

Erik Lundberg

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Curriculum Vitae

Appointments

- 2019–present **Florida Atlantic University**, Associate Professor of Mathematics.
- 2014–2019 **Florida Atlantic University**, Assistant Professor of Mathematics.
- 2011–2014 **Purdue University**, Golomb Visiting Assistant Professor of Mathematics.

Education

- 2011 **Ph.D., Mathematics**, University of South Florida, Thesis advisor: Dmitry Khavinson, Thesis topic: Potential theory and mathematical physics.
- 2005 **B.S., Mathematics**, University of Florida, *summa cum laude*.

Books authored and volumes edited

- 2018 **Linear Holomorphic Partial Differential Equations and Classical Potential Theory**, *AMS surveys and monographs, Vol. 232, 2018, 214 pp.*, (co-authored with D. Khavinson).
Proceedings of the conference “Complex functions, operators, partial differential equations, and applications to mathematical physics”, *special issue of Analysis and Mathematical Physics*, Volume 8 (2018) Issue 2, (co-edited with R. Teodorescu).

Publications (peer-reviewed)

- Topologies of random geometric complexes on Riemannian manifolds in the thermodynamic limit**, to appear in *IMRN* (with A. Auffinger and A. Lerario)
- Asymptotic enumeration of lonesum matrices**, to appear in *Adv. Appl. Math* (with J. Khera and S. Melczer)
- A note on the critical points of the localization landscape**, to appear in *Complex Analysis and its Synergies*. (with K. Ramachandran)
- The lemniscate tree of a random polynomial**, to appear in *Annales de l’Institut Fourier* (with M. Epstein and B. Hanin)
- 2019 **Random fields and the enumerative geometry of lines on real and complex hypersurfaces**, *Math. Ann.* 374 (2019), 1773-1810. (with S. Basu, A. Lerario, and C. Peterson)
- 2018 **EGBTER: Capturing degree distribution, clustering coefficients, and community structure in a single random graph model**, proceedings of the conference on Advances in Social Networks Analysis and Mining, (with O. Eldaghar and R.A. Bridges)
- 2017 **The arclength and topology of a random lemniscate**, *J. London Math. Soc.*, 96 (2017), 621-641. (with K. Ramachandran)
- A four-dimensional Neumann ovaloid**, *Arkiv för Matematik*, 55 (2017), 185-198. (with L. Karp)
- The Bergman analytic content of planar domains**, *Comput. Meth. Fct. Thy.*, 17 (2017), 369-379. (with M. Fleeman)
- Dirichlet’s problem with entire data posed on an ellipsoidal cylinder**, *Potential Analysis*, 46 (2017), 55-62. (with D. Khavinson and H. Render)

