

Departments of Mathematics  
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## Research Interests

Topological Data Analysis, Mathematical Biology, Computational Topology, Computational Geometry

## Education

Ph.D., Mathematical Sciences, New Jersey Institute of Technology and Rutgers the State University of New Jersey, May 2005. Advisor: Denis Blackmore. Thesis: *Theory and algorithms for swept manifold intersections*.

Specialist (equivalent to M.S.), Applied Mathematics, National Taras Shevchenko University of Kyiv, June 2001.

B.S., Applied Mathematics, National Taras Shevchenko University of Kyiv, July 2000.

## Professional Experience

Visiting Assistant Professor, Department of Mathematics, Duke University, Sep. 1, 2009 –

Postdoctoral Fellow, School of Biology, Georgia Institute of Technology, March 2008 – August 31, 2009

Advisor: Joshua Weitz

Postdoctoral Fellow, Department of Computer Science, Duke University, May 16, 2005 – February 29, 2008

Advisors: Herbert Edelsbrunner and John Harer

Research Assistant, NSF/DARPA CARGO Grant CCR-0310619, Accuracy and Stability of Computational Representations of Swept Volume Operations, July 2003 – May 2005

Advisor: Denis Blackmore

## Teaching Experience

Lead Instructor

Differential Equations (GA Tech, MATH 2403, Fall 2008), Undergraduate

Differential Equations (NJIT, MATH 222, Spring 2004), Undergraduate

Special course: Linear Algebra, Real and Complex Analysis, and Numerical Methods for Qualifying Exams (NJIT, Fall 2003), Graduate

Calculus III (NJIT, MATH 213B, Summer 2003), Undergraduate

Co-Instructor

Geometry, Random Matrices, and Statistical Inference (SAMSI, Spring 2007), Graduate

## Guest Lecturer

Modeling Bio Systems (Duke, Math 214S, Fall 2009, 1 lecture), Undergraduate

Theoretical Ecology (GA Tech, Fall 2007, 1 lecture), Advanced Undergraduate and Graduate

Topology (Duke, MATH 205, Fall 2006, 4 lectures), Undergraduate

Advanced Calculus I (NJIT, MATH 545, Fall 2003, 6 lectures), Advanced Undergraduate and Graduate

## Teaching Assistant

Calculus II (NJIT, MATH 112, Spring 2003), Undergraduate

Calculus I (NJIT, MATH 111, Fall 2002), Undergraduate

## Publications

\* indicates alphabetical author list.

### Published/In Press

CHARLES A. PRICE, OLGA SYMONOVA, Y. MILEYKO, TROY HILLEY, AND JOSHUA S. WEITZ. *LEAF GUI: segmenting and analyzing the structure of leaf veins and areoles*, Plant Physiology, in press

Y. MILEYKO AND J. S. WEITZ. *Bifurcation Analysis of Gene Regulatory Circuits Subject to Copy Number Variation*, SIAM Journal on Applied Dynamical Systems, Volume 9, Issue 3, pp. 799–826, 2010

\* D. COHEN-STEINER, H. EDELSBRUNNER, J. HARER, AND Y. MILEYKO. *Lipschitz functions have  $L_p$ -stable persistence*, Foundations of Computational Mathematics Journal, Vol. 10, No. 2, pp. 127–139, 2010

A. IYER-PASCUZZI, OLGA SYMONOVA, Y. MILEYKO, YUELING HAO, HEATHER BELCHER, JOHN HARER, J.S. WEITZ AND PHILIP BENFEY. *Imaging and Analysis Platform for Automatic Phenotyping and Classification of Plant Root Systems*, Plant Physiology, Vol. 152, No. 3, pp. 1148–1157, 2010

Y. MILEYKO, R. I. JOH, AND J. S. WEITZ. *Small-scale copy number variation and large-scale changes in gene expression*, Proceedings of the National Academy of Sciences USA, Vol 105, pp. 16659-16664, 2008

J. WEITZ, Y. MILEYKO, R. I. JOH, AND E. VOIT. *Collective Decision Making in Bacterial Viruses*, Biophysical Journal, Vol. 95, pp. 2673–2680, 2008

\* M.-L. DEQUEANT, S. AHNERT, H. EDELSBRUNNER, T. M. A. FINK, E. F. GLYNN, G. HATTEM, A. KUDLICKI, Y. MILEYKO, J. MORTON, A. R. MUSHEGIAN, L. PACHTER, M. ROWICKA, A. SHIU, B. STURMFELS, OLIVIER POURQUIE. *Comparison of Pattern Detection Methods in Microarray Time Series of the Segmentation Clock*, PLoS ONE 3(8): e2856, 2008. doi:10.1371/journal.pone.0002856

