Miroslav Kramár

David and Judi Proctor Department of Mathematics
University of Oklahoma
601 Elm Avenue
Norman, OK 73019-0315 USA
Email: miro@ou.edu

Employment

2019 -	Assistant Professor, University of Oklahoma, USA.
2017 - 2019	Researcher, INRIA Saclay, France.
2015 - 2017	Assistant Professor, Advanced Institute for Materials Research, Japan.
2009 - 2015	Postdoctoral Associate, Rutgers University, USA.

Education

Vrije Universiteit Amsterdam, The Netherlands.
Ph.D. Mathematics, February 2009.
Thesis Advisor: R.C.A.M van der Vorst.

Univerzita Komenského, Slovakia.
M.S. Mathematics, June 2003, with Honors Math Degree.
Thesis Advisor: Milan Medved.

Awards & Honors

2020-2021	Junior Faculty Fellowship Program at University of Oklahoma.
2016-2017	AIMR Fusion research grant: *Analyzing Dynamical Processes in Cells via Persistent Homology.*

Graduate Students:

Philip Bretz (2023).

Areas of Interest

Topological data analysis: computational algebraic topology, analysis of non-linear structures in high-dimensional data, manifold reconstruction, persistent homology.

Non-linear dynamics: reconstruction of dynamics from data, pattern formation, Conley index theory, anomaly detection.

Interdisciplinary research: dense granular media, turbulent flows, dynamics of silo deformation, protein structure and function, spreading processes on networks.

Publications in Refereed Journals

R. Basak, R. Kozlowski, L. Pugnaloni, M. Kramár, J. Socolar, C. Carlevaro, and L. Kondic, *Evolution of force networks during stick-slip motion of an intruder in a granular material: Topological measures extracted from experimental data.* Physical Review E, **108** (2023): 5, 054903.

P. Bretz, L. Kondic, M. Kramár , *Stochastic methods for slip prediction in a sheared granular system.* Physical Review E, **107** (2023): 5, 054901.

M. Kramár, C. Cheng, R. Basak, and L. Kondic, *On intermittency in sheared granular systems.* Journal of Soft Matter, **18** (2022): 18, 3583-3593.

R. Basak, M. Carlevaro, R. Kozlowski, C. Cheng, L. A. Pugnaloni, M. Kramár, H. Zheng, J. E. S. Socolar, and L. Kondic, *Two Approaches to Quantification of Force Networks in Particulate Systems.* Journal of Engineering Mechanics, **147** (2021): 11, 04021100.

R. Sergazinov and M. Kramár, *Machine learning approach to force reconstruction in photoelastic materials.* Machine Learning: Science and Technology, **2** (2021): 4, 045030.

M. Kramár, L. Kovalcinova, L. Kondic and K. Mischaikow, *Quantitative measure of memory loss in complex spatio-temporal systems.* Chaos: An Interdisciplinary Journal of Nonlinear Science, **31** (2021): 3.

S. Harker, M. Kramár, R. Levanger and K. Mischaikow, *A comparison framework for interleaved persistence modules.* Journal of Applied and Computational Topology, **3** (2019): 85-118.

C. Colonnello and M. Kramár, *Dynamics of silo deformation under granular discharge*, Physical Review E, **98** (2018): 5, 052902.

J.A. Dijksman, L. Kovalcinova, J. Ren, R.P. Behringer, M. Kramar, K. Mischaikow and L. Kondic, *Characterizing granular networks using topological metrics.* Physical Review E, **97** (2018): 4, 042903.

L. Kondic, M. Kramár, L. Kovalčinová and K. Mischaikow, *Evolution of force networks in dense granular matter close to jamming.* Powders & Grains , **140** (2017): 15014.

J. Jaquette and M. Kramar, *On ϵ-approximations of persistence diagrams.* Mathematics of Computation, **86** (2017): 306, 1887–1912.

M. Kramár, R. Levanger, J. Tithof, B. Suri, M. Xu, M. Paul, M.F. Schatz and K. Mischaikow, *Analysis of Kolmogorov flow and Rayleigh-Bénard convection using persistent homology.* Physica D, **334** (2016): 82–98.

L. Kondic, M. Kramár, L.A. Pugnaloni, C.M. Carlevaro and K. Mischaikow, *Structure of force networks in tapped particulate systems of disks and pentagons. II. Persistence analysis.* Physical Review E, **93** (2016): 6, 062903.

L.A. Pugnaloni, C.M. Carlevaro, M. Kramár, K. Mischaikow and L. Kondic, *Structure of force networks in tapped particulate systems of disks and pentagons. I. Clusters and loops.* Physical Review E, **93** (2016): 6, 062902.

