

Curriculum Vitae – W. Patrick Hooper

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Education

PHD, Mathematics, *Stony Brook University* June, 2006
Thesis advisor: Yair Minsky
Thesis: *On the stability of periodic billiard paths in triangles*

M.A., Mathematics June, 2001
University of Maryland, College Park

B.S., Mathematics June, 2001
University of Maryland, College Park

Appointments

Associate Professor 2014-present
Department of Mathematics, *City College of New York*

Member of the Doctoral Faculty 2013-present
Department of Mathematics, *CUNY Graduate Center*

Assistant Professor 2010-2014
Department of Mathematics, *City College of New York*

Ralph Boas Assistant Professor 2006-2009
Department of Mathematics, *Northwestern University*

Visiting Assistant in Research 2004-2006
Department of Mathematics, *Yale University*

Grants and Awards

NSF Grant (DMS-1500965, \$171,884) 2015-2018
Renormalization in piecewise isometric dynamical systems

Simons Foundation Collaboration Grant for Mathematicians 2015
Dynamics and Geometric Structures (#359270, \$35,000, Awarded but declined)

PSC-CUNY Research Award (\$3,499.18) 2015-2016
Invariant curves in piecewise isometric dynamical systems

PSC-CUNY Research Award (\$3,499.50) <i>PETs Percolation and Tilings</i>	2014-2015
PSC-CUNY Research Award (\$3,246) <i>Billiards in Irrational Polygons</i>	2012-2013
NSF Grant (DMS-1101233, \$142,962) <i>Ergodic theory of infinite interval exchange transformations</i>	2011-2015
BSF USA-Israel Grant (BSF 2010428, \$161,000, Co-PI) with B.Weiss (PI) and Co-PI's D. Kleinboch, and J. Smillie <i>Dynamics on Parameter spaces</i>	2010-2014
PSC-CUNY Research Award (\$3413.08) <i>Renormalization in Polygon Exchange Maps</i>	2011-2012
NSF Mathematical Sciences Postdoctoral Fellow (DMS-0803013, \$108,000)	2008-2011

Publications

The invariant measures of some infinite interval exchange maps, *Geometry & Topology*, **19** (2015), 1895–2038. doi: 10.2140/gt.2015.19.1895.

An infinite surface with the lattice property I: Veech groups and coding geodesics, *Transactions of the American Mathematical Society*, **366** (2014), 2625–2649. doi: 10.1090/S0002-9947-2013-06139-9.

Grid Graphs and Lattice surfaces, *International Mathematics Research Notices*, (2013), no. 12, 2657–2698. doi:10.1093/imrn/rns124.

Dynamics on the infinite staircase, with P. Hubert and B. Weiss, *Discrete and Continuous Dynamical Systems- Series A*, **33** (2013), no. 9, 4341–4347. doi:10.3934/dcds.2013.33.4341.

Renormalization of Polygon Exchange Maps arising from Corner Percolation, *Inventiones Mathematicae*, **191** (2013), no. 2, 255–320. doi:10.1007/s00222-012-0393-4.

Another Veech Triangle, *Proceedings of the American Mathematical Society*, **141** (2013), no. 3, 857–865. doi:10.1090/S0002-9939-2012-11379-6.

Generalized staircases: recurrence and symmetry, with B. Weiss, *Annales de l'Institut Fourier*, **62** (2012), no. 4, 1581–1600. doi:10.5802/aif.2730.

Billiards in nearly isosceles triangles, with R. Schwartz, *Journal of Modern Dynamics*, **3** (2009), no. 2, 159–231. doi:10.3934/jmd.2009.3.159.

Lower bounds on growth rates of periodic billiard trajectories in some irrational polygons, *Journal of Modern Dynamics*, **1** (2007), no. 4, 649–663. doi:10.3934/jmd.2007.1.649.

Periodic billiard paths in right triangles are unstable, *Geometriae Dedicata*, **125** (2007), no. 1, 39–46. doi:10.1007/s10711-007-9129-9.

