

Department of Mathematics
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Appointments

Vanderbilt University, Nashville, TN

Associate Professor of Mathematics

8/2022 –

Assistant Professor of Mathematics

8/2015 – 8/2022

University of Illinois, Urbana, IL

8/2011 – 5/2015

J.L. Doob Research Assistant Professor of Mathematics

NSF Postdoctoral Fellow, University of Illinois, Urbana, IL

6/2012 – 5/2015

Education

University of Chicago, Chicago, IL

9/2006 – 6/2011

Ph.D. in Mathematics, June 2011

Dissertation: *On the Dilatations and Self-Intersections of
Point-Pushing Pseudo-Anosov Homeomorphisms*

Advisor: Benson Farb

M.S. in Mathematics, June 2008

University of Michigan, Ann Arbor, MI

9/2002 – 5/2006

M.S. in Mathematics, May 2006

M.S. in Physics, May 2006

B.A. in Honors Mathematics, May 2006

Extended Research Visits

Simons Laufer Mathematical Sciences Institute (SLMath), Berkeley, CA

– Research Member, Complementary Program

Fall 2022

University of California, Berkeley – Visiting Scholar

Fall 2022

Mathematical Sciences Research Institute (MSRI), Berkeley, CA

– Research Member, Geometric Group Theory

Fall 2016

– Research Member, Dynamics on Moduli Spaces of Geometric Structures

Spring 2015

Inst. for Comp. and Exp. Res. in Math. (ICERM), Providence, RI

– Research Fellow

Oct-Nov 2013

Research Interests

My research areas include low-dimensional and geometric topology, geometric group theory, and dynamics, with particular focus on Teichmüller spaces, mapping class groups, $\text{Out}(F_N)$, and dynamical properties of surface homeomorphisms and free group automorphisms.

Fellowships, Honors and Awards

NSF Individual Grant DMS-2405061 – \$270,578	9/2024 – 8/2027
Shanks Faculty Award, Vanderbilt Department of Mathematics	April 2024
NSF Individual Grant DMS-2005368 – \$239,596	6/2020 – 5/2025
NSF Individual Grant DMS-1711089 – \$169,930	6/2017 – 5/2022
GEAR Network Conference Grant – \$25,000 for YGGT 2018 Conference	June 2017
NSF Conference Grant DMS-1707524 – \$35,000 for 2017 Shanks Conference	April 2017
List of Teachers Ranked as Excellent, University of Illinois	Fall 2014
List of Teachers Ranked as Excellent, University of Illinois	Spring 2013
NSF Mathematical Sciences Postdoctoral Research Fellowship Institution: University of Illinois, Sponsor: Christopher J. Leininger	2012–2015
Lawrence and Josephine Graves Teaching Prize, University of Chicago <i>for excellence in undergraduate teaching</i>	May 2010
McCormick Fellowship, University of Chicago	2006–2008

Publications and Preprints

(Copies available at <http://www.math.vanderbilt.edu/~dowdalsd/research.html>)

- Dilatation versus self-intersection number for point-pushing pseudo-Anosov homeomorphisms.** *Journal of Topology* Vol 4 (2011) no. 4: 942–984.
- Statistical hyperbolicity in Teichmüller space**, with M. Duchin and H. Masur. *Geom. Funct. Anal.* Vol. 24 (2014) 748–795.
- Spheres in the curve complex**, with M. Duchin and H. Masur. *Contemporary Mathematics*, Vol. 590, Amer. Math. Soc., Providence, RI, 2013, 1–8.
- Pseudo-Anosov subgroups of fibered 3-manifold groups**, with R. P. Kent IV and C. J. Leininger. *Groups Geom. Dyn.* 8 (2014) no. 4, 1247–1282.
- Dynamics on free-by-cyclic groups**, with I. Kapovich and C. J. Leininger. *Geometry & Topology* 19-5 (2015), 2801–2899.
- McMullen polynomials and Lipschitz flows for free-by-cyclic groups**, with I. Kapovich and C. J. Leininger. *J. Eur. Math. Soc. (JEMS)* 19 (2017), no. 11, 3253–3353.
- Unbounded asymmetry of stretch factors**, with I. Kapovich and C. J. Leininger. *Comp. Rend. Math. Acad. Sci. Paris, Ser. I.* Vol. 352 (2014) 885–887.
- Hyperbolic extensions of free groups**, with S. Taylor. *Geometry & Topology* 22 (2018), no. 1 517–570.
- Contracting orbits in Outer space**, with S. Taylor. *Mathematische Zeitschrift* 293 (2019), no. 1-2, 767–787.
- Cannon–Thurston maps for hyperbolic free group extensions**, with I. Kapovich and S. Taylor. *Israel Journal of Mathematics* 216 (2016), 753–797.
- Endomorphisms, train track maps, and fully irreducible monodromies**, with I. Kapovich and C. Leininger. *Groups Geom. Dyn.* 11 (2017), 1179–1200.
- The co-surface graph and the geometry of hyperbolic free group extensions**, with S. Taylor. *Journal of Topology* 10 (2017) no. 2, 447–482.