D. Taylor, F. Klimm, H.A. Harrington, M. Kramar, K Mischaikow, M.A. Porter and P.J. Mucha, *Topological data analysis of contagion maps for examining spreading processes on networks.* Nature Communications, **6** (2015): 1, 7723.

M. Kramar, A. Goullet, L. Kondic and K. Mischaikow, *Evolution of force networks in dense particulate media.* Physical Review E, **90** (2014): 5, 052203.

M. Gameiro, Y. Hiraoka, S. Izumi, M. Kramar, K. Mischaikow and V. Nanda, *A topological measurement of protein compressibility.* Japan Journal of Industrial and Applied Mathematics, **32** (2014): 1–17.

M. Kramar, A. Goullet, L. Kondic and K. Mischaikow, *Quantifying force networks in particulate systems.* Physica D, **283** (2014): 37–55.

M. Kramar, A. Goullet, L. Kondic and K. Mischaikow, *Persistence of force networks in compressed granular media.* Physical Review E, **87** (2013): 4, 042207.

L. Kondic, A. Goullet, C. S. O'Hern, M. Kramar, K. Mischaikow and R.P. Behringer, *Topology of force networks in compressed granular media.* Europhysics Letters, **97** (2012): 5, 54001.

J.B. van den Berg, M. Kramar, R.C.A.M. Vandervorst, *Oscillatory solutions of fourth order conservative systems via the Conley index* Journal of Differential Equations, **252** (2012): 11, 6061–6098.

J.B. van den Berg, M. Kramar, R.C.A.M. Vandervorst, *The order of bifurcation points in fourth order conservative systems via braids.* SIAM Journal on Applied Dynamical Systems, **10** (2011): 2, 510–550.

M. Kramár, *Generic and stability properties of reciprocal and pseudogradient vector fields.* Mathematica Slovaca, **54** (2004): 4, 349–368.

Academic and Teaching Experience

TheUniversity of Oklahoma

2024 Spring	Introduction to Mathematical Analysis.
2024 Spring	Differential and Integral Calculus I.
2023 Fall	Numerical Analysis.
2023 Fall	Differential and Integral Calculus III.
2023 Spring	Applied Numerical Methods.
2022 Fall	NumericalAnalysis.
2022 Fall	Calculus and Analytical Geometry I.
2022 Spring	NumericalAnalysis.
2022 Spring	Mathematics of Data.
2021 Fall	Topics in Topology (Introduction to Topological Data Analysis).
2021 Fall	Introduction to Partial Differential Equations.
2021 Spring	Applied Numerical Methods.
2021 Spring	Calculus and Analytical Geometry III.
2020 Fall	Calculus and Analytical Geometry III.
2020 Fall	Introduction to Partial Differential Equations.
2020 Spring	Calculus and Analytical Geometry III.
2019 Fall	Calculus and Analytical Geometry II.

Rutgers University

2015 Spring	Advanced calculus for engineers.
2014 Fall	Stochastic models in operations research.
2014 Spring	Introduction to mathematical reasoning.
2013 Fall	Introduction to mathematical reasoning.
2013 Spring	Differential equations for engineering and physics.
2012 Fall	Introduction to mathematical reasoning.
2012 Spring	Differential equations for engineering and physics.
2011 Fall	Elementary differential equations.
2011 Spring	Elementary differential equations.
2010 Fall	Elementary differential equations.
2010 Spring	Elementary differential equations.
2009 Fall	Differential equations for engineering and physics.

Vrije Universiteit Amsterdam

2007 Fall	Partial differential equations.
2005 Fall	Calculus II.

Univerzita Komenského

2004 Fall	Differential equations.
2004 Spring	Mathematical analysis III.
2003 Fall	Mathematical analysis II.
2003 Spring	Mathematical analysis III, Differential equations.
2002 Fall	Mathematical analysis II.

Summer and Winter schools

2018 **The Complex Math of the Real World**,
Israel Institute of Technology, Haifa, Israel.

2016 **Dalian Winter School on Computational Topology**,
Dalian University of Technology, Dalian, China.

2016 **CNU-International Workshop on Industrial Mathematics**,
Chungnam National University, Daejeon, South Korea.

2016 **A3 Foresight Winter School**,
Tohoku University, Sendai, Japan.

2014 **Mathematical and Statistical Analysis of Big Data**,
Wits University, Johannesburg, South Africa.

