CHRISTOPHER J. BISHOP
Department of Mathematics
Stony Brook University
Stony Brook, NY 11794-3651

RESEARCH INTERESTS

Real and complex analysis, geometric function theory, conformal dynamics, probability theory, numerical analysis, analysis on fractals, quasiconformal geometry, computational geometry.

Some of my more particular interests have included: potential theory, fractal properties of harmonic measure, geometric properties of Brownian motion and other random processes, algebras generated by harmonic and holomorphic functions, geometry of hyperbolic manifolds and their covering groups, numerical computation of conformal mappings, multipole methods, optimal meshing algorithms, nonobtuse triangulation, quadrilateral meshing, iteration of entire functions and dimension distorting properties of quasiconformal maps. I program in C, Mathematica and Matlab as part of my investigations in these areas, and teach a class on experimental aspects of mathematics.

PROFESSIONAL EXPERIENCE

Sept. 1997 to present: Professor at Stony Brook University.
Sept. 1992 to Aug. 1997: Assoc. professor at Stony Brook.
Sept. 1991 to Aug. 1992: Asst. professor at Stony Brook.
Sept. 1988 to Aug. 1991: Hedrick Asst. professor at UCLA.
Sept. 1987 to Aug. 1988: NSF postdoc at MSRI, Berkeley.

EDUCATION

Cambridge University, Master of Advanced Study (MASt), 2011.
University of Chicago, Mathematics, Ph. D., 1987, Advisor Peter W. Jones.
Visiting graduate student and programmer, Dept. of Mathematics, Yale University, 1985-1987.
University of Chicago, Mathematics, Master of Science, 1984.
Cambridge University, Certificate of Advanced Study (Part III of Math. Tripos), 1983.
Michigan State University, Mathematics, Bachelor of Science, 1982.

PH.D. STUDENTS

Zsuzsanna Gonye, Ph. D. 2001, Geodesics in hyperbolic manifolds, Assoc. Professor, University of West Hungary

Karyn Lundberg, Ph. D. 2005, Boundary behavior of conformal mappings, researcher, Lincoln Labs

Hrant Hakobyan, Ph.D. 2007, Hausdorff dimension and quasisymmetric mappings, Assoc. Professor, Kansas State University

Chris Green, Ph.D. Dec. 2011, Ahlfors iteration for numerical conformal mapping, senior researcher at Twitter

Kirill Lazebnik , Ph.D. August 2017, Wandering domains for the Eremenko-Lyubich class Bateman instructor at Cal Tech

Jack Burkart, Ph.D expected May 2020, Packing dimension of transcendental Julia sets

POSTDOCS AND VISITORS

Maria Victoria Meliáan, 1994-1995

Torbjorn Lundh, 1996-1998

Jeremy Tyson, 1999-2002

Luke Rogers, Spring 2004

Mathew Badger, 2011-2014

Yaar Solomon, 2013-2016

Malik Younsi, 2014-2016

Simon Albrecht, Spring 2016

Dimitrios Ntalampekos, 2018-2021

Peter Lin, 2019-2022

Christina Karafyllia, 2019-2021

RECENT UNDERGRADUATE THESES AND RESEARCH

Ahmad Rafiqi, Summer 2011, Estimating conformal maps with accelerated random walks, Ph.D. program at Cornell.

Kevin Sackel, 2012-13, Geometric problems related to removability, Churchill Scholar at University of Cambridge, Ph.D. program MIT, postdoc at Stony Brook starting Fall 2019.

Abraham Rabinowitz, 2013-2014, Real Analysis, Ph.D. program at Northwestern.

Luke Green 2012-13, Real Analysis, data scientist for Openslate.

Jackson Rudd, Spring 2013, Functional Analysis, data intern for Disney/ESPN.

Shalin Parekh, 2014-15, Small dimension paths in the Brownian trace, one of ten students accepted special year in probability at University of Geneva run by Smirnov and Werner, currently in Ph.D. program at Columbia.