- The Dirichlet problem for the slab with entire data and a difference equation for harmonic functions**, *Canadian Math. Bull.*, 60 (2017), 146-153. (with D. Khavinson and H. Render)
- 2016 **On the geometry of random lemniscates**, *Proc. of the London Math. Soc.*, 113 (2016), 649-673. (with A. Lerario)
- On the zeros of random harmonic polynomials: The truncated model**, *J. Math. Analysis Appl.*, 438 (2016), 1041-1054. (with A. Lerario)
- Gap probabilities and Betti numbers of a random intersection of quadrics**, *Discrete Comput. Geom.*, 55 (2016), 462-496. (with A. Lerario)
- 2015 **On the growth of solutions to the minimal surface equation over domains containing a halfplane**, *Calc. Var. PDE*, 54 (2015), 3385-3395. (with A. Weitsman)
- A solution to T. Sheil-Small's harmonic mapping problem for polygons**, *Proc. AMS*, 143 (2015), 5219-5225. (with D. Bshouty and A. Weitsman)
- On the number of connected components of random algebraic hypersurfaces**, *J. Geom. Physics*, 95 (2015), 1-20. (with Y. V. Fyodorov and A. Lerario)
- Quasi-exceptional domains**, *Pacific J. Math.*, 276 (2015), 167-183. (with A. Eremenko)
- Electrostatic skeletons**, *Annales Academiae Scientiarum Fennicae*, 40 (2015), 397-401. (with K. Ramachandran)
- Statistics on Hilbert's sixteenth problem**, *Int. Math. Res. Not.*, 12 (2015), 4293-4321. (with A. Lerario)
- Experiments on the zeros of random polynomials using certified counting**, *Exper. Math.*, 24 (2015), 133-141. (with J. Hauenstein, A. Lerario, and D. Mehta)
- Remarks on Wilmsurth's theorem**, *Indiana Univ. Math. J.*, 64 (2015), 1153-1167. (with S-Y. Lee and A. Lerario)
- Asymptotics of the extremal exceedance set statistic**, *European J. Combin.*, 46 (2015), 75-88. (with R. Ferraz de Andrade and B. Nagle)
- 2014 **A tale of ellipsoids in potential theory**, *Notices of the AMS*, 61 (2014), 148-156. (with D. Khavinson)
- Self-commutators of Toeplitz operators and isoperimetric inequalities**, *Proc. Royal Irish Acad.*, 114 (2014), 115-132. (with S. R. Bell and T. Ferguson)
- Spiral galaxy lensing: a model with twist**, *Math. Physics, Anal., and Geom.*, 17 (2014), 9157. (with S. R. Bell, B. Ernst, S. Fancher, Ch. R. Keeton, and A. Komanduru)
- 2013 **Non-algebraic quadrature domains**, *Potential Anal.*, 38 (2013), 787-804. (with A. Eremenko)
- An overdetermined problem in potential theory**, *Pacific J. Math.*, 265 (2013), 85-111. (with D. Khavinson and R. Teodorescu)
- Generalized pattern frequency in large permutations**, *Electronic J. Combinatorics*, 20 (2013), P28. (with J. Cooper and B. Nagle)
- Lemniscate growth**, *Anal. Math. Physics*, 3 (2013), 45-62. (with V. Totik)
- 2011 **Laplacian growth, elliptic growth, and singularities of the Schwarz potential**, *J. Phys. A: Math. Theor.* 44 (2011) 135202.
- Gravitational lensing by a collection of objects with radial densities**, *Anal. Math. Physics*, 1 (2011), 139-145. (with D. Khavinson)
- Polynomial decompositions and the Khavinson-Shapiro conjecture**, *J. Math. Anal. Appl.* 376 (2011), 506 - 513. (with H. Render)

- 2010 **Transcendental harmonic mappings and gravitational lensing by isothermal galaxies**, *Complex Anal. Oper. Thy.*, 4 (2010), 515 - 524. (with D. Khavinson)
- The search for singularities of solutions to the Dirichlet problem: recent developments**, *CRM Proceedings and Lecture Notes*, 51 (2010), 121-132. (with D. Khavinson)
- 2009 **Fixed points of conjugated Blaschke products with applications to gravitational lensing**, *Comput. Meth. Fct. Thy.*, 9, No. 2 (2009), 435-442. (with L. Kuznia)
- Dirichlet's problem and complex lightning bolts**, *Comput. Meth. Fct. Thy.*, 9 (2009), 111-125.
- 2007 **Almost all orbit types imply period-3**, *Topol. Appl.*, 154 (2007), 2741-2744.

Funding

- 2020-2025 Simons Foundation Collaboration Grant for Mathematicians, \$42,000
- 2019 collaborate@ICERM (travel and accommodation for research visit)
- 2018 Funds to hire a graduate research consultant for research intensive course, \$750
- 2017 NSF Funds for the conference "Complex functions, operators, partial differential equations, and applications in mathematical physics" held at the Mittag-Leffler Institute, \$9,740
- 2017 FAU Faculty Mentoring Program Grant (with W. Kalies), \$6,000
- 2016-2018 FAU Curriculum Grant (with W. Kalies), \$10,000
- 2016-2017 PIC Math (preparation for Industrial Careers in Mathematics; with N. Tuncer), \$5,000
- 2015-2016 PIC Math, \$5,000
- 2014-2015 NASA Florida Hybrid Motor Rocket competition, \$940

Awards

- 2021 CMFT Young Researcher Award (awarded once every four years to a mathematician with research in Analytic Function Theory)
- 2021 FAU College of Science nominee for the 2021 Distinguished Teacher of the Year Award (only one nominee per college)
- 2018 FAU College of Science nominee for the 2017 Distinguished Mentor of the Year (only one nominee per college)
- 2013 Spira award for excellence in teaching at Purdue University (awarded to only one junior faculty member that year)
- 2009 Academic and professional achievement award (awarded to only one graduate student in Mathematics at University of South Florida that year)
- 2005 Kermit Sigmon Scholarship (awarded to only one senior undergraduate student each year at University of Florida)