\* D. ATTALI AND H. EDELSBRUNNER AND Y. MILEYKO. *Weak Witnesses for Delaunay Triangulations of Submanifolds*, SPM '07: Proceedings of the 2007 ACM symposium on Solid and physical modeling, pp. 143–150, 2007

D. ATTALI, H. EDELSBRUNNER, J. HARER, AND Y. MILEYKO. *Alpha-Beta Witness Complexes*, In “Proc. 11th Workshop Alg. Data Struct.”, Springer-Verlag, Lecture Notes in Computer Science, Vol. 4619, pp. 386–397, 2007

\* D. BLACKMORE AND Y. MILEYKO. *Computational Differential Topology*, Applied General Topology, Volume 8, No. 1, pp. 35-92, 2007

\* D. BLACKMORE, M.C. LEU, Y. MILEYKO, W.C. REGLI, AND W. SUN. *Computational topology and swept volumes*, DIMACS Series in Discrete Mathematics and Theoretical Computer Science, Volume 67, pp. 53-78, 2005

B.V. RUBLEV AND Y. MILEYKO. *Construction of the smallest enclosing ellipse and the smallest enclosing ellipsoid for a finite set of points in  $m$ -dimensional Euclidean space*, In “Proc. 5th Ukrainian Intl. Conf. ‘UkrOBRAZ’ ”, Kyiv, 2000, pp.79-82

B.V. RUBLEV, Y.I. PETUNIN AND Y. MILEYKO. *Geometric properties of the smallest enclosing ellipse and some related questions*, Kyiv University Publisher, Kyiv, 2000, 74p.

B.V. RUBLEV, O.I. MOLODTSOV AND Y. MILEYKO. *Fast method for constructing Fisher linear discriminant functions*, Kyiv University Bulletin, Vol. 4, pp. 217-222, 1999

B.V. RUBLEV AND Y. MILEYKO. *Construction of the smallest enclosing ellipsoid for elementary polyhedra*, Kyiv University Bulletin, Vol. 3, pp. 236-242, 1999

B.V. RUBLEV AND Y. MILEYKO. *Modification of the recursive procedure for solving linear programming problem*, Kyiv University Bulletin, Vol. 2, pp. 273-277, 1999

Y.I. PETUNIN, B.V. RUBLEV AND Y. MILEYKO. *An optimal algorithm for constructing the smallest enclosing ellipse in a finite number of steps*, Kyiv University Bulletin, Vol. 3, pp. 87-95, 1998

## Manuscripts and work in preparation

Y. MILEYKO, J. S. WEITZ, AND A. J. FRIEND. *Effect of Unbalanced Copy Number Variation on Gene Expression*, in prep.

\* H. EDELSBRUNNER, Y. MILEYKO, AND J. S. WEITZ. *Hierarchical ordering of reticular networks*, in prep.

\* H. EDELSBRUNNER AND Y. MILEYKO.  *$L_p$ -stability of Lipschitz functions on a sphere*, in prep.

\* H. EDELSBRUNNER, J. HARER, AND Y. MILEYKO. *An experimental study of alpha-beta witness complexes*, Manuscript, Duke Univ., Durham, North Carolina, 2006

Y. MILEYKO. *Theory and algorithms for swept manifold intersections*, Ph.D. Thesis, Newark, NJ, May 2005

## Invited Talks

*Estimating homology of high-dimensional point clouds*, Vision, Information and Statistical Signal Theories and Applications group seminar, September 18, 2009, North Carolina State University, Raleigh, NC

*Computational Aspects of Persistent Homology*, NSF/CBMS Regional Conference on Algebraic Topology in Applied Mathematics, August 3-7, 2009, Cleveland State University, Cleveland, OH

*Defining Hierarchical Order within Reticular Networks*, Workshop on Data Analysis using Computational Topology and Geometric Statistics, March 8-13, 2009, BIRS, Banff, Alberta, Canada

*Nonlinear Effect of Copy Number Variation on Gene Expression*,

Systems Biology Seminar, February 3, 2010, Center for Systems Biology, Duke University, Durham, NC

Nonlinear Science Seminar, March 3, 2009, School of Physics, Georgia Institute of Technology, Atlanta, GA

Mathematical Biology & Ecology Seminar, February 25, 2009, School of Mathematics, Georgia Institute of Technology, Atlanta, GA

*Persistent Homology of Leaf Networks*, SIAM Conference on Discrete Mathematics, June 16-19, 2008, Burlington, VT

*$L_p$ -Stability of Persistence of Lipschitz Functions*,

Workshop on Geometric and Topological Approaches to Data Analysis, October 8-12, 2007, Chicago, IL

Geometry and Topology Seminar, October 22, 2007, School of Mathematics, Georgia Institute of Technology, Atlanta, GA

*$L_p$ -Stability of Total Persistence*, Workshop on Discrete Geometry and Topology in Low Dimensions, April 1-6, 2007, BIRS, Banff, Alberta, Canada