Christopher Dular, Fall 2015, Refining a triangulation to nonobtuse triangulation, masters program Georgia Tech.
William Vickery, Fall 2016, Generating random permutations using transpositions, Ph.D. program Northwestern.
Ray Zhang, Fall 2017, Functional analysis and machine learning, finance industry.
Joseph Suk, Fall 2017, Numerical approximation of shapes by dessins d'enfants, attending Carnegie-Mellon Ph.D. program.
Yugarshi Mondal, Spring 2018, Schramm-Loewner Evolutions.
Emi Brawley, Fall 2018, Kakeya sets, attending UC Davis PhD program in Fall 2019.
Hindy Drillick, Spring 2019, Removable sets and dimension, attending Columbia Ph.D. program in Fall 2019.

RECENT SERVICE

Department

Professional development seminar.
Search committee.
Graduate committee.
Hiring committee.
Simons lecture committee.
Math day lecturer/organizer.
Comprehensive exam writer/grader.

University

Organizer SCGP Spring School in Discrete and Computational Geometry, April 2017.
SBU Center for Finance committee.
Search committee for Frey chair in quantitative finance.
Mentor for senior honors theses.

Outside University

Reviewer for various journals.
NSF panelist and reviewer.
Math Reviews Reviewer.
Lecturer for Center for Talented Youth Program.
Organizer for Special Section as AMS sectional meeting, Spring 2016.
Organizer for International Research Symposium, KIAS Seoul South Korea, April 2017.
Outside hiring referee, Jyväskylä University.
Outside dissertation referee, Jyväskylä University.
Outside dissertation referee, Tel Aviv university.
Various promotion evaluations and letters.

AWARDS

Simons Fellow, 2019-20.
Fellow of the American Mathematical Society, 2019.
Invited speaker at 2018 ICM, Rio de Janeiro.
NSF standard grants (1991-present): DMS 91-00671, DMS 92-04092, DMS 95-00577, DMS 98-00924, DMS 01-03626, DMS 04-05578, DMS 07-05455, DMS 10-06309, DMS 13-05233, DMS 16-08577, DMS 19-06259. Recent proposal reviews available on personal website.
1992 Alfred P. Sloan Research Fellow
1987-91 NSF Postdoctoral Fellowship
1983-1986 McCormick Fellowship, NSF Fellowship, U. of Chicago
1982-1983 Churchill Fellowship, Cambridge England.

PUBLICATIONS

[1] C. J. Bishop and J. K. Wetterer Planktivore prey selection: the relative field volume model vs. the apparent size model. *Ecology*, 66(2):457, 1985.

[2] C. J. Bishop. A counterexample in conformal welding concerning Hausdorff dimension. *Michigan Math. J.*, 35(1):151–159, 1988.

[3] C. J. Bishop. An element of the disk-algebra that is stationary on a set of positive length. *Algebra i Analiz*, 1(3):83–88, 1989.

[4] C. J. Bishop. Constructing continuous functions holomorphic off a curve. *J. Funct. Anal.*, 82(1):113–137, 1989.

[5] C. J. Bishop. Approximating continuous functions by holomorphic and harmonic functions. *Trans. Amer. Math. Soc.*, 311(2):781–811, 1989.

[6] C. J. Bishop, L. Carleson, J. B. Garnett, and P. W. Jones. Harmonic measures supported on curves. *Pacific J. Math.*, 138(2):233–236, 1989.

[7] C. J. Bishop. Bounded functions in the little Bloch space. *Pacific J. Math.*, 142(2):209–225, 1990.

[8] C. J. Bishop. Conformal welding of rectifiable curves. *Math. Scand.*, 67(1):61–72, 1990.

[9] C. J. Bishop and P. W. Jones. Harmonic measure and arclength. *Ann. of Math. (2)*, 132(3):511–547, 1990.

[10] C. J. Bishop and T. Steger. Three rigidity criteria for $\mathrm{PSL}(2, \mathbf{R})$. *Bull. Amer. Math. Soc. (N.S.)*, 24(1):117–123, 1991.

[11] C. J. Bishop. A characterization of Poissonian domains. *Ark. Mat.*, 29(1):1–24, 1991.