- Rank and Nielsen equivalence in hyperbolic extensions**, with S. Taylor.
Internat. J. Algebra Comput. 29 (2019), no. 4, 615–625.
- Isomorphisms between big mapping class groups**, with J. Bavard and K. Rafi.
Int. Math. Res. Not. IMRN (2020), no. 10, 3084–3099.
- Discretely shrinking targets in moduli space**, with G. Work.
Geom Dedicata 216, 53 (2022), 17pp.
- Extensions of Veech groups I: A hyperbolic action**, with M. Durham, C. Leininger, and A. Sisto.
Journal of Topology 16 (2023), no.2, 757–805.
- Extensions of Veech groups II: Hierarchical hyperbolicity and quasi-isometric rigidity**, with M. Durham, C. Leininger, and A. Sisto.
Comment. Math. Helv. 99 (2024), no.1, 149–228.
- Orientable maps and polynomial invariants of free-by-cyclic groups**, with R. Gupta and S. Taylor.
Advances in Mathematics 415 (2023) Paper No. 108872, 45pp.
- Lattice point counting for finite-order mapping classes**, with H. Masur.
arXiv:2305.03721 [math.GT].
- Constructing reducibly geometrically finite subgroups of the mapping class group**, with T. Aougab, H. Bray, H. Hoganson, S. Maloni, and B. Whitfield. Preprint arXiv:2501.13234 [math.GT].

Invited Talks

Conferences and Colloquia

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| University of Oklahoma, Department Colloquium | March 2025 |
| <i>Joint Mathematics Meeting - AMS Special Session on Combinatorial and Probabilistic Methods in Group Theory</i> , Seattle, WA | January 2025 |
| <i>Dubrovnik X - Topology & Dynamical Systems</i> , Dubrovnik, Croatia | June 2024 |
| <i>BIRS workshop - Advances in Hierarchical Hyperbolicity</i> , Banff, Canada | May 2024 |
| <i>AIM workshop - Rigidity properties of free-by-cyclic groups</i> , Pasadena, CA | October 2023 |
| <i>68th Cascade Topology Seminar</i> , University of British Columbia, Canada | April 2023 |
| <i>17th Chico Topology Conference</i> , Chico State University, CA | April 2022 |
| <i>54th Spring Top. & Dynam. Sys. Conf.</i> (online) Murray State Univ., KY | May 2021 |
| (Canceled) <i>AMS Special Session on Combinatorial Methods in Geometric Group Theory</i> , University of Virginia | March 2020 |
| <i>AMS Special Session on Group actions on manifolds & related spaces</i> , SUNY Binghamton, NY | October 2019 |
| <i>MSRI Grad. School on Geom. Group Theory</i> (5-part minicourse), Oaxaca, Mexico | July 2019 |
| <i>Dubrovnik IX - Topology & Dynamical Systems</i> , Dubrovnik, Croatia | June 2019 |
| <i>Workshop on surfaces of infinite type</i> (lightning talk), AIM, San José, CA | May 2019 |
| <i>Workshop on Geometry of Teichmüller Space</i> , Fields Institute, Toronto | August 2018 |
| <i>40th Semiannual Wasatch Topology Conference</i> , Midway, Utah | August 2018 |
| <i>Summer Conference on Topology and its Applications</i> , Western Kentucky Univ. | July 2018 |