From Pappus' theorem to the twisted cubic, *Geometriae Dedicata*, **110** (2005), 103–134.
doi:10.1007/s10711-004-0543-y.

Preprints

Immersion and the space of all translation structures, arXiv:1310.5193, 31 pages.

Immersion and translation structures I: The space of structures on the pointed disk, arXiv:1309.4795, 34 pages.

Indiscriminate covers of infinite translation surfaces are innocent, not devious, with Rodrigo Treviño, arXiv:1503.00389, 45 pages.

Periodicity and ergodicity in the trihexagonal tiling, with Diana Davis, arXiv:1609.00772, 31 pages.

Rel leaves of the Arnoux-Yoccoz surfaces, with Barak Weiss and an appendix by Lior Bary-Soroker, Mark Shusterman and Umberto Zannier, arXiv:1508.05363, 56 pages.

Conference proceedings

Immersion and the space of all translation surfaces, Abstracts from the workshop held May 23-29, 2014. Oberwolfach Rep. 11 (2014) no. 1, 933-934. doi:10.4171/OWR/2014/15

Renormalization of Polygon Exchange Maps arising from Corner Percolation, Abstracts from the workshop held May 8-14, 2011. Oberwolfach Rep. 8 (2011) no. 2, 3 pages. doi:10.4171/OWR/2011/25

Invitations and Nominations

Research Fellow for the semester program at the Institute for Computational and Experimental Research in Mathematics for the semester program in *Low-dimensional Topology, Geometry, and Dynamics*, Fall 2013.

Software Developed

sage-flatsurf, joint with Vincent Delecroix, 2013-present.

This is a software package (Sage module) for working with flat surfaces in Sage.

Available online: <https://github.com/videlec/sage-flatsurf/>

McBilliards 2, 2012.

A collection of programs for investigating periodic billiards paths in convex polygons.

Available online: <http://wphooper.com/visual/mcb2/>

Truchet Dynamics, 2010-2011.

Truchet Dynamics is a computer program to investigate patterns of Truchet tilings.

Available online: http://wphooper.com/visual/truchet_dynamics/

McBilliards, joint with R. Schwartz. 2004-2007.

McBilliards is a computer program to investigate periodic billiard paths in triangles. Available online: <http://mcbilliards.sourceforge.net/>

I have created java applets to illustrate examples from subjects such as geometric structures and dynamical systems.

Available online: <http://wphooper.com/visual/>

Synergistic Activities

Co-organizer of the NYC Dynamics Seminar at CUNY & Yeshiva University, 2016-present [<http://nycdynamics.org/>].

Co-organizer of Complex Analysis and Dynamics Seminar at CUNY Graduate Center, 2014-present [<http://qcpages.qc.cuny.edu/zakeri/seminar.html>].

Created a SVG tutorial designed to teach mathematical graphics and programming to undergraduates, 2013 [<http://wphooper.com/svg/>]. Taught Summer@ICERM undergraduate researchers to use SVG [http://icerm.brown.edu/summerug_2013].

An organizer of the “International Conference and Workshop on Surfaces of Infinite Type,” taking place 29 Jul - 2 Aug 2013 in Morelia, México [<http://www.matmor.unam.mx/infinite-surfaces-morelia/>].

Organized the Summer@ICERM undergraduate summer research program jointly with Sergei Tabachnikov, June 18 - August 10, 2012 [http://icerm.brown.edu/summerug_2012].

Recently advised student research projects:

- Jonathan Inbal (masters student, CCNY) in “Piecewise isometries and ergodic theory,” 2014-2015. (Now a PhD Student at the University of Maryland.)
- Warren Tai (masters student, CCNY) in “Substitutive Dynamics,” 2012-2014. (Now a PhD student at CUNY Graduate Center.)
- Madison Crocker (undergraduate student, CCNY) in “Ramsey Theory” and “Counting problems for Tilings,” 2012.
- Hai Bin Chang and Yilong Yang (undergraduates, Summer@ICERM) in “Billiards in Polygons,” 2012.
- Francisc Bozgan, In-Jee Jeong and Julianne LaChance (undergraduates, Summer@ICERM) in “Outer billiards with contraction,” 2012. (Jointly mentored with Tarik Aougab and Diana Davis.)