[12] C. J. Bishop. Brownian motion in Denjoy domains. *Ann. Probab.*, 20(2):631–651, 1992.

[13] C. J. Bishop. Some questions concerning harmonic measure. In *Partial differential equations with minimal smoothness and applications (Chicago, IL, 1990)*, volume 42 of *IMA Vol. Math. Appl.*, pages 89–97. Springer, New York, 1992.

[14] C. J. Bishop and T. Steger. Representation-theoretic rigidity in PSL$(2, \mathbf{R})$. *Acta Math.*, 170(1):121–149, 1993.

[15] C. J. Bishop. An indestructible Blaschke product in the little Bloch space. *Publ. Mat.*, 37(1):95–109, 1993.

[16] C. J. Bishop. How geodesics approach the boundary in a simply connected domain. *J. Anal. Math.*, 64:291–325, 1994.

[17] C. J. Bishop and P. W. Jones. Harmonic measure, L^2 estimates and the Schwarzian derivative. *J. Anal. Math.*, 62:77–113, 1994.

[18] C. J. Bishop. Some homeomorphisms of the sphere conformal off a curve. *Ann. Acad. Sci. Fenn. Ser. A I Math.*, 19(2):323–338, 1994.

[19] C. J. Bishop. A counterexample concerning smooth approximation. *Proc. Amer. Math. Soc.*, 124(10):3131–3134, 1996.

[20] C. J. Bishop. A distance formula for algebras on the disk. *Pacific J. Math.*, 174(1):1–27, 1996.

[21] C. J. Bishop. Minkowski dimension and the Poincaré exponent. *Michigan Math. J.*, 43(2):231–246, 1996.

[22] C. J. Bishop. On a theorem of Beardon and Maskit. *Ann. Acad. Sci. Fenn. Math.*, 21(2):383–388, 1996.

[23] C. J. Bishop. Some characterizations of $C(\mathcal{M})$. *Proc. Amer. Math. Soc.*, 124(9):2695–2701, 1996.

[24] C. J. Bishop. Geometric exponents and Kleinian groups. *Invent. Math.*, 127(1):33–50, 1997.

[25] C. J. Bishop and Y. Peres. Packing dimension and Cartesian products. *Trans. Amer. Math. Soc.*, 348(11):4433–4445, 1996.

[26] C. J. Bishop and Peter W. Jones. Hausdorff dimension and Kleinian groups. *Acta Math.*, 179(1):1–39, 1997.

[27] C. J. Bishop and P. W. Jones. The law of the iterated logarithm for Kleinian groups. In *Lipa's legacy (New York, 1995)*, volume 211 of *Contemp. Math.*, pages 17–50. Amer. Math. Soc., Providence, RI, 1997.

[28] C. J. Bishop and P. W. Jones. Wiggly sets and limit sets. *Ark. Mat.*, 35(2):201–224, 1997.

[29] C. J. Bishop, P. W. Jones, Robin Pemantle, and Yuval Peres. The dimension of the Brownian frontier is greater than 1. *J. Funct. Anal.*, 143(2):309–336, 1997.

[30] C. J. Bishop. Quasiconformal mappings which increase dimension. *Ann. Acad. Sci. Fenn. Math.*, 24(2):397–407, 1999.

[31] C. J. Bishop. A quasisymmetric surface with no rectifiable curves. *Proc. Amer. Math. Soc.*, 127(7):2035–2040, 1999.

[32] C. J. Bishop, A. Böttcher, Yu. I. Karlovich, and I. Spitkovsky. Local spectra and index of singular integral operators with piecewise continuous coefficients on composed curves. *Math. Nachr.*, 206:5–83, 1999.

[33] C. J. Bishop and J. T. Tyson. Conformal dimension of the antenna set. *Proc. Amer. Math. Soc.*, 129(12):3631–3636, 2001.

[34] C. J. Bishop and J. T. Tyson. Locally minimal sets for conformal dimension. *Ann. Acad. Sci. Fenn. Math.*, 26(2):361–373, 2001.

