Department of Mathematics	http://sites.math.washington.edu/~vinzant/
University of Washington	vinzant@uw.edu

Education

University of California, Berkeley	Ph.D. Mathematics 2011
Oberlin College	B.A. Mathematics and Neuroscience 2007

Appointments

Assistant Professor, University of Washington	2021 - present
Von Neumann Fellow, Institute for Advanced Studies	2020 - 2021
Associate Professor, North Carolina State University	2020 - 2021
Assistant Professor, North Carolina State University	2015 – 2020
Research Fellow, Simons Institute	Fall 2014
Hildebrandt Assistant Professor, University of Michigan	2011 – 2014
Postdoctoral Researcher, Universität Konstanz	Summer 2011

Research Area

My research involves connections between real algebraic geometry, convexity, combinatorics and optimization. Specifically, this includes the study of polynomials with special properties, such as nonnegativity or hyperbolicity, certificates for these properties, such as sums-of-squares and determinantal representations, and applications in combinatorics, optimization, and operator theory.

Preprints

(5) A. Al Ahmadieh and C. Vinzant. Determinantal representations and the image of the principal minor map. (`arXiv:2205.05267`)

(4) G. Blekherman, F. Rincón, R. Sinn, C. Vinzant, and J. Yu. Moments, Sums of Squares, and Tropicalization (`arXiv:2203.06291`)

(3) A. Al Ahmadieh and C. Vinzant. Characterizing principal minors of symmetric matrices via determinantal multiaffine polynomials. (`arXiv:2105.13444`)

(2) F. P. Simon and C. Vinzant. Invariant hyperbolic curves: determinantal representations and applications to the numerical range. (`arXiv:2102.01726`)

(1) N. Anari, K. Liu, S. Oveis Gharan, and C. Vinzant. Log-Concave Polynomials III: Mason's Ultra-Log-Concavity Conjecture for Independent Sets of Matroids. (`arXiv:1811.01600`)

Publications

(24) Z. Rosen, G. Scholten, and C. Vinzant. Sparse moments of univariate step functions and allele frequency spectra. Vietnam J. Math. 50 (2022), no. 2, 523–544.

(23) N. Anari, S. Oveis Gharan, and C. Vinzant. Log-concave polynomials, I: entropy and a deterministic approximation algorithm for counting bases of matroids. *Duke Math. J.* 170(16) (2021), 3459–3504.

(22) F. Rincón, C. Vinzant, and J. Yu. Positively Hyperbolic Varieties, Tropicalization, and Positroids. *Advances in Mathematics* 383 (2021). No. 107677, 35 pp.

(21) C. Vinzant. The geometry of spectrahedra. Sum of squares: theory and applications, 11–35, *Proc. Sympos. Appl. Math.*, 77, Amer. Math. Soc., Providence, RI, 2020.

(20) G. Blekherman, M. Kummer, C. Riener, M. Schweighofer, and C.Vinzant. Generalized eigenvalue methods for Gaussian quadrature rules. *Ann. H. Lebesgue* 3 (2020), 1327–1341.

(19) I. Kogan, M. Ruddy, and C. Vinzant. Differential signatures of algebraic curves. *SIAM J. Appl. Algebra Geom.* 4(1) (2020), 185–226.

(18) G. Scholten and C. Vinzant. Semi-inverted linear spaces and an analogue of the broken circuit complex. *Algebraic Combinatorics*, 2(4) (2019), 645–661.

(17) M. Kummer and C. Vinzant. The Chow form of a reciprocal linear space. *Michigan Math. J.*, 68 (2019), no. 4, 831–858

(16) D. Brake, J. Hauenstein, and C. Vinzant. Computing complex and real tropical curves using monodromy. *J. Pure Appl. Algebra* , 223(12) (2019), 5232–5250.

(15) G. Blekherman, D. Plaumann, R. Sinn, and C. Vinzant. Low-rank sum-of-squares representations on varieties of minimal degree. *International Mathematics Research Notices*, 1 (2019), 33–54.

(14) L. Chua, D. Plaumann, R. Sinn, and C. Vinzant. Gram spectrahedra. *Ordered algebraic structures and related topics, Contemp. Math.,* 697, (2017), 81–105.

(13) D. Plaumann, R. Sinn, D. Speyer, and C. Vinzant. Computing Hermitian determinantal representations of hyperbolic curves. *Internat. J. Algebra Comput.* 25(8) (2015), 1327– 1336.

