Christopher L. Cox

epistibrain.github.io

Contact Information

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Research Interests

My research aims to broadly understand no-slip billiards, a mechanical model in which angular and linear momentum may be conservatively exchanged at collisions. Using analytic and computational techniques, we are working to fill in a narrative beginning with a physically motivated geometric model, leading to the dynamics of the consequent billiards, and then opening the door to incorporating rotational models in statistical mechanics as well as macroscopic applications, including non-holonomic systems.

Employment

Tarleton State University

Assistant Professor of Mathematics 2018-Present

University of Delaware

Visiting Assistant Professor of Mathematics 2017-2018

Washington University in St. Louis

Postdoctoral Teaching Fellow 2016-2017

Illinois Central College

Professor of Mathematics 1998-2011

Education

Washington University in St. Louis

Ph.D. in Mathematics 2016

- Dissertation: No-slip Billiards, Advisor: Renato Feres

Northwestern University M.S. in Mathematics

M.S. in Mathematics 1994

Williams College B.A. in Mathematics

B.A. Cum Laude, with honors in Mathematics 1992

Publications

T. Chumley, S. Cook, C. Cox, R. Feres, *Rolling and no-slip bouncing in cylinders*, Journal of Geometric Mechanics, 12 (1) 2020. (arxiv:1808.08448).

C. Boone, C. Cox, E. Smith, *Specular and no-slip billiards with cusps*, Proceedings of the ICTCM, to appear.

C. Cox, R. Feres, H.-K. Zhang, *Stability of periodic orbits of no-slip billiards*, Nonlinearity, 31 (10), 2018, 4433-4471.

C. Cox, R. Feres *No-slip billiards in dimension two*, Dynamical Systems, Ergodic Theory, and Probability: in Memory of Kolya Chernov, Contemporary Mathematics, vol. 698, Amer. Math. Soc., Providence, RI, 2017, 91-110.

M. Correia, C. Cox, H.-K. Zhang, *Ergodicity in umbrella billiards*, New Horizons in Mathematical Physics, 1 (2), 2017, 56-67.

C. Cox, R. Feres, *Differential geometry of rigid bodies collisions and non-standard billiards,* Discrete and Continuous Dynamical Systems A 36 (11), 2016, 6065-6099.

C. Cox, *Flow-dependent networks: Existence and behavior at Steiner points,* Networks **31** (1998), no. 3, 149-156.

C. Cox, L. Harrison, M. Hutchings, S. Kim, J. Light, A. Mauer, M. Tilton, *The shortest enclosure of three connected areas in* $\mathbb{R}^2$*,* Real Anal. Exchange 20 (1994/95), 313-335.

T. Colthurst, C. Cox, J. Foisy, H. Howards, K. Kollett, H. Lowy, and S. Root, *Networks minimizing length plus the number of Steiner points,* Network Optimization Problems: Algorithms, Complexity and Applications, (1993), pp. 23-26.

Teaching

Tarleton State University

Assistant Professor 2018-Present

- Taught undergraduate and graduate courses, from College Algebra to graduate level Math Modeling.
- Math Club faculty sponsor Fall 2018 through Fall 2019.
- Putnam Lunch faculty sponsor Fall 2019.
- Ran a summer REU program (with Scott Cook) for four undergraduates, supported by two internal and one external grant.
- Along with other Tarleton faculty, took over fifty students to undergraduate research conference over three semesters. The majority were involved in talks or poster sessions.
- Worked with a master's student researching billiards of varying mass distribution, supported by an internal grant.
- Hosted three guests for department talks on undergraduate math research, sports analytics, and using Monte Carlo methods for decryption.

University of Delaware

Visiting Assistant Professor 2017-2018

- Taught Calculus, Linear Algebra, and Differential Equations.
- Served as coordinator for Multivariable Calculus.
- Served as a poster session judge at the graduate research fair.
- Hosted one guest for a department colloquium.

Washington University

Postdoctoral Fellow 2016-2017

- Teaching duties included Calculus, Linear Algebra, and Combinatorics.

Teaching Assistant 2011-2015

- Taught Calculus in the Freshman Summer Academic Program, Foundations of Calculus.
- Teaching Assistant for Differential Equations.
- Tutor at the Calculus Help Room.
- Grader for graduate level Differential Geometry, Algebraic Topology, Point Set Topology, and Fourier Analysis.

Illinois Central College

Professor of Mathematics 1998-2011

- Taught Calculus I, II, and III, Differential Equations, Discrete Math, Finite Math, Statistics, College and Intermediate Algebra, Calculus for Business and Social Science.
- Experience with distance learning, including teaching DL classes to rural high schools allowing students to complete the Calculus sequence.
- Taught online College Algebra and Business Calculus open sections for nine years, as well as designated dual-credit sessions for high school students.
- Extensive committee work, including hiring, syllabus and compliance, textbook, college accreditation, faculty forum, ICC Educational Foundation campaign, and community outreach committees.
- Extracurricular activities included Student Math League (coach), WYSE and Illinois Council of Teachers of Mathematics high school competitions.
- Supervised honors projects for math majors and served as director of the Honors Program.