Created a Java tutorial designed to teach mathematics students programming with an emphasis on visualization, 2012 [<http://wphooper.com/java/tutorial/>].

Supervisor of Putnam Competition activities at City College of New York, 2011-2012 and 2016.

Assistant for the Mathematics Research Community on “The Geometry of Real Projective Structures,” June 12-18, 2011.

Referee for journals including: The American Mathematical Monthly, Discrete and Continuous Dynamical Systems, Dynamical Systems, Experimental Mathematics, Geometriae Dedicata, Geometric and Functional Analysis, Inventiones mathematicae, Israel Journal of Mathematics, Israel Journal of Mathematics, Journal of the London Mathematical Society, Journal of Modern Dynamics, New Journal of Physics, Nonlinearity, Proceedings of the American Mathematical Society, SIAM Review, Transactions of the American Mathematical Society.

Talks at seminars and conferences (since 2010)

“Periodicity and ergodicity in the trihexagonal tiling.” Midwest Dynamical Systems Seminar (Conference), Indianapolis, IN, Nov 2016.

“Fractal Curves Arising from Cutting and Resewing Pillow Cases.” 11th AIMS International Conference on Dynamical Systems, Differential Equations and Applications, Orlando, FL. Jul 2016.

“FlatSurf and translation surfaces in Sage.” Sage Days 74, Observatoire de Paris, France. Jun 2016.

“Topologizing the space of all translation structures.” Workshop on Flat Surfaces and Dynamics of Moduli Space, Casa Matemática Oaxaca, Mexico. May 2016.

“Demonstration of the FlatSurf computer package.” Sage Days 73, Oaxaca, Mexico. May 2016.

“Random covers of translation surfaces.” Special Session on Invariant Measures of Dynamical Systems, Spring Southeastern Sectional Meeting of the AMS, Athens, GA. Mar 2016.

“Rel leaves of the Arnoux-Yoccoz surfaces.” Geometry and Topology Seminar, Brown University. Feb 2016.

“Rel leaves of the Arnoux-Yoccoz surfaces.” Simons Semester Workshops: Translation Surfaces and Dynamics, Bedlewo, Poland. Nov 2015.

“Rel leaves of the Arnoux-Yoccoz surfaces.” Dynamical Systems Seminar, Northwestern University. Nov 2015.

“Classical and non-classical translation surfaces, renormalization, and invariant measures.” Geometry & Dynamics Seminar, Tel Aviv University. Jun 2015.

“Interval Exchange Transformations and Translation Surfaces.” Extremal Length Seminar, CUNY Graduate Center. Dec 2014.

“Piecewise isometric dynamics on the square pillowcase.” Ergodic Theory and Statistical Mechanics, Princeton University. Nov 2014.

“Detecting vanishing periodic billiard trajectories in polygons.” 29th Summer Conference on Topology and its Applications, College of Staten Island, CUNY. Jul 2014.

“Ergodic properties of finite covers of finite area infinite genus translation surfaces.” Ergodic Theory and Dynamical Systems Seminar, University of Bristol. Jun 2014.

“Topologizing the space of all translation surfaces.” Complex Analysis and Dynamics Seminar, CUNY Graduate Center. Apr 2014.

“Immersion and the space of all translation surfaces.” Workshop on Flat surfaces and dynamics on moduli spaces, Mathematisches Forschungsinstitut Oberwolfach. Mar 2014.

“Detecting vanishing periodic billiard trajectories.” Karlsruher Institut für Mathematik. Mar 2014.

“Detecting vanishing periodic billiard trajectories.” Topology and Geometry Seminar, Yale University. Mar 2014.

“Renormalization in piecewise isometries.” MathFest 2014 (For recruiting of PhD students), CUNY Graduate Center. Feb 2014.