(12) A. Conca, D. Edidin, M. Hering, and C. Vinzant. An algebraic characterization of injectivity in phase retrieval. *Appl. Comput. Harmon. Anal.* 38(2) (2015), 346–356.

(11) J. C. Ottem, K. Ranestad, B. Sturmfels, and C. Vinzant. Quartic spectrahedra. *Math. Program.* 151(2) (2015) Series B, 585–612.

(10) M. Kummer, D. Plaumann, and C. Vinzant. Hyperbolic polynomials, interlacers, and sums of squares. *Math. Program.* 153(1) (2015), Series B, 223–245.

(9) C. Vinzant. What is a spectrahedron? *Notices Amer. Math. Soc.* 61(5) (2014), 492–494.

(8) D. Plaumann and C. Vinzant. Determinantal representations of hyperbolic plane curves: an elementary approach. *J. Symbolic Comput.* 57 (2013), 48–60.

(7) R. Sanyal, B. Sturmfels, C. Vinzant. The entropic discriminant. *Adv. Math.* 244 (2013), 678–707.

(6) J. De Loera, B. Sturmfels, C. Vinzant. The central curve in linear programming. *Found. Comput. Math.* 12 (2012), no. 4, 509–540.

(5) D. Plaumann, B. Sturmfels, C. Vinzant. Computing linear matrix representations of Helton-Vinnikov curves Mathematical methods in systems, optimization, and control, *Oper. Theory Adv. Appl.* 222, Birkhäuser, Basel, pp. 259–277 (2012).

(4) C. Vinzant. Real radical initial ideals. *J. Algebra* 352 (2012), 392–407

(3) C. Vinzant. Edges of the Barvinok-Novik orbitope. *Discrete Comput. Geom.* 46 (2011), no. 3, 479–487.

(2) D. Plaumann, B. Sturmfels, C. Vinzant. Quartic curves and their bitangents. *J. Symbolic Comput.* 46 (2011), no. 6, 712–733.

(1) C. Vinzant. Lower bounds for optimal alignments of binary sequences. *Discrete Appl. Math.* 157 (2009), no. 15, 3341–3346.

Conference Proceedings

(4) N. Anari, K. Liu, S. Oveis Gharan, and C. Vinzant. Log-Concave Polynomials IV: Approximate Exchange, Tight Mixing Times, and Near-Optimal Sampling of Forests. 53rd Annual ACM Symposium on Theory of Computing (STOC 2021).

(3) N. Anari, K. Liu, S. Oveis Gharan, and C. Vinzant. Log-Concave Polynomials II: High-dimensional walks and an FPRAS for counting bases of a matroid. 51st Annual ACM Symposium on the Theory of Computing (STOC 2019). *(Best paper award.)*

(2) N. Anari, S. Oveis Gharan, and C. Vinzant. Log-concave polynomials, entropy, and a deterministic approximation algorithm for counting bases of matroids. 59th Annual IEEE Symposium on Foundations of Computer Science – FOCS 2018, 35–46, IEEE Computer Soc., Los Alamitos, CA, 2018.

(1) C. Vinzant. A small frame and a certificate of its injectivity. *Sampling Theory and Applications (SampTA), Conference Proceedings.* (2015), 197 – 200.

Funding

(5) Sloan Research Fellowship, 2020

(4) NSF CAREER Award, $418,588, 2020-2025, PI

(3) NSF Conference Grant, $30,000, 2018 - 2019, Co-PI

(2) NSF DMS Computational Math, $150,000, 2016-2020, PI

(1) NSF Postdoc Research Fellowship, $150,000, 2012-2016, PI

Mentoring

Ph.D. Students

(4) Abeer Al Ahmadieh, Ph.D. 2022
   Thesis: Determinantal Representations and the Image of the Principal Minor Map

(3) Georgy Scholten, Ph.D. 2021
   Thesis: Combinatorial and Real Algebraic Structures in Statistics and Optimization

(2) Michael Ruddy (joint with Irina Kogan), Ph.D. 2019
   Thesis: The Equivalence Problem and Signatures of Algebraic Curves

(1) Lillian Faye Pasley Simon, Ph.D. 2019
   Thesis: Determinantal Representations, Invariance, and the Numerical Range.

