

# Brian Simanek

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## Employment

- Baylor University*: Assistant Professor August 2015 - Present
- Vanderbilt University*: Non Tenure-Track Assistant Professor August 2012 - July 2015

## Education

- California Institute of Technology
  - Ph.D. in Mathematics, June 2012
    - Advisor: Barry Simon
    - Thesis Title: Asymptotic Properties of Orthogonal and Extremal Polynomials
- Williams College
  - Bachelor of Arts 2007, *Summa Cum Laude*, Highest Honors in Mathematics
  - Double Major: Mathematics and Physics

## Awards and Honors

- Simons Collaboration Grant: 2020 – Present
- NSF Conference Grant (co-PI): *Texas Analysis and Math Physics Symposium*, 2018
- NSF Conference Grant (co-PI): *Constructive Functions 2014 Conference and School*, 2014
- AMS-Simons Travel Grant, July 2013 – June 2015
- National Science Foundation (NSF) Graduate Research Fellow, 2009–2012
- Barry Goldwater Scholar, 2006
- Williams College Rosenberg Prize in Mathematics, 2007
- Williams College Phi Beta Kappa, 2006
- National Merit Scholar, 2003

## Publications

- (31) (with M. Hunziker, A. Martinez-Finkelshtein, and T. Poe) *On foci of ellipses inscribed in cyclic polygons*, submitted for publication.
- (30) (with M. Hunziker, A. Martinez-Finkelshtein, and T. Poe) *Poncelet-Darboux, Kippenhahn, and Szegő: interactions between projective geometry, matrices, and orthogonal polynomials*, preprint.
- (29) *Convergence rates of exceptional zeros of exceptional orthogonal polynomials*, submitted for publication.
- (28) (with K. Johnson) *Electrostatic equilibria on the unit circle via Jacobi polynomials*, *Journal of Mathematical Physics* 61 (2020), no. 12, 122901.
- (27) (with L. Harris) *Interpolation and cubature for rectangular sets of nodes*, accepted for publication in the *Proceedings of the American Mathematical Society*.

- (26) (with T. Le) *Hyponormal Toeplitz operators on weighted Bergman space*, accepted for publication in *Integral Transforms and Special Functions*.
- (25) *Zero spacings of paraorthogonal polynomials on the unit circle*, *Journal of Approximation Theory* 256 (2020), 105437.
- (24) (with R. Grigorchuk) *Spectra of Cayley graphs of the lamplighter group and random Schrödinger operators*, accepted for publication in *Transactions of the American Mathematical Society*.
- (23) (with A. Martinez-Finkelshtein and B. Simon) *Poncelet's Theorem, paraorthogonal polynomials and the numerical range of compressed multiplication operators*, *Advances in Mathematics* 49 (2019), 992–1035.
- (22) *Hyponormal Toeplitz operators with non-harmonic algebraic symbol*, *Analysis and Mathematical Physics* 9 (2019), no. 4, 1613–1626.
- (21) (with B. Osting) *A maximal energy pointset configuration problem*, *Journal of Math Analysis and Applications* 85 (2020), no. 2, 123830.
- (20) *Applications of a new formula for OPUC with periodic Verblunsky coefficients*, *Research in the Mathematical Sciences* 5 (2018), no. 4, 5–42.
- (19) *Universality at an endpoint for orthogonal polynomials with Geronimus-type weights*, *Proceedings of the American Mathematical Society* 146 (2018), no. 9, 3995–4007.
- (18) (with M. Derevyagin) *Asymptotics for polynomials orthogonal in an indefinite metric*, *Journal of Math Analysis and Applications* 460 (2018), no. 2, 777–793.
- (17) (with M. Fleeman) *Torsional rigidity and Bergman analytic content of simply connected regions*, *Computational Methods and Function Theory* 19 (2019), no. 1, 37–63.
- (16) (with T. Ferguson and T. Mei)  *$H^\infty$ -calculus for semigroup generators on BMO*, *Advances in Mathematics* 347 (2019), 408–441.
- (15) (with M. Derevyagin) *On Szegő's Theorem for a non-classical case*, *Journal of Functional Analysis* 272 (2017), no. 6, 2487–2503.
- (14) (with C. Beneteau, D. Khavinson, C. Liaw, and D. Seco) *Zeros of optimal polynomial approximants, Jacobi matrices, and Jentzsch-type theorems*, *Revista Matemática Iberoamericana* 35 (2019), no. 2, 607–642.
- (13) *Two universality results for polynomial reproducing kernels*, *Journal of Approximation Theory* 216 (2017), 16–37.
- (12) *Relative asymptotics for general orthogonal polynomials*, *Michigan Mathematical Journal* 66 (2017), no. 1, 175–193.
- (11) *Asymptotically optimal configurations for Chebyshev constants with an integrable kernel*, *New York Journal of Mathematics* 22 (2016), 667–675.
- (10) *An electrostatic interpretation of the zeros of paraorthogonal polynomials on the unit circle*, *SIAM Journal on Mathematical Analysis* 48 (2016), no. 3, 2250–2268.
- (9) (with D. Hardin and E. Saff) *Periodic discrete energy for long-range potentials*, *Journal of Mathematical Physics* 55 (2014), no. 12, 123509.
- (8) *The Bergman shift operator on polynomial lemniscates*, *Constructive Approximation* 41 (2015), no. 1, 113–131.