<i>Geometry of outer spaces and outer automorphism groups</i> , Univ. Warwick	April 2018
<i>Geometry of Teichmüller space and mapping class groups</i> , Univ. Warwick	April 2018
<i>52nd Spring Topology and Dynamical Systems Conf.</i> Auburn Univ.	March 2018
<i>No Boundaries: Groups in Algebra, Geometry, and Topology</i> , Univ. Chicago	October 2017
<i>Groups explored through geometry and dynamics</i> , Princeton University	September 2017
<i>Geometric Structures in Group Theory</i> , Oberwolfach Research Institute	June 2017
<i>Graduate Student Conf. in Algebra, Geometry, and Dynamics</i> , Temple Univ.	June 2017
<i>51st Spring Topology and Dynamical Systems Conf.</i> New Jersey City Univ.	March 2017
<i>Surface Bundles Workshop</i> , Oberwolfach Research Institute	December 2016
<i>Geometry of mapping class groups and $\text{Out}(F_n)$</i> , Math. Sci. Research Inst.	October 2016
<i>Introductory Workshop: Geometric Group Theory</i> , Math. Sci. Research Inst.	August 2016
<i>Effective and Algorithmic Methods in Hyp. Geom. and Free groups</i> , ICERM	May 2016
<i>50th Spring Topology and Dynamical Systems Conf.</i> Baylor University	March 2016
<i>Young Geometric Group Theory V</i> , Karlsruhe, Germany	February 2016
<i>Moduli Crossroads Retreat I</i> , University of Wisconsin - Madison	June 2015
<i>Workshop on Mapping Class Groups and $\text{Out}(F_n)$</i> , University of Texas at Austin	May 2015
<i>AMS Special Session on</i>	
<i>Geometric Group Theory and Topology</i> , University of Alabama in Huntsville	March 2015
<i>Geometry, Groups, and Dynamics Day</i> , Rose-Hulman Inst. of Technology	February 2015
University of Nebraska - Lincoln, Department Colloquium	February 2015
North Dakota State University, Department Colloquium	January 2015
University of Illinois at Chicago, Department Colloquium	January 2015
Vanderbilt University, Department Colloquium	January 2015
SUNY Buffalo, Department Colloquium	December 2014
<i>Ahlfors–Bers Colloquium, sixth triennial</i> , Yale University	October 2014
<i>Topology Student Workshop</i> , Georgia Tech	June 2014
<i>CMS Special Session on</i>	
<i>Low-dimensional Topology and Geometric Group Theory</i> , Winnipeg, Manitoba	June 2014
<i>Georgia Topology Conference</i> , University of Georgia	May 2014
<i>Redbud Topology Conference</i> , University of Oklahoma	April 2014
<i>AMS Special Session on</i>	
<i>Low-dimensional Topology and Group Theory</i> , University of Maryland	March 2014
<i>AMS Special Session on</i>	
<i>Geometric Topology and Number Theory</i> , University of Tennessee	March 2014
<i>Joint Meetings – Crash Course on Mapping Class Groups</i> , Baltimore, MD	January 2014
<i>Geometric and Dynamical Aspects of Discrete Groups</i> , Université Lille 1	September 2013
<i>Research program on the Geometry of Outer Space</i> , Université d’Aix Marseille	July 2013
<i>Workshop on Higher Teichmüller–Thurston Theory</i> , Northport, Maine	June 2013

<i>CRM Semester Program on Automorphisms of Free Groups</i> , Barcelona	October 2012
<i>GEAR Retreat</i> , University of Illinois	August 2012
<i>AMS Special Session on Geometric Topology and Group Theory</i> , University of Kansas	March 2012
<i>Park City Math Institute summer session on Moduli spaces of Riemann surfaces</i> , Park City, Utah	July 2011
<i>Ahlfors–Bers Colloquium, fifth triennial</i> , Rice University	March 2011
<i>Wasatch Topology Conference</i> , Park City, Utah	August 2010
<i>Workshop on pseudo-Anosovs with small dilatation</i> , University of Wisconsin	April 2010
<i>Graduate Student Topology and Geometry Conference</i> , University of Michigan	April 2010

Seminars

George Mason University <i>Geometry MMA Seminar</i>	March 2025
University of Oklahoma <i>Geometry/Topology Seminar</i>	February 2025
University of Tennessee <i>Topology Seminar</i>	February 2025
Yale University <i>GATSBY seminar</i>	April 2024
Temple University <i>PATCH seminar</i>	April 2024
University of Michigan <i>Geometry Seminar</i>	March 2024
Vanderbilt University <i>Undergraduate Math Seminar</i>	March 2024
Vanderbilt University <i>Topology & Group Theory Seminar</i>	September 2023
University of Virginia, Charlottesville, <i>Geometry Seminar</i>	March 2023
University of California, Riverside, <i>Geometry-Topology Seminar</i>	December 2022
University of Utah, Salt Lake City <i>Max Dehn Seminar</i>	November 2022
University of California, Berkeley <i>Topology Seminar</i>	September 2022
University of Wisconsin <i>Dynamics Seminar</i>	February 2022
Vanderbilt University <i>Topology & Group Theory Seminar</i>	February 2021
University of Glasgow <i>Geometry & Topology Seminar</i>	November 2020
Vanderbilt University <i>Subfactor Seminar</i>	May 2020
Vanderbilt University <i>Undergraduate Math Seminar</i>	February 2020
University of Michigan <i>Geometry Seminar</i>	November 2019
University of Michigan <i>Undergraduate MathClub Seminar</i>	November 2019
University of Utah <i>Max Dehn Seminar</i>	September 2019
Yale University <i>Geometry & Topology Seminar</i>	October 2018
Vanderbilt University <i>Topology & Group Theory Seminar</i>	September 2018
Universidad Autónoma de Madrid / ICMAT <i>Group Theory Seminar</i>	May 2018
Columbia University <i>Geometric Topology Seminar</i>	March 2018
Vanderbilt University <i>Group Theory & Topology Seminar</i>	November 2017
Regensburg University, <i>2-part Minicourse on free-by-cyclic groups</i>	June 2017

