Oleksandr Vlasiuk

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Employment

PTC, Senior Software Engineer	2023–present
Vanderbilt University, Lecturer	2022–2023
Vanderbilt University, Postdoctoral Scholar	2021–2022
Florida State University, Postdoctoral Scholar	2018–2021

Education

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

Long-term visits

ICERM, Brown University	Feb 2018–Apr 2018

Research interests

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

Publications

1. with D. Bilyk, A. Glazyrin, R. Matzke, and J. Park, **Experimental survey of discrete minimizers of the p-frame energy**, 8 pp., 57th Asilomar Conference on Signals, Systems, and Computers (2023)
doi:10.1109/IEEECONF59524.2023.10476892.

2. with J. Batle, O. Ciftja, **Correspondence between electrostatics and contact mechanics with further results in equilibrium charge distributions**, 21 pp., Ann. Phys. (2023)
doi:10.1002/andp.202300269

3. with D. Bilyk, D. Ferizović, A. Glazyrin, R. Matzke, and J. Park, **Optimizers of three-point energies and nearly orthogonal sets**, 14 pp., Proc. Am. Math. Soc., accepted.
arXiv:2303.12283

4. with D. Bilyk, D. Ferizović, A. Glazyrin, R. Matzke, and J. Park, **Optimal measures for multivariate geometric potentials**, 23 pp. Indiana Univ. Math. J., accepted.
arXiv:2303.14258

Updated: May 15, 2024.

5. with D. Hardin, E. Saff, **Asymptotics of k-nearest neighbor Riesz energies**, 37 pp., Constr. Approx. (2023)
doi:10.1007/s00365-023-09641-5, arXiv:2201.00474

6. with A. Reznikov, A. Anderson, E. White, **Polarization and covering on sets of low smoothness**, 28 pp., Adv. Math. (2022)
doi:10.1016/j.aim.2022.108720, arXiv:2106.11956

7. with D. Bilyk, R. Matzke, **Positive definiteness and the Stolarsky invariance principle**, 30 pp., J. Math. Anal. Appl. (2022)
doi:10.1016/j.jmaa.2022.126220, arXiv:2110.04138

8. with D. Bilyk, D. Ferizović, A. Glazyrin, R. Matzke, and J. Park, **Potential theory with multivariate kernels**, 23 pp., Math. Zeitschrift.(2022)
doi:10.1007/s00209-022-03000-z, arXiv:2104.03410

9. with D. Bilyk, A. Glazyrin, R. Matzke, and J. Park, **Optimal measures for p-frame energies on spheres**, Rev. Matemática Iberoam. (2022)
doi:10.4171/RMI/1329, arXiv:1908.00885

10. with D. Bilyk, A. Glazyrin, R. Matzke, and J. Park, **Energy on spheres and discreteness of minimizing measures**, J. Funct. Anal. (2021),
doi:10.1016/j.jfa.2021.108995, arXiv:1908.10354

11. with A. Reznikov, **Riesz energy on self-similar sets**, Proc. Am. Math. Soc., accepted.
doi:10.1090/proc/14663, arXiv:1810.01557

12. 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

13. 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

14. 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

15. 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

16. with D. P. Hardin and E. B. Saff, **Asymptotic properties of short-range interaction functionals**, arXiv:2010.11937, 62 pp.

17. **Discreteness of the minimizers of weakly repulsive interaction energies on Riemannian manifolds**, arXiv:2003.01597, 8 pp.

Papers in preparation

18. 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) Discrete Systems and Calculus of Variations, Technical University Munich, Nov 2022

    2) 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) "Γ-convergence of hypersingular Riesz energy functionals", Multivariate Algorithms and their Foundations in Number Theory, Johann Radon Institute, Linz, Nov 2018

20) "Γ-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) Tutorial lectures on "Optimal and Near Optimal Energy Minimizing Point Configurations" at the workshop Point Configurations: Deformations and Rigidity, LMS Research School, University College London, July 2021

2) "Fourier transform, sparsity, and compressed sensing", FSU Machine Learning seminar, November 2019

3) Sphere Packings and Optimal Configurations (summer school), Hausdorff Center for Mathematics, Sep 2019

4) "Minimizing p-frame energies", Mathematics Colloquium, Florida State University, Tallahassee, Jan 2019

5) "Sumset estimates and the Menger's theorem", Analysis seminar, Florida State University, Nov 2018

6) "Basics of large deviations and Cramér's theorem", Analysis seminar, Vanderbilt University, Jun 2017,

7) "Ball multiplier problem", Analysis seminar, Vanderbilt University, Apr 2017,

8) "Finite Grassmannian frames, spherical codes, and equiangular lines", Analysis seminar, Vanderbilt University, Apr 2016,

9) "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. INDS 3884: Interdisciplinary Internship, Vanderbilt University, Summer 2023
(*Advising a student intern.*)
2. Calculus II, Vanderbilt University, Spring 2023
3. Methods of Linear Algebra, Vanderbilt University, Fall 2022-Spring 2023
4. Methods of Ordinary Differential Equations, Vanderbilt University, Spring-Fall 2022
5. Calculus III, Vanderbilt University, Fall 2021
6. 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.*)
7. Calculus II, Florida State University, Spring 2019–Spring 2021
8. Calculus II, Vanderbilt University, Fall 2017 (*TA*)
9. Statistical learning, Vanderbilt University, Fall 2017 (*TA*)
10. Calculus I, Vanderbilt University, Fall 2015–Spring 2017 (*TA*)
11. 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, Analysis and Mathematical Physics, 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