- (7) *Ratio asymptotics, Hessenberg matrices, and weak asymptotic measures*, International Math Research Notices (2014), no. 24, 6798–6825.
- (6) (with Erwin Miña-Díaz) *Spectral transforms of measures and orthogonal polynomials on regions*, Journal of Mathematical Analysis and Applications, 407 (2013), no. 2, 290–304.
- (5) *A new approach to ratio asymptotics for orthogonal polynomials*, Journal of Spectral Theory 2 (2012), no. 4, 373–395.
- (4) *Asymptotic properties of extremal polynomials corresponding to measures supported on analytic regions*, Journal of Approximation Theory, 170 (2013), 172–197.
- (3) *Weak convergence of CD kernels: A new approach on the circle and real line*, Journal of Approximation Theory 164 (2012), no. 1, 204–209.
- (2) *Zeros of non-Baxter paraorthogonal polynomials on the unit circle*, Constructive Approximation, 35 (2012), no. 1, 107–121.
- (1) (with J. Chatlos, N. Watson, and S. Wu) *Semi-lical formal fibers of principal prime ideals*, Journal of Commutative Algebra 4 (2012), no. 3, 369–385.
- (0) (with G. Hatfull, M. Pedulla, D. Jacobs-Sera, et al.) *Exploring the mycobacteriophage metaproteome: phage genomics as an educational platform*, PLoS Genetics 2:e92 (2006).

### Volumes Edited

- (with Doug Hardin and Doron Lubinsky) *Modern trends in constructive function theory*, Contemporary Mathematics, 661, American Mathematical Society, Providence, RI, 2016.

### Invited Talks

- AMS Section Meeting: Special Session, Virtual, October, 2020
  - *Orthogonal Polynomials and Poncelet Ellipses*
- OPSFA: Special Session, Hagenberg, Austria, July, 2019
  - *Blaschke Products, Numerical Ranges, and Zeros of Orthogonal Polynomials*
- Southeastern Analysis Meeting, Tuscaloosa, AL, March, 2019
  - *Blaschke Products, Numerical Ranges, and Zeros of Orthogonal Polynomials*
- Workshop on Groups, Dynamics, and Operator Algebras, Texas A&M, November, 2018
  - *Blaschke Products, Numerical Ranges, and Zeros of Orthogonal Polynomials*
- AMS Section Meeting: Special Session, Portland State, April, 2018
  - *Hyponormal Toeplitz Operators Acting on the Bergman Space*
- Analysis, Approximation Theory, Operator Theory and their Interconnections; Columbus, OH, March, 2018
  - *Geronimus Polynomials and Chebyshev Polynomials*
- Joint Mathematics Meetings Special Session, San Diego, January, 2018
  - *Geronimus Polynomials and Chebyshev Polynomials*
- AMS Section Meeting: Special Session, UCF, September, 2017

