pre-Collegiate Summer Institute, Summer 2007.

Memberships

American Mathematical Society (AMS)

Society for Industrial and Applied Mathematics (SIAM)