Presentations

Invited talks

- 2020 (remote) AMS special session "Polynomials, Approximation Theory, and Potential Theory", (Fall 2020)
- (two talks 45-minutes each, remote) Symmetry, Randomness, and Computations in Real Algebraic Geometry, ICERM (Fall 2020)
- (one-hour talk, remote) Joint seminar in Probability + Geometry/Topology, Weizmann Institute (Summer 2020)

- 50th International Conference on Combinatorics, Graph Theory & Computing, Boca Raton (Spring 2020)
- Special Session “Geometry of complex polynomials and rational functions”, JMM, Denver (Spring 2020)
- 2019 AMS Special Session “Nonlinear Elliptic Partial Differential Equations”, Gainesville (Fall 2019)
- 2018 (one-hour talk) Geometry Seminar, SISSA (Summer 2018)
- (40-minute talk) Conference on Complex Analysis, Potential Theory, and Applications, Dublin, Ireland (Summer 2018)
- (one-hour talk) Analysis seminar, Univ. South Florida (Spring 2018)
- AMS special session “Probabilistic models in mathematical physics”, Nashville (Spring 2018)
- AMS special session “Operators on function spaces in one and several variables”, JMM, San Diego (Spring 2018)
- MAA Session “Integrating Research into the Undergraduate Classroom”, JMM, San Diego (Spring 2018)
- 2017 Random Algebraic Geometry minisymposium, SIAM conference on Algebraic Geometry, Atlanta (Summer 2017)
- (one-hour talk) Deterministic and Random Aspects of the Topology of Real Algebraic Varieties, Vanderbilt (Spring 2017)
- Southeastern Analysis Meeting (SEAM), Knoxville, TN (Spring 2017)
- Special session on enumerative combinatorics of trees and permutations, 48th Southeastern International Conference on Combinatorics, Graph Theory & Computing, Boca Raton, (Spring 2017)
- 2016 Stochastic Topology and Thermodynamic Limits, ICERM, (Fall 2016)
- Midwestern workshop on Asymptotic Analysis, IPFW, (Fall 2016)
- Minisymposium on Zeros of harmonic functions in the plane, European Congress of Mathematics, Berlin (Summer 2016)
- (one-hour talk) Statistical topology of random manifolds, ICTP, Trieste (Summer 2016)
- (two part talk) Geometry and Control, SISSA, Trieste (Summer 2016)
- (one-hour talk) Special day on nodal sets of random functions, Northwestern Univ. (Spring 2016)
- International conference on PDE, Complex Analysis, and related topics, Miami (Spring 2016)
- Approximation Theory, special session on random polynomials, San Antonio (Spring 2016)
- (one-hour talk) Geometry Seminar, Florida International Univ. (Spring 2016)
- Southeastern Analysis Meeting, Tampa (Spring 2016)
- (40-minute talk) Special session on Operators, function spaces, and models, Joint Meetings of the AMS, Seattle (Spring 2016)
- 2015 (one-hour talk) Colloquium, Ort Braude College, Israel (Summer 2015)
- Complex Analysis and Dynamical Systems VI, Israel (Summer 2015)
- 2014 Foundations of Computational Mathematics, Montevideo, Uruguay (Fall 2014)
- (one-hour talk) Algebraic Geometry seminar, U.C. Berkeley (Fall 2014)
- (one-hour talk) Astrophysics Seminar, U. Notre Dame (Fall 2014)
- (one-hour talk) Analysis and PDE Seminar, Johns Hopkins U. (Fall 2014)
- Red Raider Mini-symposium, Texas Tech (Fall 2014)