Postdocs

(1) Alperen Ergur, 2016-2017

Mentored undergraduate research projects

(5) Sam Weninger, NCSU, 2019 - 2020, *Examples of positive correlation in matroids*

(4) Georgy Scholten, NCSU, Jan. - Sept. 2016, *Semi-inverted linear spaces*

(3) Alexander Hazeltine, NCSU, Jan. - May 2016, *Inscribed triangles of quartic curves*

(2) Samuel Burton and Yewon Youm, June - July 2013, U. Michigan, *Vámos Matroids and the Half-Plane Property*

(1) Samuel Burton, U. Michigan, July - December 2012, *Convex Hulls of Curves*

Teaching

University of Washington

Quarter	Course	# Students
Spring 2022	Math 514: Networks and Combinatorial Optimization	17
Winter 2022	Math 582G: Convex Algebraic Geometry	14
Fall 2021	Math 124D: Calculus I	165

North Carolina State University

Semester	Course	# Students
Spring 2020	MA 721: Abstract Algebra II	11
Fall 2019	MA 521: Abstract Algebra I	17
Fall 2019	MA 425: Mathematical Analysis I	12
Spring 2019	MA591: Real algebraic geometry & convex opt.	19
Spring 2018	MA526: Algebraic Geometry	7
Spring 2018	MA/CSC 416: Introduction to Combinatorics	28
Spring 2017	MA437: Applications of Algebra	19
Fall 2016	MA526: Algebraic Geometry	6
Spring 2016	MA591: Tropical Geometry	8
Fall 2015	MA526: Algebraic Geometry	12

University of Michigan, Ann Arbor

Semester	Course	# Students
Spring 2014	MA216: Differential Equations	≈ 90
Fall 2013	MA216: Differential Equations	≈ 90
Spring 2012	MA217: Linear Algebra	≈ 25
Fall 2011	MA115: Calculus I	≈ 20

Invited Lectures and Presentations

Invited Research Presentations

(09/22) MATRIX: Theory and Applications of Stable Polynomials, University of Melbourne
(07/22) Formal Power Series & Algebraic Combinatorics Plenary, IISc, Bangalore, India
(06/22) Combinatorial, Computational, and Applied Algebraic Geometry, UW Seattle
(05/22) Simons Institute 10th Anniversary Symposium, Berkeley, CA
(05/22) 7th Lake Michigan Workshop on Combinatorics, UIC, Chicago
(04/22) Western Algebraic Geometry Symposium, Colorado State University, CO
(03/22) Current Developments in Mathematics, Harvard/MIT
(10/21) IAS Member seminar
(06/21) AlCoVE (Algebraic Combinatorics Virtual Expedition)
(01/20) MIFODS workshop on Learning with a complex structure, MIT
(10/19) CORE Seminar, University of Washington, Seattle
(07/19) SIAM $(AG)^2$ Minisymposium on Polynomial Optimization and its Applications
(06/19) Universität Bremen Math Colloquium, Bremen, Germany
(06/19) MEGA: Effective Methods in Algebraic Geometry Plenary, Madrid, Spain
(05/19) Carnegie Mellon ACO seminar
(05/19) Simons Institute, Hyperbolic Polynomials and Hyperbolic Programming, CA

