ALEXEY MIROSHNIKOV

CURRICULUM VITAE

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https://alexey-miroshnikov.github.io/

Education

- **UNIVERSITY OF MARYLAND – COLLEGE PARK**
  Ph.D. Mathematics, 2012
  Advisors: Athanasios Tzavaras and Konstantina Trivisa.

- **VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY**
  M.Sc. Mathematics, 2004

- **MOSCOW STATE TECHNOLOGICAL UNIVERSITY "STANKIN"**
  M.Sc. Computer Science, Honors, 2002
  B.Sc. Mechanical Engineering, Honors, 2000

Industry Positions

- **DISCOVER FINANCIAL SERVICES,** Riverwoods, Illinois
  Senior Principal Research Scientist. Emerging Capabilities & Data Science Research Group, 2021 – Present

- **DISCOVER FINANCIAL SERVICES,** Riverwoods, Illinois
  Manager Modeling, Emerging Capabilities & Data Science Research Group, 2019 – 2021

Academic Positions

- **UNIVERSITY OF CALIFORNIA, LOS ANGELES,** Los Angeles, California
  Assistant Adjunct Professor. Department of Mathematics, 2016 – Present

- **UNIVERSITY OF MASSACHUSETTS AMHERST**, Amherst, Massachusetts
  Postdoctoral Research Associate. Department of Biostatistics and Epidemiology, 2015 – 2016

- **UNIVERSITY OF MASSACHUSETTS AMHERST**, Amherst, Massachusetts
  Visiting Assistant Professor. Department of Mathematics and Statistics, 2012 – 2015

- **INSTITUTE OF APPLIED AND COMPUTATIONAL MATHEMATICS – FORTH**, Crete, Greece
  Marie Curie Early Stage Researcher. 2008 – 2010

- **ARGONNE NATIONAL LABORATORY,** Chicago, Illinois
  Visiting Position. Mathematics and Computer Science Division, Summer 2004

Research Interests

- Machine Learning Mathematics
  - Fairness of Machine Learning Algorithms
  - Machine Learning Explainability and Game Theory
- Computational and Mathematical Biology
  - Population genomics, including stochastic modeling and inference

- Population dynamics, including structured populations

- Partial Differential Equations with applications to:
  - Materials science, including elastodynamics and gas dynamics
  - Singularity formations: vacuums, cavities and fractures
  - Hyperbolic balance laws, including shocks

- Statistics with applications to data science

Immigration Status

- U.S. permanent resident.

Publications

Submitted Papers and Preprints

1. A. Miroshnikov, K. Kotsiopoulos, A. Ravi Kannan, Mutual information-based group explainers with coalition structure for machine learning model explanations, preprint (2021), arXiv:2102.10878.

2. A. Miroshnikov, K. Kotsiopoulos, R. Franks, A. Ravi Kannan, Model-agnostic bias mitigation methods with regressor distribution control for Wasserstein-based fairness metrics, preprint (2021), arXiv:2111.11259.

3. A. Miroshnikov, K. Kotsiopoulos, E. Conlon, Asymptotic Properties and Approximation of Parallel Bayesian Logspline Density Estimators. preprint (2021). arXiv:1710.09071.

Accepted and Published Papers

4. A. Miroshnikov, K. Kotsiopoulos, R. Franks, A. Ravi Kannan, Wasserstein-based fairness interpretability framework for machine learning models, **Machine Learning Journal**, Springer, (2022), to appear.

5. A. Miroshnikov, E. Savelev, Asymptotic Properties of Parallel Bayesian Kernel Density Estimators. **Annals of the Institute of Statistical Mathematics**, (2019), Vol. 71, 711-810.

6. A. Miroshnikov, M. Steinrücken, Computing the Joint Distribution of the Total Tree Length across Loci in Populations with Variable Size. **Theoretical Population Biology** (2017), Vol. 118, 1-19.

7. A. Miroshnikov, P.-E. Jabin, R. Young, Cellulose Biodegradation Models; an Example of Cooperative Interactions in Structured Populations, **ESAIM: Mathematical Modelling and Numerical Analysis** (2017), 51-6, 2289-2318.

8. A. Miroshnikov, R. Young, Weak* Solutions II: The Vacuum in Lagrangian Gas Dynamics, **SIAM Journal on Mathematical Analysis** (2017), 49(3), 1810-1843.

9. A. Miroshnikov, R. Young, Weak* Solutions I: A New Perspective on Solutions to Systems of Conservation Laws. **Methods and Applications of Analysis** (2017). Vol. 24-3, 351-382.