Service to the department

Committees

2022 - present	Chair, Interdisciplinary Committee, OU.
2024 - present	Member, Institutional Animal Care & Use Committee.
2023 - present	Member, Department Data Management Committee, OU.
2023 - present	Member, Karcher Colloquium Committee Committee, OU.
2023 - present	Member, Development Committee, OU.
2022 - 2023	Member, Post Doctoral search Committee, Department of Mathematics, OU.
2020 - 2021	Member, Interdisciplinary Committee, Department of Mathematics, OU.

Service to the profession

Conference organizer

2022 AMS special session at Spring Western Sectional Meeting.
2017 TDART 2017 (Topological Data Analysis and Related Topics), Sendai, Japan.
2015 AMS special session at Fall Eastern AMS Sectional Meeting, New Brunswick, USA.
2013 Special session at Canadian applied and industrial Mathematics society meeting, Quebec, Canada.

Seminar organizer/founder

2020 - 2022 Graduate reading and research seminar, OU Norman, USA.
2017 - 2019 DataShape seminar, INRIA Saclay, France.
2015 - 2017 Applied Math Seminar, Advanced Institute for Materials Research, Sendai, Japan.

Referee

Physics of Fluids.
Journal of Mathematical Biology.
PhysicaD: Nonlinear Phenomena.
SIAM Journal on Mathematics of Data Science.
FoCM.
SOSG.
Mathematica Slovaca.

Proposal reviewer

Research & Sponsored Programs at the University of Central Oklahoma.

Invited talks

Mar 2023 Computer science seminar, OU, USA.
Nov 2023 Applied mathematics seminar, Rutgers University, USA.
Mar 2023 AMS Sectional Meeting, Atlanta, USA.
May 2022 AMS Sectional Meeting, Denver, USA.
Feb 2021 Applied mathematics seminar, Montana State University, USA.
Oct 2018 Applied mathematics seminar, University of Southampton, UK.
Sep 2018 Applied mathematics seminar, Comenius University, Slovakia.
Sep 2018 Dragon Applied Topology Conference, Swansea, UK.
July 2018 Algebraic topology in data and dynamics, Montana, USA.
May 2018 Annual seminar of Inria, Hyeres, France.
Nov 2017 Seminar Inria, Saclay France.
Oct 2017 Seminar of Department of Physics and Applied Mathematics, Universidad de Navarra, Pamplona, Spain.
Sep 2017 Geometry and physics of spatial random systems, Bad Herrenalb, Germany.
July 2017 Applied topology in Będlewo, Będlewo, Poland.
Apr 2017 Seminar Inria, Saclay France.
Aug 2016 Patterns and Waves 2016, Sapporo, Japan.
Jun 2016 International Workshop on Theoretical Aspects of Near-Wall Turbulence Studies, Kyoto, Japan.

Jun 2016	RIMS workshop on dynamical systems, Kyoto, Japan.
Jan 2016	ICMC Summer Meeting on Differential Equations, Sao Carlos, Brazil.
Sep 2015	Seminar, AIMR Tohoku University, Sendai, Japan.
May 2015	Colloquium, Universidad Simón Bolívar, Caracas, Venezuela.
Dec 2014	FoCM, Montevideo, Uruguay.
Aug 2014	Colloquium, Kyoto University, Japan.
Aug 2014	PASI, La Plata, Argentina.
Jul 2014	SIAM Annual Meeting, Chicago, USA.
Apr 2014	Colloquium, Montana State University, USA.
Feb 2014	IMA - Topological Data Analysis, USA.
Nov 2013	Computational and Applied Mathematics Seminar, Rutgers University, USA.
Nov 2013	APS-DFD meeting, Pittsburgh, USA.
Oct 2013	IMA - Topological Data Analysis, USA.
Jun 2013	Canadian applied and industrial Mathematics society meeting, Quebec, Canada.
May 2013	SIAM Conference on Applications of Dynamical Systems, USA.
Nov 2012	AMS Sectional Meeting , USA.
Jun 2012	8th European Solid Mechanics Conference, Graz, Austria.
Jun 2012	Applied and computational topology: ATMCS, Edinburgh, UK.
Jan 2012	Joint Mathematics meetings, Boston, USA.
Nov 2011	4th Annual Meeting of the APS Division of Fluid Dynamics, Maryland, USA.
Jul 2011	Workshop on applied topology, Hakata, Japan.
Jul 2011	FoCM, Budapest, Hungary.
May 2011	SAIM Conference on Applications of Dynamical Systems, USA.
May 2010	AMS Sectional Meeting, NJIT, USA.
Mar 2010	APS March Meeting, Portland USA.

Computer Proficiency

Programming: C/C++ with STL, MPI, Open MPI, CSS/HTML, Matlab, Python, Mathematica, Maple and LaTeX.

OS: Experienced with Mac OS X, cluster computers and various GNU/Linux distributions.