(04/19) Georgia Tech Meeting on Applied Algebraic Geometry
(04/19) Georgia Tech ACO Colloquium
(02/19) Simons, Beyond Randomized Rounding and the Probabilistic Method, CA
(01/19) JMM, AMS Special Session on Geometric and Topological Combinatorics
(11/18) Math seminar, MIT
(04/18) Special Session on Arrangements of Hypersurfaces, MA
(09/17) MSRI, GTC: Modern techniques and methods
(09/17) MSRI, Intro Workshop: Geometric and Topological Combinatorics
(08/17) SIAM (AG)^2, Minisympoisum on Algebraic Methods in Rigidity Theory
(07/17) ILAS, Linear Algebra and Positivity with Applications to Data Science
(07/17) FOCM, Workshop on Computational Algebraic Geometry, Barcelona
(05/17) SIAM OPT, Polynomial Optimization and Sums-of-Squares, Vancouver
(03/17) U. Calgary Operations research seminar
(03/17) Real Algebraic Geometry Workshop, Oberwolfach
(01/17) JMM, SIAM Minisymposium on Applications of Algebra, Geometry, and Topology
(01/17) JMM, Gaussian Graphical Models and Combinatorial Algebraic Geometry
(12/16) Dagstuhl: Algorithms and Effectivity in Tropical Mathematics and Beyond, Germany
(10/16) Valley Geometry Seminar, Amherst, MA
(07/16) MTNS, Invited Session on Hyperbolic Polynomials
(03/16) Clemson, joint Operations Research/Algebraic Geometry seminar, Clemson, SC
(02/16) University of Miami, Combinatorics seminar, Miami, FL
(01/16) Joint Math Meetings, Special Session on Nonlinear Algebra
(12/15) Simons Institute, Algorithms and Complexity in Algebraic Geometry Reunion
(12/15) Fields Institute, Computations in Real Algebraic Geometry
(11/15) Wesleyan U., Math Colloquium, Middletown, CT
(10/15) UNC Statistics and Operations Research Colloquium, Chapel Hill, NC
(07/15) ALTA: Frames and Algebraic & Combinatorial Geometry, Bremen, Germany
(07/15) ISMP (International Symposium on Mathematical Programming), Pittsburgh, PA
(05/15) SAMPTA (Sampling Theory and Applications), Washington D.C.
(04/15) MAGA (Meeting on Algebraic Geometry for Applications), Atlanta, GA
(04/15) Georgia Tech Algebra Seminar, Atlanta, GA
(04/15) USC Algebraic Geometry, Commutative Algebra, and Number Theory Seminar
(04/15) USC Mathematics Colloquium, Columbia, SC
(03/15) Caltech Algebraic Geometry Seminar, Pasadena, CA
(03/15) MSRI Hot Topics: Kadison-Singer, Interlacing Polynomials, and Beyond
(02/15) IMA Convexity and Optimization, Minneapolis, MN
(12/14) FOCM, Workshop on Computational Algebraic Geometry
(12/14) FOCM, Workshop on Continuous Optimization
(10/14) San Jose State Combinatorics seminar, San Jose, CA
(10/14) Special Session on Algebraic Geometry, Fall Western AMS Sectional Meeting
(10/14) UC Berkeley Combinatorics seminar
(06/14) SIAM Discrete Mathematics, Minneapolis, MN
(06/14) ICERM conference on Nonlinear Algebra, Providence, RI
(04/14) AGNES (Algebraic Geometry Northeastern Series) Stonybrook, NY
(04/14) IPAM Workshop on Tools from Algebraic Geometry, Los Angeles, CA
(04/14) CMU Operations Research seminar, Pittsburgh, PA

(03/14) Texas A&M Algebraic Geometry Seminar, College Station, TX
(03/14) Southwest Local Algebra Meeting Texas A&M, College Station, TX
(01/14) IUS Polyhedra, Lattices, Algebra, and Moments, Singapore
(12/13) IUS Optimization, Moment Problems, and Geometry Conference, Singapore
(10/13) U Wisconsin, Applied Algebra Seminar, Madison, WI
(10/13) Loyola Algebra and Combinatorics Seminar, Chicago, IL
(09/13) University of Oslo Seminar in Algebra and Algebraic Geometry, Oslo, Norway
(08/13) SIAM Applied Algebraic Geometry, Fort Collins, CO
(07/13) SIAM Annual Meeting, San Diego, CA
(04/13) AMS Western Sectional, Boulder, CO
(03/13) Columbia Discrete Math, New York, NY
(02/13) NCSU Symbolic Computation Seminar, Raleigh, NC
(11/12) Texas A&M Geometry Seminar, College Station, TX
(09/12) U Michigan Combinatorics Seminar, Ann Arbor, MI
(07/12) SIAM Annual Meeting, Convex Algebraic Geometry and Optimization
(05/12) Michigan Computational Algebraic Geometry, Oakland U., Rochester, MI
(05/12) Fields Institute, From Dynamics to Complexity
(04/12) Oakland U. Math Colloquium, Rochester, MI
(03/12) Lehigh U. ISE Seminar, Bethlehem, PA
(03/12) U. Waterloo, Optimization Seminar, Waterloo, ON
(02/12) Georgia Tech Algebra Seminar, Atlanta, GA
(02/12) U. Michigan Algebraic Geometry Seminar, Ann Arbor, MI
(11/11) NCSU, Symbolic Computation seminar , Raleigh, NC
(10/11) Applied Algebra Days at University of Wisconsin, Madison, WI
(10/11) SIAM – Applied Algebraic Geometry, Algebraic Geometry in Convex Optimization
(09/11) U. Michigan Combinatorics Seminar, Ann Arbor, MI
(07/11) Combinatorial Methods in Algebraic Geometry and Commutative Algebra, Leipzig
(07/11) U. Konstanz Real Geometry and Algebra Seminar, Konstanz, Germany