10. A. Miroshnikov, K. Trivisa, Stability and Convergence of Relaxation Schemes to Hyperbolic Balance Laws via a Wave Operator, **Journal of Hyperbolic Differential Equations** (2015), Vol. 12, No. 1, 189-219.

11. A. Miroshnikov, Z. Wei, E. Conlon, Parallel Markov Chain Monte Carlo for Non-Gaussian Posterior Distributions, **Stat** (2015), Vol. 4, Issue 1, 304-319. DOI: 10.1002/sta4.97.

12. A. Miroshnikov, A. Tzavaras, On the Construction and Properties of Weak Solutions Describing Dynamic Cavitation, **Journal of Elasticity** (2015), 118-2, 141-185.

13. J. Philips, A. Miroshnikov, P.-J. Haest, D. Springael, and E. Smolders, Motile Geobacter Dechlorinators Migrate into a Model Source Zone of Trichloroethene Dense Non-aqueous Phase Liquid: Experimental Evaluation and Modeling, **Journal of Contaminant Hydrology** (2014), 170, 28-38.

14. A. Miroshnikov, E. Conlon, ParallelMCMCcombine: An R Package for Bayesian Methods for Big Data and Analytics, **PLoS ONE** (2014), 9(9):e108425. DOI:10.1371/journal.pone.0108425.

15. A. Miroshnikov, K. Trivisa, Relative Entropy in Hyperbolic Relaxation for Balance Laws, **Communications in Mathematical Sciences** (2014), 12-6, 1017-1043.

16. A. Miroshnikov, A. Tzavaras, Convergence of Variational Approximation Schemes for Elastodynamics with Polyconvex Energy, **Journal of Analysis and its Applications (ZAA)** (2014), 33-1, 43-64.

17. J. Giesselmann, A. Miroshnikov, A. Tzavaras, The problem of Dynamic Cavitation in Nonlinear Elasticity, **Séminaire Laurent Schwartz - EDP et applications (2012-2013)**, Exp. 14, 1-17. DOI: 10.5802/slsedp.41.

18. A. Miroshnikov, A. Tzavaras, A Variational Approximation Scheme for Radial Polyconvex Elasticity That Preserves the Positivity of Jacobians, **Communications in Mathematical Sciences** (2012), 10-1, 87-115.

Software Publications

1. A. Miroshnikov, E. Conlon, R-package `parallelMCMCcombine`: Methods for combining subset MCMC posterior samples to estimate a posterior density given the full data set (2015).

2. E. Savel'ev, A. Miroshnikov, E. Conlon, R-package `BayesSummaryStatLM`: methods for generating MCMC posterior samples of Bayesian linear regression model parameters that require only summary statistics of data as input (2015).

Grants and Awards

- Tenure-track Assistant Professorship in Data Science, Iowa State University, 2018. (Declined).
- MSP Research Support Funds, University of Massachusetts Amherst, 2014.
- MSP Research Support Funds, University of Massachusetts Amherst, 2013.
- Research Support Funds awarded by Marie Curie Initial Training Network. EU EST-project DEASE: MEST-CT-2005-021122. IACM – FORTH, Crete, Greece, 2009 – 2010.
- Research Support Funds awarded by Marie Curie Initial Training Network. EU EST-project DEASE: MEST-CT-2005-021122. IACM – FORTH, Crete, Greece, 2008.
- Michael Brin Fellowship, University of Maryland – College Park, 2006 – 2010.
- Kaplan Travel Grant, University of Maryland – College Park, 2011 – 2012.
- AMS Grad Student Travel Grant awarded by AMS, 2011.
- Fellowship of the President of Russian Federation, MSTU Stankin, 2000 and 1998.
- Fellowship of the Government of Russian Federation, MSTU Stankin, 1999.
- Fellowship of the President of Russian Federation, MSTU Stankin, 1998.