- Special session on Dynamics in systems with interfaces, 10th AIMS conference, Madrid, (Summer 2014)
- (one-hour talk) Algebraic Geometry Seminar, Lyon 1 (Summer 2014)
- (40-minute talk) International Youth Conference on Geometry and Control, Moscow, Russia (Spring 2014)
- (one-hour talk) Colloquium, Baylor U. (Spring 2014)
- (one-hour talk) Colloquium, Oklahoma State U. (Spring 2014)
- (one-hour talk) Colloquium, Florida Atlantic U. (Spring 2014)
- (one-hour talk) Colloquium, NC State (Spring 2014)
- 2013 (one-hour talk) Probability seminar, U. Chicago (Fall 2013)
- (one-hour talk) Harmonic Analysis seminar, UIUC (Fall 2013)
- (one-hour talk) Mini-conference on real algebraic geometry and topology, Lafayette, IN (Fall 2013)
- (one-hour talk) Colloquium, Univ. of Miami (Fall 2013)
- (one-hour talk) Combinatorics seminar, Georgia Tech (Fall 2013)
- Midwest PDE seminar, Lafayette, IN (Fall 2013)
- (40-minute talk) AMS session on operator theory, St. Louis, MO (Fall 2013)
- CMFT conference, Shantou, China (Summer, 2013)
- (one-hour talk) Geometry seminar, Univ. di Pavia, Italy (Summer, 2013)
- (40-minute talk) Hilbert Spaces conference, Gargnano, Italy (Summer, 2013)
- Midwest PDE seminar, Ann Arbor, MI (Spring, 2013)
- AMS session on Teichmüller theory, Ames, IA (Spring 2013)
- Nonlinear Mathematical Physics conference, Tampa, FL (Spring, 2013)
- (one-hour talk) Colloquium, U. of South Florida (Spring, 2013)
- Southeastern Analysis Meeting (SEAM), Blacksburg, VA (Spring 2013)
- 2012 AIMS session on growth models and interface dynamics, Orlando, FL (Summer 2012)
- (two one-hour talks) HCAA conf., Tenerife, Spain (Spring 2012)
- (one-hour talk) Diff. Eq. Seminar, U. of Michigan (Spring, 2012)
- (one-hour talk) Analysis Seminar, Washington U., St. Louis (Spring, 2012)
- 2011 (one-hour talk) Florida Analysis Seminar (FLOAS), Florida Southern College (Spring 2011)
- Southeastern Analysis Meeting (SEAM), Gainesville, FL (Spring 2011)
- 2010 Complex Analysis and Mathematical Physics, Universidad del Bio-Bio, Chile (Fall 2010)
- (40-minute talk) Stochastic and integrable growth dynamics, Banff, Canada (Fall 2010)
- Harmonic and Complex Analysis conf., Bremen, Germany (Summer 2010)
- 2009 (one-hour talk), Erwin Schrödinger Institute, Vienna, Austria (Winter 2009)
- AMS Special Session on Hypercomplex Analysis, Boca Raton, FL (Fall 2009)
- Computational Methods and Function Theory, Ankara, Turkey (Summer 2009)
- 2008 Complex Analysis and Mathematical Physics, Sophus Lie conference center, Norway (Summer 2008)
- (one-hour talk) Dynamical Systems Seminar, U. of Florida, (Spring 2008)
- [Talks for students](#)
- 2018 Keynote address at Mu Alpha Theta Math Competition (with teams from 57 highschools), FAU-Davie, (Spring 2018)

- 2017 Career development talk for FAU graduate students, (Fall 2017)
Colloquium, Nova Southeastern, (Spring 2017)
Spanish River Highschool, (Spring 2017)
- 2016 Colloquium, Florida Gulf Coast University (Fall 2016)
Suncoast Highschool, (Spring 2016)
- 2015 Middle School Math Day, FAU (Fall 2015)
- 2014 Math Club, FAU (Fall 2014)
Colloquium, Oberlin College (Spring 2014)
- 2013 Math Club, Purdue (Fall 2013)
MathFest invited session (Complex Geometry), Hartford, CT (Summer 2013)
- 2012 Math Club, Purdue (Fall 2012)
Bridge to research, Purdue (Fall 2012)
Basic notions seminar, Purdue (Fall 2012)
- 2010 Math Club, U. South Florida, (Fall 2010)
- 2009 Math Club, U. South Florida, (Fall 2009)
- 2008 Graduate student seminar, U. South Florida, (Fall 2008)
Graduate student seminar, U. South Florida, (Spring 2008)
- 2007 Math Club, U. South Florida, (Spring 2007)

Advising and mentoring of students

Ph.D. students supervised

Andrew Thomack, *Random Harmonic Polynomials*, December, 2017, current position: Assistant Professor (tenure-track) at Greenville University.

Zachariah Tyree, *Characterizing the Geometry of a Random Point Cloud*, (co-advised with Hongwei Long), December, 2018, current position: Research scientist at General Motors.

Current Ph.D. students

Jessica Thune.

Sean Perry, (co-advised with William Kalies).

M.S. students supervised

Yuxun Sun, *Random meromorphic lemniscates*, May, 2017.

Andrew Burruss, *Chaos in discrete and continuous systems*, December, 2014.

Undergraduate senior research projects supervised

K. Alex Dowling, *Homotopy types of random cubical complexes*, (graduated with honors), May, 2020.

Omar Eldaghar, *Capturing degree distribution, clustering coefficients, and community structure in a single random graph model*, (graduated with honors), May, 2017.