Vanderbilt University <i>Group Theory & Topology Seminar</i>	January 2017
University of Florida <i>Topology Seminar</i>	January 2017
University of California Santa Barbara <i>Topology Seminar</i>	November 2016
University of Chicago <i>Geometry/Topology Seminar</i>	June 2016
University of Illinois <i>Geometry, Groups and Dynamics/GEAR Seminar</i>	April 2016
Boston College <i>Geometry/Topology Seminar</i>	April 2016
Vanderbilt University <i>Group Theory & Topology Seminar</i>	March 2016
Vanderbilt University <i>Geometry Seminar</i>	November 2015
Vanderbilt University <i>Geometry Seminar</i>	November 2015
University of California Santa Barbara <i>Topology Seminar</i>	May 2015
University of Arkansas <i>Topology Seminar</i>	April 2015
The Ohio State University <i>Geometric Group Theory Seminar</i>	April 2015
MSRI semester program on Dynamics on Moduli Spaces, <i>Postdoc Seminar</i>	February 2015
Brown University, <i>GATSBY Seminar</i>	December 2014
University of Michigan <i>Topology Seminar</i>	November 2014
University of Illinois <i>Geometry, Groups and Dynamics/GEAR Seminar</i>	November 2014
Purdue University <i>Geometry Seminar</i>	October 2014
Yale University <i>Geometry and Topology Seminar</i>	September 2014
University of Illinois at Chicago <i>Geometry, Topology and Dynamics Seminar</i>	April 2014
University of Illinois <i>Group Theory Seminar</i>	March 2014
University of Texas at Austin <i>Topology Seminar</i>	February 2014
University of Wisconsin <i>Geometry and Topology Seminar</i>	January 2014
Brown University <i>Geometry Topology Seminar</i>	November 2013
Columbia University <i>Geometric Topology Topology Seminar</i>	September 2013
University of Toronto <i>Geometry and Topology Seminar</i>	March 2013
University of Illinois <i>Group Theory Seminar</i>	February 2013
University of Chicago <i>Geometry and Topology Seminar</i>	December 2012
University of Oklahoma <i>Geometry and Topology Seminar</i>	November 2012
Yale University <i>Geometry and Topology Seminar</i>	November 2012
University of Illinois <i>Group Theory Seminar</i>	December 2011
University of Illinois <i>Geometry Seminar</i>	October 2011
Indiana University <i>Geometry Seminar</i>	October 2011
University of Michigan <i>Topology Seminar</i>	March 2011
Ohio State University <i>Geometric Group Theory Seminar</i>	December 2010
Georgia Tech <i>Geometry Topology Seminar</i>	November 2010
Rice University <i>Topology Seminar</i>	November 2010
University of Illinois <i>Differential Geometry Seminar</i>	October 2010

Teaching Experience

Vanderbilt University

Instructor, Topolgoy (Math 4201/6201)	Spring 2025
Instructor, Topolgoy (Math 4200/6200)	Fall 2024
Instructor, Differential Topology (Math 6210)	Spring 2024
Instructor, Multivariable Calculus (Math 2300)	Fall 2023
Instructor, Transformation Geometry (Math 3210)	Fall 2023
Instructor, Linear Algebra (Math 2600)	Spring 2023
Instructor, Transformation Geometry (Math 3210)	Spring 2023
Instructor, Linear Algebra (Math 2600)	Spring 2022
Instructor, Multivariable Calculus (Math 2300)	Fall 2021
Instructor, Linear Algebra (Math 2600)	Fall 2021
Instructor, Introduction to Differential Geometry (Math 3230)	Spring 2021
Instructor, Multivariable Calculus (Math 2300)	Fall 2020
Instructor, Seminar in Topology (Math 9200)	Fall 2020
Instructor, Linear Algebra (Math 2600)	Spring 2020
Instructor, Linear Algebra (Math 2600)	Fall 2019
Instructor, Riemannian Geometry (Math 7210)	Fall 2019
Instructor, Selected Topics: Dynamical Systems (Math 3890)	Spring 2019
Instructor, Multivariable Calculus (Math 2300; 2 sections)	Fall 2018
Instructor, Seminar in Topology (Math 9201)	Spring 2018
Instructor, Linear Algebra (Math 2600)	Fall 2017
Instructor, Riemannian Geometry (Math 7210)	Spring 2017
Instructor, Introduction to Topology (Math 3200)	Spring 2016
Instructor, Linear Algebra (Math 2600)	Fall 2015