“Cutting and resewing pillow cases.” Institute for Computational and Experimental Research in Mathematics (ICERM), Conference on Geometric structures in low-dimensional dynamics. Nov 2013.

“Cutting and Resewing Pillow Cases.” Dynamical Systems Seminar. University of Maryland, College Park. Nov 2013.

“Cutting and resewing pillow cases.” Indiana University, Geometry Seminar. Bloomington, IN. Oct 2013.

“Cutting and Resewing Pillow Cases.” Summer 2013 Wasatch Topology Conference. Park City, Utah. Aug 2013.

“Deforming infinite flat surfaces.” International conference and workshop on surfaces of infinite type, Centro de Ciencias Matemáticas de la Universidad Nacional Autónoma de México. Morelia, Mexico. Aug 2013.

“SVG Training Sessions” mini-course given at Summer@ICERM Undergraduate Summer Research Program. Providence, RI. July 15-19, 2013.

“Resewing pillow cases.” Institute for Pure and Applied Mathematics, Los Angeles. Apr 2013.

“Renormalization, Corner Percolation, and Rectangle Exchanges.” Centre International de Rencontres Mathématiques, Laminations and Symbolic Dynamics. Marseille, France. Apr 2012.

“The invariant measures of some infinite interval exchange maps.” University of Maryland, Dynamical Systems Seminar. College Park, MD. Feb 2012.

“Renormalization of Rectangle Exchange Maps Arising from Corner Percolation.” Ben Gurion University, Ergodic Theory and Probability Theory seminar. Be'er Sheva, Israel. Jan 2012.

“Renormalization of Rectangle Exchange Maps Arising from Corner Percolation.” Penn State University, Center for Dynamics and Geometry Seminar. University Park, PA. Nov 2011.

“On Periodic Billiard Trajectories in Triangles.” Penn State University, MASS Seminar. University Park, PA. Nov 2011.

“Renormalization of Rectangle Exchange Maps Arising from Corner Percolation.” Brown University, Dynamics and Geometry Seminar. Providence, RI. Oct 2011.

“Renormalization of Rectangle Exchange Maps Arising from Corner Percolation.” CUNY Graduate Center, Complex Analysis and Dynamics Seminar. New York, NY. Sep 2011.

“Renormalization of Rectangle Exchange Maps Arising from Corner Percolation.” Mathematisches Forschungsinstitut Oberwolfach, Workshop on Billiards, Flat Surfaces, and Dynamics on Moduli Spaces. May 2011.

“Renormalization in Truchet Tilings.” Clemson University, Colloquium. Apr 2011.

“Loops in Truchet tilings.” City College of New York, Research Talk for Undergraduates. Apr 2011.

“From Truchet tilings to polygon exchange transformations.” City College of New York, Dynamical Systems Seminar. Feb 2011.

“The invariant measures of some infinite interval exchange maps.” Brown University, Geometry and Topology Seminar. Oct 2010.

“Symmetry groups of translation surface covers.” CUNY Grad Center, Complex Analysis and Dynamics Seminar. Oct 2010.

“The invariant measures of some infinite interval exchange maps.” Yale University, Geometry and Topology Seminar. Oct 2010.

“The invariant measures of some infinite interval exchange maps.” Rutgers University, Topology/Geometry Seminar. Sept 2010.

“The invariant measures of some infinite interval exchange maps.” CUNY Grad Center, Geometry and Topology Seminar. Sept 2010.

“The invariant measures for some infinite interval exchange maps.” Hausdorff Institute, Bonn, Germany. Geometry and Dynamics of Teichmüller Spaces: Main Conference. June 2010.

“Veech triangle groups.” Hausdorff Institute, Bonn, Germany. Geometry and Dynamics of Teichmüller Spaces: Trimester program, June 2010.

“Infinite genus surfaces admitting two affine multi-twists.” Dresden, Germany. AIMS Conference on Dynamical Systems, Differential Equations and Applications. May 2010.

“Infinite genus surfaces admitting two affine multi-twists.” Central Connecticut State University, Riemann Surfaces and Teichmüller Theory Conference. Apr 2010.