

Oleksandr Vlasiuk

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CONTACT INFORMATION

Department of Mathematics,
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EDUCATION

Vanderbilt University , Ph.D. in Mathematics	2018
Université de Toulon , Master I Mathématiques	2013
Taras Shevchenko National University of Kyiv , B.Sc.	2013

APPOINTMENTS

Vanderbilt University , Lecturer	2022–2023
Vanderbilt University , Postdoctoral Scholar	2021–2022
Florida State University , Postdoctoral Scholar	2018–2021

LONG-TERM VISITS

ICERM , Brown University	Feb 2018–Apr 2018
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RESEARCH INTERESTS

Optimization over spaces of measures, point distributions, statistical mechanics, potential theory, computational and convex geometry.

PUBLICATIONS

1. with A. Reznikov, A. Anderson, E. White, **Polarization and covering on sets of low smoothness**, arXiv:2106.11956, 28 pp, Adv. Math., accepted.
2. with D. Bilyk, R. Matzke, **Positive definiteness and the Stolarsky invariance principle**, arXiv:2110.04138, 30 pp, J. Math. Anal. Appl., accepted.
3. with D. Bilyk, D. Ferizović, A. Glazyrin, R. Matzke, and J. Park, **Potential theory with multi-variate kernels**, 23 pp., Math. Zeitschrift.
doi:10.1007/s00209-022-03000-z, arXiv:2104.03410
4. with D. Bilyk, A. Glazyrin, R. Matzke, and J. Park, **Optimal measures for p-frame energies on spheres**, Rev. Matemática Iberoam.
doi:10.4171/RMI/1329, arXiv:1908.00885.

5. with D. Bilyk, A. Glazyrin, R. Matzke, and J. Park, **Energy on spheres and discreteness of minimizing measures**, J. Funct. Anal., doi:10.1016/j.jfa.2021.108995, arXiv:1908.10354.
6. with A. Reznikov, **Riesz energy on self-similar sets**, Proc. Am. Math. Soc., accepted. doi:10.1090/proc/14663, arXiv:1810.01557
7. with T. Michaels, N. Flyer, and B. Fornberg, **Fast high-dimensional node generation with variable density**, Comput. Math. Appl. 76 (2018), no. 7, 1739–1757. doi:10.1016/j.camwa.2018.07.026, arXiv:1710.05011
8. with A. Reznikov and E. B. Saff, **A minimum principle for potentials with application to Chebyshev constants**, Potential Anal. 47 (2017), no. 2, 235–244. doi:10.1007/s11118-017-9618-x, arXiv:1607.07283
9. with D. P. Hardin and E. B. Saff, **Generating Point Configurations via Hypersingular Riesz Energy with an External Field**, SIAM J. Math. Anal. 49 (2017), no. 1, 646–673. doi:10.1137/16m107414x, arXiv:1605.03840
10. with D. Leviatan and I. A. Shevchuk, **Positive results and counterexamples in comonotone approximation II**, J. Approx. Theory 179 (2014), 1–23. doi:10.1016/j.jat.2013.11.004

PREPRINTS

11. with D. Hardin, E. Saff, **Asymptotics of k-nearest neighbor Riesz energies**, arXiv:2201.00474, 37 pp.
12. with D. P. Hardin and E. B. Saff, **Asymptotic properties of short-range interaction functionals**, arXiv:2010.11937, 62 pp.
13. **Discreteness of the minimizers of weakly repulsive interaction energies on Riemannian manifolds**, arXiv:2003.01597, 8 pp.

PAPERS IN PREPARATION

14. with D. Bilyk, A. Glazyrin, R. Matzke, and J. Park, **Experimental survey of discrete minimizers of the p-frame energy**
15. with E. Saff, M. Vu, **K-nearest neighbor logarithmic energy**

GRANTS AND AWARDS

1. AMS-Simons Travel Grant 2020, \$5000
2. Collaborate@ICERM “Codes and Designs: Optimal Discrete Measures”, August 2021. Joint with Dmitriy Bilyk, Alexey Glazyrin, Ryan Matzke, and Josiah Park.
3. Florida State University Postdoctoral Travel Award, September 2019, \$1000
4. Vanderbilt Graduate Travel Award, September 2016, \$500