- *Torsional Rigidity and Bergman Polynomials*
- Foundations of Computational Math (workshop talk), Barcelona, Spain, July, 2017
  - *Bergman Polynomials and Torsional Rigidity*
- Joint Mathematics Meetings Special Session, Atlanta, GA, January, 2017
  - *New Universality Results for Polynomial Reproducing Kernels*
- Methods of Modern Mathematical Physics, Fields Institute, Toronto, August, 2016
  - *Zeros of Optimal Polynomial Approximants*
- Orthogonal and Multiple Orthogonal Polynomials, BIRS-CMO, Mexico, August, 2015
  - *Orthogonal Polynomials and the Bergman Shift Matrix*
- OPSFA: Special Session, NIST, Gaithersburg, MD, USA, June, 2015
  - *Ratio Asymptotics and Weak Asymptotic Measures*
- Complex Analysis & Dynamical Systems VII, Nahariya, Israel, May, 2015
  - *Paraorthogonal Polynomials and Electrostatics on the Unit Circle*
- AMS Section Meeting: Special Session on Spectral Theory, U. of New Mexico, April, 2014
  - *Orthogonal Polynomials and the Bergman Shift Operator*
- SIAM Annual Meeting, July, 2013
  - *Spectral Transforms and Orthogonal Polynomials on Regions*
- AMS Section Meeting: Special Session on Approximation Theory, Ole Miss, March, 2013
  - *The Bergman Shift Operator on Weighted Spaces*
- AMS Section Meeting: Special Session on Spectral Theory, USF, March, 2012
  - *Ratio Asymptotics for General Orthogonal Polynomials*

### Seminar Talks

- Rice Spectral Theory Seminar, Houston, TX, March, 2020
  - *Torsional Rigidity of Planar Domains*
- Joint KTH/Stockholm University Analysis Seminar, Stockholm, Sweden, April, 2019
  - *Blaschke Products, Numerical Ranges, and Zeros of Orthogonal Polynomials*
- Lund University Analysis Seminar, Lund, Sweden, April, 2019
  - *Blaschke Products, Numerical Ranges, and Zeros of Orthogonal Polynomials*
- Texas A&M Groups and Dynamics Seminar, College Station, TX, March, 2019
  - *Spectral Theory of Graph Laplacians and Orthogonal Polynomials*
- Houston Analysis Seminar, Houston, TX, March, 2019
  - *Blaschke Products, Numerical Ranges, and Zeros of Orthogonal Polynomials*
- Kentucky Analysis & PDE Seminar, Lexington, KY, December, 2018
  - *Blaschke Products, Numerical Ranges, and Zeros of Orthogonal Polynomials*
- Baylor Analysis Seminar, Waco, TX, November, 2018

- *Blaschke Products, Numerical Ranges, and Zeros of Orthogonal Polynomials*
- The Ohio State Analysis and Operator Theory Seminar, Columbus, OH, January, 2017
  - *Relative Asymptotics of Orthogonal Polynomials*
- University of Mississippi Analysis Seminar, Oxford, MS, March, 2016
  - *Paraorthogonal Polynomials on the Unit Circle and Their Zeros*
- Baylor Analysis Seminar, Waco, TX, September, 2015
  - *An Introduction to Minimum Energy Problems and Extremal Polarization Configurations for Integrable Kernels*
- Hebrew University of Jerusalem PDE Seminar, Jerusalem, Israel, May, 2015
  - *Paraorthogonal Polynomials and Electrostatics on the Unit Circle*
- University of Cyprus Math Seminar, Nicosia, Cyprus, May, 2015
  - *Ratio Asymptotics & Weak Asymptotic Measures for General Orthogonal Polynomials*
- University of Utah Applied Math Seminar, Salt Lake City, UT, April, 2015
  - *Paraorthogonal Polynomials and Electrostatics on the Unit Circle*
- University of Copenhagen Analysis Seminar, March, 2012
  - *Asymptotics of General Orthogonal Polynomials*
- University of Mississippi Analysis Seminar, March, 2012
  - *Asymptotic Properties of Extremal Polynomials*
- UC Irvine Mathematical Physics Seminar, March, 2012
  - *Asymptotic Properties of Extremal Polynomials*