Expository Talks

(07/21) Symposium on Theory of Computing Tutorial (online)
(05/19) ASGARD Math 2019 University of Oslo, Norway (3 lectures)
(01/19) JMM, AMS Short Course on Sums of Squares
(09/18) Nonlinear Algebra Bootcamp, ICERM
(06/18) Summer School: Hyperbolic Poly., SOS and Optimization, Georgia Tech (4 lectures)
(02/18) NCSU SUM Series, Raleigh, NC
(01/18) NCSU SUM Series, Raleigh, NC
(10/17) Berkeley Math Circle
(07/17) Workshop on Real Algebraic Geometry, Max Planck Institute, Leipzig
(03/17) PIMS Lunchbox Lecture, Calgary, Canada
(02/17) NCSU SUM Series, Raleigh, NC
(10/16) NCSU SUM Series, Raleigh, NC
(09/16) NCSU SUM Series, Raleigh, NC
(07/16) Summer School: Real Alg. Geom. and Optimization, Georgia Tech (3 lectures)
(09/15) NCSU SUM Series, Raleigh, NC
(09/14) Simons Institute, Algebraic Geometry Boot Camp, Berkeley, CA
(09/13) U Michigan "What is" seminar, Ann Arbor, MI

(11/12) U Michigan Math Club, Ann Arbor, MI
(10/12) U Michigan Postdoc Algebraic Geometry Seminar, Ann Arbor, MI
(02/12) U Michigan Math Club
(01/12) U Michigan Postdoc Algebraic Geometry Seminar, Ann Arbor, MI

K-12 Outreach Presentations

(10/17) Berkeley Math Circle
(04/17) Keynote, Sonia Kovalevsky Day, NCSU
(07/15) MathILy Daily Gather, Bryn Mawr, PA
(07/15) MathILy "Week of Chaos" class, Bryn Mawr, PA (5 lectures)
(07/14) MathILy Daily Gather, Bryn Mawr, PA

Service

Professional Service

SIAM activity group for Algebraic Geometry, Program Director, 2022 - present
SIAM Journal on Applied Algebra and Geometry (SIAGA), Associate Editor, 2021-present
Program Committee, Effective Methods in Algebraic Geometry (MEGA) 2022
Program Committee, Foundations of Computer Science (FOCS) 2021
The American Mathematical Monthly, Associate Editor, 2016 - 2021
Refereed 63 journal articles, (2010 - present)

Co-organization of non-local conferences/workshops/meetings

Oberwolfach: New Directions in Real Algebraic Geometry, March 2023
MSRI Summer School: Sums of Squares Method in Geometry, Combinatorics and Optimization, August 2022
SIAM $(AG)^2$ Minisymposium on Convex Algebraic Geometry, August 2021
SIAM $(AG)^2$ Minisymposium on Positive and Negative Association, August 2019
Banff Workshop on Geometry of Real Polynomials, Convexity and Optimization, May 2019
ICERM semester on Nonlinear Algebra, Fall 2018
ICERM Workshop on Real Algebraic Geometry and Optimization, ICERM, Oct. 2018
Oberwolfach, Algebraic, Geometric, and Combinatorial Methods in Frame Theory, Oct. 2018
Simons Workshop: Hierarchies, Ext. Form. and Matrix-Analytic Techniques, Nov. 2017
MSRI Connections for Women: Geometric and Topological Combinatorics, Sept. 2017
SIAM $(AG)^2$ Minisymposium: Semidefinite Opt. and Convex Alg. Geometry, Aug. 2017
AMS SE Sectional Special Session: Discrete and Applied Algebraic Geometry, March 2016
MSRI Hot Topics: Kadison-Singer, Interlacing Polynomials, and Beyond, March 2015
Graduate Workshop, Simons Institute, Nov. 2014
MathFest Invited Paper Session: "Convex Algebraic Geometry", Summer 2012

Organization of local seminars/conferences (NCSU 2015-2020, UW 2021-present)

Co-organizer, Combinatorial, Computational, and Applied Algebraic Geometry, June 2022
Organizer, Reading seminar on stable polynomials at UW (online), Spring 2021
Steering committee, Triangle lectures in combinatorics, 2016 - 2021
Co-organizer, SUM Series (weekly informal math talks for NCSU undergrads) 2015 -2020
Local organizing committee, Triangle lectures in combinatorics, 2/15, 11/16, 3/18, 11/20
Co-organizer, SAMSI Working Group on Sums of Squares, Fall 2016
Co-organizer, Reading seminar on tropical geometry and optimization, Summer 2016

PhD committees for other universities
Goethe-Universität Frankfurt, Germany, Thesis reviewer, 2022
Sorbonne Université, France, Thesis defense committee member, 2021
École Polytechnique, France, Thesis defense committee member, 2018
Aalto University, Finland, Thesis pre-examiner, 2014