PRESENTATIONS

1. Research presentations

- 1) (upcoming) Discrete Systems and Calculus of Variations, Technical University Munich, Nov 2022
- 2) (upcoming) Midwestern Workshop on Asymptotic Analysis, Purdue University Fort Wayne, Oct 2022
- 3) “Nearest neighbor interactions and meshing algorithms”, Point Configurations LMS Research School, University College London, Jul 2022
- 4) “Particle interactions and large-scale optimization”, Mathematics in Computation Seminar, Oak Ridge National Laboratory, Feb 2022
- 5) “Optimal polarization and covering on sets of low smoothness”, ESI Program on “Optimal Point Configurations on Manifolds”, Jan 2022
- 6) “Clustering phenomena for short-range interactions”, SIAM Texas-Louisiana Section, University of Texas Rio Grande Valley, Nov 2021
- 7) “Optimizing short-range interactions for point cloud generation” SIAM SEAS Sectional meeting, Auburn University, Sep 2021
- 8) “Short-range interactions in nature, geometry, and information theory”, Southern Georgia Mathematics Conference, Online, Apr 2021
- 9) “Asymptotic properties of short-range interaction functionals”, MAAM Conference, Online, Oct 2020
- 10) “Asymptotic properties of short-range interaction functionals”, Point Distributions Webinar, Oct 2020
- 11) “Properties of measures that minimize integral energy functionals on the sphere”, AMS Sectional meeting, Gainesville FL, Nov 2019
- 12) “Sparsity of supports of measures minimizing integral energy functionals”, SIAM-SEAS, Knoxville, Sep 2019
- 13) “Properties of minimizers of quadratic functionals over probability measures on homogeneous spaces”, Barcelona Analysis Conference, University of Barcelona, June 2019
- 14) “Minimizers of quadratic functionals over probability measures on the sphere”, Approximation, sampling, and compression in high dimensional problems (workshop), *poster presentation*, INI Cambridge, June 2019
- 15) “Minimizing p -frame energies (and other continuous functionals with radial kernels)” Approximation Theory 16, Vanderbilt University, Nashville, May 2019
- 16) “Minimizers of quadratic functionals over probability measures on the sphere”, Madison Lectures in Fourier Analysis, *poster presentation*, UW Madison, May 2019
- 17) “Minimizing continuous functionals over probability measures”, Shanks Workshop on Energy, Packing, and Covering, Vanderbilt University, Nashville, May 2019
- 18) “Minimizing p -frame energies”, SEAM, University of Alabama, Tuscaloosa, March 2019
- 19) “ T -convergence of hypersingular Riesz energy functionals”, Multivariate Algorithms and their Foundations in Number Theory, Johann Radon Institute, Linz, Nov 2018
- 20) “ T -convergence of hypersingular Riesz energy functionals”, Texas Analysis and Mathematical Physics Symposium, Baylor University, Oct 2018
- 21) “High-dimensional node generation with variable density”, Fast Algorithms for Generating Static and Dynamically Changing Point Configurations, ICERM, March 2018

- 22) “Variable density node distribution: Riesz minimizers and irrational lattices”, Computational and Applied Mathematics seminar, Oak Ridge National Laboratory, Jan 2018
- 23) “Discretizing distributions with Riesz minimizers and irrational lattices”, Analysis seminar, Florida State University, Nov 2017
- 24) “Variable density node distribution: Riesz minimizers and irrational lattices”, Computational Methods and Function Theory, Lublin, July 2017
- 25) “Generating point configurations via hypersingular Riesz energy with an external field”, Joint Mathematics Meetings, Atlanta, Jan 2017
- 26) 1st Northeastern Analysis Meeting, the College at Brockport, SUNY, Oct 2016
- 27) Optimal and random point configurations, Institut Henri Poincaré, Paris, June-July 2016, *poster presentation*

2. Expository and non-research talks

- 1) “Fourier transform, sparsity, and compressed sensing”, FSU Machine Learning seminar, November 2019
- 2) Sphere Packings and Optimal Configurations (summer school), Hausdorff Center for Mathematics, Sep 2019
- 3) “Minimizing p -frame energies”, Mathematics Colloquium, Florida State University, Tallahassee, Jan 2019
- 4) “Sumset estimates and the Menger’s theorem”, Analysis seminar, Florida State University, Nov 2018
- 5) “Basics of large deviations and Cramér’s theorem”, Analysis seminar, Vanderbilt University, Jun 2017,
- 6) “Ball multiplier problem”, Analysis seminar, Vanderbilt University, Apr 2017,
- 7) “Finite Grassmannian frames, spherical codes, and equiangular lines”, Analysis seminar, Vanderbilt University, Apr 2016,
- 8) “Riesz energy with an external field”, Analysis seminar, Vanderbilt University, Apr 2015.