[35] C. J. Bishop. Bi-Lipschitz homogeneous curves in $\mathbb{R}^2$ are quasicircles. *Trans. Amer. Math. Soc.*, 353(7):2655–2663 (electronic), 2001.

[36] C. J. Bishop. Divergence groups have the Bowen property. *Ann. of Math. (2)*, 154(1):205–217, 2001.

[37] C. J. Bishop. BiLipschitz approximations of quasiconformal maps. *Ann. Acad. Sci. Fenn. Math.*, 27(1):97–108, 2002.

[38] C. J. Bishop. Quasiconformal mappings of Y-pieces. *Rev. Mat. Iberoamericana*, 18(3):627–652, 2002.

[39] C. J. Bishop. Non-rectifiable limit sets of dimension one. *Rev. Mat. Iberoamericana*, 18(3):653–684, 2002.

[40] C. J. Bishop and P. W. Jones. Compact deformations of Fuchsian groups. *J. Anal. Math.*, 87:5–36, 2002. Dedicated to the memory of Thomas H. Wolff.

[41] C. J. Bishop. Quasiconformal Lipschitz maps, Sullivan's convex hull theorem and Brennan's conjecture. *Ark. Mat.*, 40(1):1–26, 2002.

[42] C. J. Bishop, V. Ya. Gutlyanskiĭ, O. Martio, and M. Vuorinen. On conformal dilatation in space. *Int. J. Math. Math. Sci.*, (22):1397–1420, 2003.

[43] C. J. Bishop. Big deformations near infinity. *Illinois J. Math.*, 47(4):977–996, 2003.

[44] C. J. Bishop. δ-stable Fuchsian groups. *Ann. Acad. Sci. Fenn. Math.*, 28(1):153–167, 2003.

[45] C. J. Bishop. An explicit constant for Sullivan's convex hull theorem. In *In the tradition of Ahlfors and Bers, III*, volume 355 of *Contemp. Math.*, pages 41–69. Amer. Math. Soc., Providence, RI, 2004.

[46] C. J. Bishop. The linear escape limit set. *Proc. Amer. Math. Soc.*, 132(5):1385–1388 (electronic), 2004.

[47] C. J. Bishop. Orthogonal functions in H^∞. *Pacific J. Math.*, 220(1):1–31, 2005.

[48] C. J. Bishop. Boundary interpolation sets for conformal maps. *Bull. London Math. Soc.*, 38(4):607–616, 2006.

[49] C. J. Bishop. A criterion for the failure of Ruelle's property. *Ergodic Theory Dynam. Systems*, 26(6):1733–1748, 2006.

[50] C.J. Bishop. Harmonic measure by Garnett and Marshall. *Book review in Bull. Amer. Math. Soc.* 44(2):267-276, 2007.

[51] C.J. Bishop. An A_1 weight not comparable to any quasiconformal Jacobian. *In the tradition of Ahlfors-Bers, IV*, volume 432 of *Contemp. Math.*, pages 7–18. Amer. Math. Soc., Providence, RI. 2007

[52] C.J. Bishop and H. Hakobyan. A central set of dimension 2. *Proc. Amer. Math. Soc.*, pages 2453-2461, 136(2008), no. 7.

[53] C.J. Bishop. Conformal welding and Koebe's theorem. *Ann. of Math.* 166(2): 613–656, 2007.

[54] C.J. Bishop. Decreasing dilatations can increase dimension. *Proc. Amer. Math. Soc*, 136: 2453–2461, 2008.

[55] C.J. Bishop. A set containing rectifiable arcs locally but not globally. Pure and Applied Math. Quarterly, 7(1): 121-138, 2011. Special issue in honor of Fred Gehring, part 1 of 2.

[56] C.J. Bishop. Conformal mapping in linear time. Discrete and Computational Geometry, 44(2) 330-428, 2010.

[57] C.J. Bishop. Bounds for the CRDT algorithm. Computational Methods in Function Theory, 10(1): 325-366, 2010.