SELECTED TALKS

Research Talks

- ❑ *Do No-slip Polygonal Billiards Have Ergodic Seas?*, lightning talk at the Institute for Experimental and Computational Research in Mathematics. (November 2019)
- ❑ *Approximating a Non-holonomic System*, MAA Spring Sectional Meeting, Tarleton State University. (March 2019)
- ❑ *No-slip bouncing and discrete non-holonomic systems.*, AMS Eastern Spring Sectional Meeting, University of Delaware, Newark, DE. (September 2018)
- ❑ *Obstructions to Ergodicity in No-slip Billiards*, Joint Mathematics Meetings, San Diego. (January 2018)
- ❑ *No-slip Billiards in Dimension Three*, SIAM Central States Section Meeting, Mini-symposium on Dynamical Systems and Their Applications, Colorado State University. (September 2017)
- ❑ *No-slip Billiards in Dimension Three*, SIAM Central States Section Meeting, Mini-symposium on Dynamical Systems and Their Applications, Colorado State University. (September 2017)
- ❑ *Ergodicity of umbrella and no-slip billiards*, invited talk, Southern University of Science and Technology of China, Shenzhen, China. (July 2016)
- ❑ *The dynamics of no-slip billiards*, The 11^{th} AIMS Conference on Dynamical Systems, Differential Equations and Applications, special session on Dynamical Systems and Their Applications, Orlando, FL. (July 2016)
- ❑ *The search for ergodic no-slip billiards*, awarded Outstanding Graduate Research Exposition, ISMAA, Jacksonville, IL. (April 2016)
- ❑ *No-slip billiards in dimension two*, Joint Mathematics Meetings, Seattle. (January 2016)
- ❑ Applied Analysis and Computation Seminar, University of Massachusetts Amherst. (November 2015)
- ❑ *No-slip billiards: periodicity, boundedness, and ergodicity*, Geometry and Topology Seminar, Washington University. (October 2015)
- ❑ *Rough collisions and periodic orbits of non-standard billiards*, The thirteenth annual Graduate Student Topology and Geometry Conference, University of Illinois Urbana Champaign. (March 2015)
- ❑ *Geometry of the Euclidean group and mechanical systems with collisions (part II)*, Geometry and Topology Seminar, Washington University. (November 2014)
- ❑ *Length-minimizing partitions of the sphere*, with Andrew Perry, Mathfest 2001, Madison, WI. (August 2001)

Math Circles and Talks for General Audiences

- ❑ *Opportunities for Students in Numerical Simulation of Billiards*, International Conference on Technology in College Mathematics. (March 2019)
- ❑ *An Introduction to No-slip Billiards*, Tarleton University Math Club, Stephenville, Texas. (March 2018)
- ❑ *Partitions of the plane*, Washington University Math Circle, St. Louis. (September 2016)
- ❑ *The mathematics of billiards*, Washington University Math Circle, St. Louis. (March 2016)
- ❑ *An introduction to billiard dynamics*, ICTM Math Contest, Illinois Central College, East Peoria, IL. (February 2016)
- ❑ *Some dynamics of rough collisions*, Szego Seminar, Washington University, St. Louis. (March 2015)
- ❑ *The lazy caterer and graceful configurations*, ICTM Math Contest, Illinois Central College, East Peoria, IL. (February 2015)
- ❑ *Cutting pancakes, cake and cheese*, Washington University Math Circle, St. Louis. (October 2014)
- ❑ *A generalized Hamilton-Jacobi problem*, Szego Seminar, Washington University, St. Louis. (February 2014)
- ❑ *Length minimizing partitions of the sphere*, Graduate Student Seminar, Washington University, St. Louis. (July 2012)
- ❑ *Steiner networks*, Washington University Math Circle, St. Louis. (February 2012)

Fellowships, Grants, and Supported Research

November 2019	ICERM Workshop on Illustrating Dynamics and Probability.
August 2018	Simons Early Career Travel Grant, International Congress of Mathematicians, Rio de Janeiro, Brazil.
2015-2017	Stochastic Thermodynamics and Random Billiards. Structured Quartet Research Ensemble, American Institute of Math, San Jose, CA. Tim Chumley (organizer), Hongkun Zhang, Renato Feres, Scott Cook, and Matt Wallace.
2015-2016	Dissertation Fellowship. Washington University in St. Louis.
May 2015	Houston Summer School on Dynamical Systems. University of Houston, Houston, TX.
2013, 2014	Summer Research Assistant. for Xiang Tang, supported by the National Science Foundation.
2011-2012	University Fellowship. Washington University in St. Louis.
2001	ICC Educational Foundation Grant. Awarded to support the development of an online College Algebra course.
1991, 1992	SMALL REU Summer Undergraduate Research Program. Advisors: Frank Morgan and Tom Garrity. Williams College, Williamstown, MA.

Relevant Skills

Programming:	Python, Sage, Mathematica, especially billiard modeling.
OHS:	WeBWork, WebAssign, and MyMathLab.
LMS:	Blackboard, Sakai, and Canvas.