University of Illinois at Urbana-Champaign

Instructor, Curve complexes and Surface Topology (Math 595) Graduate advanced topics course	Fall 2014
Instructor, Calculus II (Math 231, two sections) Large lecture course – taught 509 students, managed 9 TAs, and coordinated 17 discussion sections	Spring 2013
Instructor, Non-Euclidean Geometry (Math 402, two sections)	Spring 2012
Instructor, Non-Euclidean Geometry (Math 402)	Fall 2011

University of Chicago

co-Instructor, Basic Geometry (Math 176) Inquiry-based learning / Moore method class	Winter 2011
Instructor, Studies in Mathematics (Math 112)	Fall 2010
Instructor, Calculus III (Math 153)	Winter 2010
Instructor, Calculus II (Math 152)	Fall 2009
Instructor, Elementary Functions and Calculus III (Math 133)	Spring 2009
Instructor, Elementary Functions and Calculus II (Math 132)	Winter 2009
Instructor, Elementary Functions and Calculus I (Math 131)	Fall 2008
College Fellow, Honors Calculus III (Math 163)	Spring 2008
College Fellow, Honors Calculus II (Math 162)	Winter 2008
College Fellow, Honors Calculus I (Math 161)	Fall 2007

Service Activities

Co-organizer: Groups in Geometry, Analysis, and Logic Vanderbilt University, Nashville TN	May 2025
Vanderbilt WebWork site administrator Implemented and maintained WebWork online homework platform	2023–present
Co-organizer: Vanderbilt Math Dept. <i>Topolgy & Group Theory Seminar</i>	2018–present
Referee work <i>Adv. Studies in Pure Math., Adv. Geom., Adv. Math., Algebr. Geom. Topol., Ann. Inst. Fourier, Bull. Aust. Math. Soc. Bull. Lond. Math. Soc., Compos. Math., Duke Math J., Geom. Dedicata, Geom. Topol., Groups Geom. Dyn., IRMN, Indiana Univ. Math. J., Israel J. Math., J. Eur. Math. Soc. (JEMS) J. Top., J. Top. Analysis, Math. Z., New York J. Math., Proc. Amer. Math. Soc., Proc. Roy. Soc. Edinburgh Sect. A, Topology Proc., Trans. Amer. Math. Soc.,</i>	2008–present
NSF Panel reviewer	
AMS Joint Mathematics Meetings Travel Grants Committee Chair of the committee for from 2/1/22 – 1/31/23	2021–24
Co-organizer: AMS Special Session on <i>Boundaries and Non-positive Curvature in Group Theory</i> , Sectional Meeting, Vanderbilt University, Nashville, TN	April 2018
Co-organizer: Young Geometric Group Theory VII, Les Diablerets, Switzerland	March 2018
Ran reading seminar on <i>Random walks in groups</i> , Vanderbilt University	Fall 2017
Co-organizer: Shanks Conference on Low-dimensional Topology and Geometry Vanderbilt University, Nashville, TN	May 2017
Co-organizer: Workshop & Conference on Mapping class groups and $\text{Out}(F_N)$ University of Texas, Austin, TX	May 2015
Illinois Geometry Lab, University of Illinois <i>Faculty Mentor for undergraduate research project</i>	Fall 2014
Mentor at the Topology Student Workshop, Georgia Inst. of Technology	June 2014
Co-organizer for the <i>GEAR Junior Retreat</i> , Urbana IL	Summer 2012

Park City Math Institute, Teaching Assistant	July 2011
<i>Undergraduate Summer School on Moduli Space of Riemann Surfaces</i>	
Organizer for the <i>Farb and Friends Student Seminar</i> , University of Chicago	2008–2009
University of Chicago Polk Brothers Mathematics Program	2010–2011
<i>Guest teacher in Chicago Public Schools</i>	
University of Chicago Directed Reading Program	Winter 2009
<i>Mentored undergraduate student in directed reading course on PDEs.</i>	
University of Chicago Mathematics REU	Summers 2007, 2008, 2009
<i>Mentored undergraduate students in projects across a variety of disciplines, including algebraic and differential topology, complex analysis, and dynamics.</i>	