3. Conference visits

- 1) Advances in Mathematical Physics: A Conference in Honor of Elliott H. Lieb on his 90th Birthday, Harvard University, August 2022
- 2) Harmonic Analysis and related topics, Centre de Recerca Matemàtica, Barcelona, Spain, June 2022
- 3) CBMS Conference, Florida State University, May 2022
- 4) (online) Minimal energy problems with Riesz potentials, American Institute of Mathematics, May 2021
- 5) (online) Combinatorial and Geometric Discrepancy, BIRS, Sep 2020
- 6) (online) Online Summer School on Optimization, Interpolation and Modular Forms, EPFL, Aug 2020
- 7) (online) Optimal transport and applications to machine learning and statistics, MSRI, May 2020
- 8) Midwestern Workshop on Asymptotic Analysis, Indiana University in Bloomington, Oct 2015
- 9) Minimal Energy Point Sets, Lattices, and Designs, ESI, Vienna, Oct 2014
- 10) Recent Methods in Sphere Packing and Optimization, Oberwolfach, Jun 2014

TEACHING

1. Methods of Linear Algebra, Vanderbilt University, Fall 2022
2. Methods of Ordinary Differential Equations, Vanderbilt University, Spring-Fall 2022
3. Calculus III, Vanderbilt University, Fall 2021
4. Measure and Integration, Florida State University, Fall 2020–Spring 2021
(*One of the basic courses in the graduate program at FSU. Followed by a prelim.*)
5. Calculus II, Florida State University, Spring 2019–Spring 2021
6. Calculus II, Vanderbilt University, Fall 2017 (TA)
7. Statistical learning, Vanderbilt University, Fall 2017 (TA)
8. Calculus I, Vanderbilt University, Fall 2015–Spring 2017 (TA)
9. Analysis, Vanderbilt University, Fall 2014–Spring 2015 (TA)

SERVICE

1. Coorganizer of the special session on “Energy-minimizing point configurations and measures” at the 15th Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing Conference, Linz, Austria, July 2022
2. Coorganizer of the minisymposium on “Point configurations on curves and surfaces and related energy problems” at the 10th International Conference on Curves and Surfaces, Arcachon, France, June 2022
3. Coorganizer of Point Distributions Webinar, Summer 2020–Spring 2022
4. Coorganizer of the minisymposium “Applications of discrete and continuous energy”, Shanks Conference, Vanderbilt University, May 2023
5. Coorganizer of the International Conference on Approximation and Potential Theory, Georgia Southern University, Mar 2022 (tentative date)
6. Coorganizer of the special section “Frames, designs, and optimal spherical configurations”, Joint Mathematics Meetings, Denver, Jan 2020
7. Reviewer for AMS Mathematical Reviews, Potential Analysis, Discrete & Computational Geometry, Constructive Approximation, Journal of Approximation Theory.

OUTREACH

1. Lecturer at the Nashville Math Club at Vanderbilt University
2. Participant of STEM nights at Pineview Elementary School, Tallahassee FL, organized by the National MagLab
3. Advising undergraduate students through the UROP research program at FSU:
 - 1) Will Driscoll, Fall 2019–Spring 2020
 - 2) Evelyn Castillo, Fall 2020–Spring 2021

4. Organized the Undergraduate Mathematics Seminar at FSU in Fall 2019–Spring 2020
5. Participant of the Math Fun Day at Florida State University in 2018, one of the biggest scientific outreach events at FSU with over 1400 visitors
6. Lecturer at the Undergraduate Math and Pizza Seminar at Vanderbilt University

LANGUAGE PROFICIENCY AND TECHNICAL SKILLS _____

1. Natural languages: English, Russian, Ukrainian (fluent); French (intermediate), Polish (beginner)
2. Programming languages: C++, CUDA C++, Python, Matlab, R
3. Development tools: Git, Make, GDB, Valgrind