*Persistence Based Measures of Gene Periodicity*, Workshop on Application of Topology in Science and Engineering, Sep. 18-22, 2006, Berkeley, CA

*Witness Complexes at Work*, DARPA meeting on Topological Data Analysis, May 8-10, 2006, Santa Barbara, CA

## Contributed Talks

*Nonlinear Effect of Copy Number Variation on Gene Expression*, International Conference on Mathematical Biology, July 27-30, 2009, University of British Columbia, Vancouver, Canada

*Alpha-Beta Witness Complexes*, Workshop on Algorithms and Data Structures (WADS), August 15-17, 2007, Halifax, Nova Scotia, Canada

*Construction of Witness Complexes*, IMA New Directions Short Course in Computational Topology, July 6-16, 2004, Institute for Mathematics and its Applications, Minneapolis, MN

*Differential Equation Approach to Manifold Intersections*, SIAM Conference on Geometric Design and Computing, Nov. 10-13, 2003, Seattle, Washington

*Differential Equation Approach to Manifold Intersections*, Departmental Summer Project Presentation, June 2003, NJIT, NJ

*Problems associated with the Probability Hypothesis Density Function approach for multi-target tracking*, 7th PIMS-IMA Industrial Problem Solving Workshop, May 25-29, 2003, University of Calgary, Calgary, Alberta, Canada

*Solar Car Racing Strategy*, 6th PIMS-IMA Graduate Mathematics Modelling Camp, May 17-22, 2003, BIRS, Banff, Alberta, Canada

*Construction of the smallest enclosing ellipse and the smallest enclosing ellipsoid for a finite set of points in  $m$ -dimensional euclidean space*, 5th Ukrainian International Conference 'UkrOBRAZ', October 2000, Kyiv, Ukraine

*An algorithm for constructing the smallest enclosing ellipsoid for a finite set of points in  $\mathbb{R}^n$* , 8th International Conference in honor of M. Kravchuk, May 2000, Kyiv, Ukraine

## Poster Presentations

*Assessing Periodicity in Gene Expression Data*, 2008 Workshop for Young Researchers in Mathematical Biology, Sep. 2-5, 2008, Mathematical Biosciences Institute, Columbus, Ohio

*A Probabilistic Perspective on Persistence Homologies*, NIPS Workshop, Topology Learning: New Challenges At the Crossing of Machine Learning, December 7, 2007, Whistler, British Columbia, Canada

*Homological Characterization of Tangential Intersections*, NSF/DARPA Computational and Algorithmic Representations of Geometric Objects (CARGO) Program Review, May 11-12, 2005, Santa Fe, NM

*Swept Manifolds Intersections*, Frontiers in Applied and Computational Mathematics, May 21-22, 2004, New Jersey Institute of Technology, Newark, NJ

*Swept Surfaces Intersections*, The 15th Annual Saint Joseph's University Sigma Xi Student Research Symposium, April 23, 2004, Philadelphia, Pennsylvania

*Homology Criteria for Transverse Intersections*, NSF/DARPA Computational and Algorithmic Representations of Geometric Objects (CARGO) Program Review, May 18-20, 2004, Madison, WI

## Professional Service

Scientific Committee, Second Semester Emphasis on Geometry and Random Matrices, SAMSI 2006-07 Program on High Dimensional Inference and Random Matrices

Video and multimedia presentation program committee, 22<sup>nd</sup> Annual ACM Symposium on Computational Geometry.

Reviewer for ACM Symposium on Computational Geometry (SoCG).

Reviewer for ACM-SIAM Symposium on Discrete Algorithms (SoDA).

Reviewer for Discrete and Computational Geometry journal.

Reviewer for Computer-Aided Design journal.

Reviewer for Foundations of Computational Mathematics journal.

## Awards and Honors

College of Science & Liberal Arts Award: Exceptional Graduate Student (April 28, 2004)

NJIT, Department of Mathematical Sciences Graduate Assistantship (Fall 2001–May 2005)

Third prize, Ukrainian Mathematical Students Olympiad (1997)

## Non-academic Experience

Advanced Programmer/Engineer (C++, Visual C++, Win API, Networking), KP VTI, Oct. 2000 - Aug. 2001

Programmer (Visual C++), Debet Plus, Oct. 1998 - Sep.2000

## Computer Skills

C++, C, Networking, Web Programming, MATLAB, LaTeX and other basic software

## Professional Memberships

American Mathematical Society

Association for Computing Machinery

Society for Industrial and Applied Mathematics

Society for Mathematical Biology

## Press

*Study Reveals How Multiple Viruses Can Determine Bacterial Cell Fate*, Georgia Tech Press Release, Sep. 15, 2008

*Virology: Collective calm*, Research Highlights, Nature 454, 256, Jul. 17, 2008