### **Selected Contributed Talks**

- TexAMP, Rice University, January, 2020
  - *Zeros of Paraorthogonal Polynomials*
- TexAMP, University of Texas, November, 2017
  - *Geronimus Polynomials and Chebyshev Polynomials*
- OPSFA, Kent University, UK, July, 2017
  - *Non-classical orthogonal polynomials on the unit circle*
- Computational Methods and Function Theory, Lublin, Poland, July, 2017
  - *Asymptotically optimal point configurations for Chebyshev constants*
- TexAMP, Rice University, October, 2016
  - *Universality Results for Polynomial Reproducing Kernels*
- Southeastern Analysis Meeting, South Florida, March, 2016
  - *Relative Ratio Asymptotics for General Orthogonal Polynomials*
- TexAMP, UT-Dallas, November 2015
  - *Right Limits of the Bergman Shift Matrix*

- Joint Mathematics Meetings Contributed Session, San Antonio, TX, January, 2015
  - *Optimal Polarization for Integrable Kernels*
- ESI Workshop on Optimal Point Configurations, Vienna Austria, October, 2014
  - *Periodic Discrete Energy*
- Midwestern Workshop on Asymptotic Analysis, Fort Wayne, IN September, 2014
  - *Orthogonal Polynomials on Polynomial Lemniscates*
- Constructive Functions, Vanderbilt, May, 2014
  - *Periodic Discrete Energy in Euclidean Space*
- Computational Methods and Function Theory, Shantou China, June, 2013
  - *Asymptotics of Orthogonal and Extremal Polynomials*
- Ph.D. Thesis Defense, Caltech, May, 2012
  - *Asymptotic Properties of Orthogonal and Extremal Polynomials*
- Western States Mathematical Physics Meeting, Caltech, February, 2012
  - *Ratio Asymptotics for Extremal Polynomials*
- OPSFA, Madrid Spain, August, 2011
  - *Asymptotic Properties of Polynomials Orthogonal over Analytic Regions*
- International Symposium in Approximation Theory, Vanderbilt, May, 2011
  - *Weak Convergence of CD Kernels: A New Approach*

### Teaching Experience

- Baylor University
  - Instructor for Calculus I (Fall 2015), Calculus II (Fall 2016 & Fall 2020), Calculus III (Fall 2017, Fall 2018, & Fall 2019), Complex Variables (Spring & Fall 2016), Cryptology (Spring 2021), Matrix Theory (Fall 2019 & Fall 2020), Graduate Complex Analysis (Spring 2018 & Spring 2020), Potential Theory (Spring 2017).
- Vanderbilt University
  - Instructor for Accelerated Calculus II (Fall 2014), Graduate Complex Analysis (Fall 2014), Ordinary Differential Equations (Spring 2014), Accelerated Calculus I (Fall 2013), Differential Equations with Linear Algebra (Spring 2013).
  - TA for Accelerated Calculus I, Fall 2012.