[58] C.J. Bishop. Optimal angle bounds for quadrilateral meshes. Discrete and Computational Geometry, 44(2): 308-329, 2010.

[59] C.J. Bishop. Tree-like decompositions and conformal maps. *Annals Acad. Sci. Fenn.*, 35(2): pages 389-404, 2010.

[60] C.J. Bishop. A random walk in analysis. In the collection *All That Math: portraits of mathematicians as young readers*, 2011, a special volume of Revisita Matematica Iberoamericana, celebrating the Centennial of the Real Sociedad Matematica Espanola, Edited by Antonio Cordoba, Jose L. Fernandez and Pablo Fernandez

[61] C.J. Bishop. True trees are dense. *Invent. Mat.* 197(2): pages 433-452, 2014.

[62] C.J. Bishop with E. Feinberg and J. Zhang. Examples concerning Abel and Cesaro limits. *J. Math. Analysis and App.*, 420(2): pages 1654-1661, 2014.

[63] C.J. Bishop. The order conjecture fails in S. *Journal d'Analyse*, 127(1): pages 283–302, 2015.

[64] C.J. Bishop. Constructing entire functions by quasiconformal folding. *Acta. Math.*, 214(1): pages 1–60, 2015.

[65] C.J. Bishop and K. Pilgrim. Dynamical dessins are dense. *Rev. Mat. Iberoamericana*, 31(3): pages 1033-1040, 2015.

[66] C.J. Bishop. Models for the Eremenko-Lyubich class *J. London Math. Soc.*, 92(1): 202-221, 2015.

[67] C.J. Bishop. Nonobtuse triangulations of PSLGs *Discrete and Computational Geometry*, 56(1): pages 43–92, 2016.

[68] C.J. Bishop. Quadrilateral meshes for PSLGs *Discrete and Computational Geometry*, 56(1): pages 1–42, 2016.

[69] C.J. Bishop, H. Hakobyan and M. Williams. Frequency of dimension distortion under quasisymmetric mappings , *Geometric and Functional Analysis (GAFA)*, 26(2): pages 379–421, 2016.

[70] C.J. Bishop. Models for the Speiser class. *Proc. London Math. Soc.*, 114(3), 765–797, 2017.

[71] C.J. Bishop. A transcendental Julia set of dimension 1. Inventiones Math., 212(2), 407–460, 2018.

[72] C.J. Bishop and C. LeBrun. Anti-Self-Dual 4-manifolds, Quasi-Fuchsian groups and almost-Kahler geometry to appear in *Communications in Analysis and Geometry.*

[73] C.J. Bishop and K. Lazebnik. Prescribing the Postsingular Dynamics of Meromorphic Functions, to appear in *Math. Annalen*, 375(3), 1761-1782, 2019.

PREPRINTS

[74] C.J. Bishop. Non-removable sets for quasiconformal and quasi-isometric mappings in $\mathbb{R}^3$.

[75] C.J. Bishop. Interpolating sequences for the Dirichlet space and its multipliers

[76] C.J. Bishop. Distortion of disks by conformal maps.

[77] C.J. Bishop. A fast quasiconformal mapping theorem for polygons.

[78] C.J. Bishop. Estimates for harmonic conjugation.

[79] C.J. Bishop. Another Besicovitch-Kakeya set

[80] C.J. Bishop. Quasiconformal maps with dilatations of small support

[81] C.J. Bishop. Conformal images of Carleson curves

[82] C.J. Bishop. A curve with no simple crossings by segments

[83] C.J. Bishop. A Speiser class Julia set with dimension near one, with S. Albrecht

[84] C.J. Bishop. Curves of finite total curvature and the Weil-Petersson class.

[85] C.J. Bishop, H. Drillick and D. Ntalampekos. Falconers' distance set conjecture can fail for strictly convex sets in $\mathbb{R}^d$.