Teaching Experience

- **UNIVERSITY OF CALIFORNIA, LOS ANGELES**, Los Angeles, California, 2016 – Present
  Instructor for:
  - Introductory Programming Courses
  - Multivariable Calculus
  - Probability Theory I and II
  - Mathematical Modeling
- **UNIVERSITY OF MASSACHUSETTS AMHERST**, Amherst, Massachusetts, 2012 – 2015
  Instructor for:
  - Calculus I, II and III, and Calculus I Honors
  - Advanced Multivariable Calculus
  - ODEs for Scientists and Engineers
- **UNIVERSITY OF MARYLAND – COLLEGE PARK**, College Park, Maryland, 2006 – 2012
  - ODEs for Scientists and Engineers (instructor)
  - College Algebra and Trigonometry (discussion leader)
  - Elementary Calculus I and II (discussion leader)
- **VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY**, Blacksburg, Virginia, 2002 – 2006
  - Vector Geometry (discussion leader)
  - Tutoring Lab at Math Emporium (post-class mentoring)
- **MOSCOW STATE TECHNOLOGICAL UNIVERSITY STANKIN**, Moscow, Russia, 2001 – 2002
  - Linear Algebra (discussion leader)

Mentoring

- Konstandinos Kotsiopoulos, Ph.D. student, UMass Amherst, 2015 – 2018.

Referee for Journals

- SIAM Journal on Mathematical Analysis

Invited and Contributed Talks

- Broad Institute of MIT and Harvard, Cambridge, Massachusetts, 2017.
- PDE Seminar, University of Southern California, Los Angeles, California, 2017
- PDE and Applied Mathematics Seminar, University of California, Davis, California, 2016
- 11-th AIMS International Conference on Dynamical Systems, Differential Equations and Applications, Orlando, Florida, 2016.
- British Applied Mathematics Colloquium, University of Oxford, Oxford, UK, 2016.
- SIAM-SEAS Conference. University of Alabama Birmingham, Alabama. 2015.
- SAND Lab seminar, Massachusetts Institute of Technology, Cambridge, Massachusetts. 2014.
- AMS Spring Western Section Meeting, Albuquerque, University of New Mexico. 2014.

- SIAM Conference on Analysis of Partial Differential Equations, Orlando, Florida. 2013.
- PDE seminar, University of Connecticut, Storrs, Connecticut, 2013.
- PDE seminar, Brown University, Providence, Rhode Island. 2013.
- SIAM Conference on Analysis of PDEs, San Diego, California. Contributed talk. 2011.
- AMS Fall Western Section Meeting, University of Utah. 2011.
- The 3rd Annual Meeting of Marie Curie Initial Training Network DEASE, Institute of Applied and Computational Mathematics, FORTH, Crete, Greece. Contributed talk. 2009.
- PDE Seminar, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 2008.
- Computational Aeroacoustics Seminar, Institute of Mathematical Modeling, Russian Academy of Science, Moscow, Russia. 2005.
- SIAM Conference on Computational Science & Engineering, Orlando, Florida. 2005.
- Mathematical Modeling Seminar, Institute of Mathematical Modeling, Russian Academy of Science, Moscow, Russia. 2002.
- The 2nd International Conference of the Young Scientists and Students: Actual Problems of Modern Science. Samara, Russia. Contributed talk. 2001.
- Annual Conference, Moscow State Technological University Stankin, Moscow, Russia. 2000.

Additional Conferences and Workshops Attended

- Participant of IdeaLab 2014: Program for Early Career Researchers: Toward a more realistic model of ciliated and flagellated organisms, ICERM, Brown University, Providence, Rhode Island, 2014.
- Research Workshop: Hyperbolic Conservation Laws and Infinite-Dimensional Dynamical Systems. Department of Mathematics, University of Pittsburgh, Pittsburgh, Pennsylvania. 2012.
- IMA Workshop: Mathematics at the Interface of Partial Differential Equations, the Calculus of Variations, and Materials Science, IMA, University of Minnesota, 2014.
- SIAM Conference on Mathematical Aspects of Material Science, Philadelphia, Pennsylvania. 2013.
- Conference on Hyperbolic Conservation Laws and Continuum Mechanics in Honor of Constantine Dafermos' 70-th Birthday, Brown University, Providence, Rhode Island. 2011.
- Kinetic Description of Multiscale Phenomena: Modeling, Theory, and Computation. Annual Kinetic FRG meeting, University of Wisconsin-Madison, Madison, Wisconsin. 2011.
- Workshop: Hyperbolic Conservation Laws and Fluid Dynamics, University of Parma, Italy. 2010.

Affiliations

- American Mathematical Society (AMS)
- Society for Industrial and Applied Mathematics (SIAM)

Technical Proficiencies

- C, C++, R, MATLAB
- PETSc, ADIC, WinBUGS
- LaTeX, Eclipse, Sublime Text, Cygwin, Git, Excel, HTML

Languages

- Russian (native), English (fluent), Greek (basic knowledge)