### Student Research Supervised

- Kev Johnson (Ph.D. student, 2018–2020)
- Taylor Poe (Ph.D. student, 2019–present; joint with A. Martinez-Finkelshtein)
- Harrison Jansma (undergraduate thesis, 2016–2017)
- Dohyun Kim (undergraduate independent study, 2017–2018)

### Conferences and Workshops Attended

- Many-Body Theory, Random Operators, & Matrices, Institut Mittag-Leffler, April, 2019

- Groups, Dynamics, and Operator Algebras, Texas A&M, November, 2018
- Analysis, Approximation Theory, Operator Theory and their Interconnections, 2018
- Foundations of Computational Math, Barcelona, Spain, July, 2017
- Conference on Methods of Modern Mathematical Physics, Toronto, August, 2016
- Southeastern Analysis Meeting, South Florida, March, 2016 & Alabama, March, 2019
- TexAMP: UT-Dallas (2015), Rice (2016 & 2020), UT-Austin (2017), Baylor (2018)
- Orthogonal and Multiple Orthogonal Polynomials, Oaxaca Mexico, August, 2015
- Complex Analysis & Dynamical Systems VII, Nahariya Israel, May, 2015
- ESI Workshop on Optimal Point Configurations, Vienna Austria, October, 2014
- Midwestern Workshop on Asymptotic Analysis, Fort Wayne, IN September, 2014
- Recent Methods in Sphere Packing and Optimization, Oberwolfach, Germany June, 2014
- Constructive Functions 2014, Nashville, TN May, 2014
- SIAM Annual Meeting, San Diego, CA July, 2013
- CMFT: Shantou, China (2013) & Lublin, Poland (2017)
- Arizona School of Analysis and Mathematical Physics, Tucson, AZ March, 2012
- AMS Section Meeting

- Tampa ('12), Oxford, MS ('13), Albuquerque ('14), Orlando ('17), Portland ('18), Virtual ('20)

- Partial Differential Equations and Spectral Theory, London, UK September, 2011
- OPSFA: Madrid (2011), NIST (2015), Canterbury (2017), Hagenberg (2019)
- NSF-CBMS Conference on Global Harmonic Analysis, Lexington, KY June, 2011
- International Symposium in Approximation Theory, Nashville, TN May, 2011
- PIMS Summer School in Probability, Seattle, WA, June, 2010
- AMS-MAA Joint Meetings

- San Francisco ('10), San Antonio ('15), Atlanta ('17), San Diego ('18)

- Southern California Analysis and PDE, Fall, 2009 & 2011 (Irvine) & 2010 (UCLA)
- Western States Mathematical Physics Meeting, Caltech, February, 2009 – 2012

## Service

- Co-organizer of Baylor Analysis Seminar (2015 - present)
- Baylor Math Colloquium Chair (2017 - present)
- Referee for
  - *Advances in Mathematics*, *Bulletin of the London Mathematical Society*, *Computational Methods and Function Theory*, *Constructive Approximation*, *Discrete & Computational Geometry*, *Electronic Transactions in Numerical Analysis*, *Experimental Mathematics*, *Forum Mathematicum*, *Journal d'Analyse Mathématique*, *Journal of Approximation Theory*, *Journal of Inequalities and Applications*, *Journal of Math Analysis and Applications*, *Journal of Spectral Theory*, *Journal of Statistical Physics*,

*Matematicheskii Sbornik, Mathematical Models & Methods in Applied Sciences, Minnesota Journal of Undergraduate Mathematics, Proceedings of the AMS, The Ramanujan Journal, Random Matrices: Theory and Applications, Reports on Mathematical Physics, Rocky Mountain Journal of Mathematics, and SIGMA*

- Reviewer for Math Reviews
- Review Editor for Mathematics of Computation and Data Science, 2016–2019
- Organizing Committee for 2018 Texas Analysis and Mathematical Physics Symposium
- Baylor chapter of Phi Beta Kappa (member: 2015–present; treasurer: 2018–present)
- Baylor Calendar Committee (2019–present)
- Baylor Public Exercises Committee (2019–present)
- Baylor Math Club advisor (2020–present)
- Organizing Committee for Constructive Functions 2014 Conference & School

### **Research and Work Experience**

- Researcher in SMALL REU at Williams College, June–August, 2005
- Microbiology Laboratory Technician at University of Pittsburgh, June–July, 2003

### **Other**

- US Citizen
- AMS Member
- Beginner reading and speaking ability in French
- Familiarity with Mathematica, C++, and LaTeX