BOOKS

[86] C.J. Bishop and Yuval Peres. Fractals in Analysis and Probability, Cambridge University Press, 2017

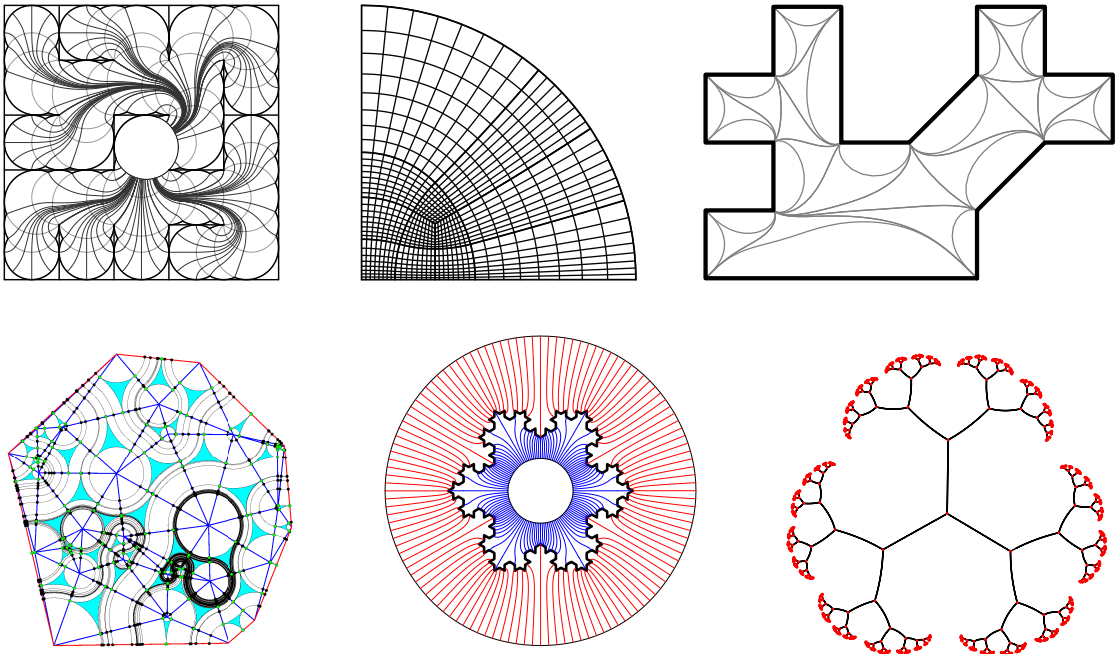
[87] C.J. Bishop and Yuval Peres. Conformal Fractals (in preparation)

[88] C.J. Bishop. The Riemann Mapping Theorem (in preparation)

[89] C.J. Bishop. Introduction to Transcendental Dynamics (in preparation)

[90] C.J. Bishop. Quasiconformal Mappings (in preparation)

POSTSCRIPT



Some illustrations from my recent work. In the top row, the left figure illustrate a flow from the boundary of a domain to an interior circle. This flow has a simple geometric definition (inspired by a result of Dennis Sullivan on hyperbolic 3-manifolds), but gives a uniform approximation to the Riemann mapping, with estimates independent of the domain and forms the first step of an algorithm that converges quadratically to the conformal map. In the center is a quadrilateral meshing of a circular triangle which forms a "worst case" in my algorithm which finds a quadrilateral mesh of any polygon with all new angles between 60° and 120°. These angle bounds are best possible and so is the required time, $O(n)$ for an n-gon. On the right is a "hyperbolic triangulation" of a polygon computed using conformal mapping software I wrote.

On the bottom row, the left figure shows a natural flow associated to any triangulation; my NOT-theorem depends on estimating the lengths of the flow lines and perturbing them to make them terminate more quickly. The center shows conformal images of radial lines corresponding to the two sides of the von Koch snowflake; the landing points illustrate the fact that the harmonic measures for the two sides are mutually singular. The rightmost is the true form of a finite binary tree, e.g., every edge has equal harmonic measure from infinity. This is related to Grothendieck's theory of *dessins d'enfants*.

Copies of my papers and lectures are available at `www.math.sunysb.edu/~bishop`
Email me at `bishop@math.stonybrook.edu`