Chelsey Hoff, *On the number of connected components of spherical harmonics generated by random Maxwell poles*, (graduated with honors), December, 2015.

REU students supervised

Sean Fancher, **Abi Komanduru**, **Brett Ernst**, *Gravitational lensing by spiral galaxies*, Purdue University, Summer, 2012.

Teaching

Undergraduate courses taught

Trigonometry/Precalculus, Calculus I, Calculus II, Calculus III, Linear Algebra, Engineering Mathematics, Ordinary Differential Equations, Second semester in Differential Equations (with intro to PDE), Modern Analysis (undergraduate level), PIC Math (Preparation for Industrial Careers in Mathematics)

Graduate courses taught

Introductory Analysis I, Introductory Analysis II, Multivariable Analysis, Theory of ODE, Analytic Combinatorics (as a seminar course), Scientific computing (project-oriented topics course), Computational homology (project-oriented topics course), PDE

Course development

PIC Math (project-oriented, preparation for industrial careers in mathematics), Analytic Combinatorics (as a seminar course), Scientific computing (project-oriented topics course), Computational homology (project-oriented topics course)

Service and outreach

Editorial work:

- Associate Editor for Analysis and Mathematical Physics (2018 - present)

Referee work:

- Journal of the AMS
- Transactions of the AMS
- Proceedings of the AMS
- The American Mathematical Monthly
- Journal of the London Mathematical Society
- Bulletin of the London Mathematical Society
- Mathematische Annalen
- Annales de l'Institut Fourier
- Journal of Mathematical Analysis and Applications
- Communications in Analysis and Geometry
- Potential Analysis
- Journal of Physics A: Mathematical and Theoretical
- Analysis and Mathematical Physics
- Revista Matemática Iberoamericana
- Revista Matemática Complutense
- Combinatorics, Probability, and Computing
- Contemporary Mathematics
- Mathematical Modelling of Natural Phenomena
- Computational Methods and Function Theory
- Complex Variables and Elliptic Equations
- Complex Analysis and Operator Theory
- Complex Analysis and its Synergies
- Journal of Geometric Analysis

Conferences and seminars organized

co-organizer of AMS special session (remote) "Polynomials, Approximation Theory, and Potential Theory", Southeastern sectional meeting (Fall 2020).

Principal organizer of the international conference: "Complex functions, operators, partial differential equations, and applications in mathematical physics", (Mittag-Leffler Institute, Summer 2017).

(co-organized with J.D. Mireles-James) Weekly seminar on Analysis and Applications at FAU (Fall 2014 - present).

organized graduate seminar-course in Analytic Combinatorics at FAU (Spring, 2015).

(co-organized with Saugata Basu and Antonio Lerario) Seminar on Random Matrix Theory and Real Algebraic Geometry (2012-2013).

Organized problem seminar at Purdue in Complex Analysis and Algebraic Geometry, (Fall 2012, 3 function theorists, 4 geometers).

Organized two-semester seminar at Purdue centered around Zalcman's Lemma (2012-2013, 2 postdocs, 2 graduate students).

(co-organized with Mark D. Ward) seminar-course in Analytic combinatorics with both graduate and undergraduate students, (Spring 2013).

(co-organized with D. Khavinson) Gravitational lensing workshop at U. of South Florida (Summer 2010).

Initiated and organized a student seminar at U. of South Florida (2007 - 2009).

Club advising

- o FAU Math Club: Faculty Advisor 2014-2017

- o FAU team for Hybrid motor rocket competition: Faculty Advisor 2014-2015

Departmental service at FAU

2016-present Master teacher (Fall 2016 - Spring 2020)

2017-2018 Calculus I coordinator: Oversaw implementation of Learning Assistant program in all nine sections of Calculus I in Spring 2018

2016-2017 Effective Teaching Workshop for GTAs: developed and taught (Spring 2017)

2015-2016 Outreach committee: volunteered and/or helped organize several events for middle school and highschool students

Other service

NSF review panel for Harmonic Analysis and Linear PDE (Spring 2020)

References

- o Saugata Basu (Purdue): sbasu@math.purdue.edu

- o Steven R. Bell (Purdue): bell@math.purdue.edu

- o Alexandre Eremenko (Purdue): eremenko@math.purdue.edu

- o Dmitry Khavinson (**Thesis advisor**, U. South Florida): dkhavins@usf.edu

- o John McCarthy (Washington University, St. Louis): mccarthy@wustl.edu

- o Mihai Putinar (UC Santa Barbara): mputinar@math.ucsb.edu