

Alexander Vladimirovsky

curriculum vitae

Department of Mathematics
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Personal

Born in Odessa (USSR) in 1973.
Immigrated to USA in February 1991.
Became a US citizen in August 1997.

Education

Ph.D. in Applied Mathematics from the University of California, Berkeley, May 2001.
B.A. in Applied Mathematics (with high honors), University of California, Berkeley, May 1995.

Awards & Fellowships

2008 - Department of Mathematics Teaching Award (Cornell University).
2005 - NSF grant DMS-0514487 “*Non-iterative Numerical Methods for Boundary Value Problems*”.
2001 - NSF Mathematical Sciences Postdoctoral Research Fellowship (Cornell University).
2001 - Bernard Friedman Memorial Prize in Applied Mathematics (UC Berkeley).
1995 - Dorothea Klumpke Roberts Prize in Mathematics (UC Berkeley).

Academic Work Experience

Assistant Professor of Mathematics, Cornell University, since Fall 2004.

- taught a freshman-level course *Calculus for Engineers II* (Math 1910; Fall 2008);
- taught an undergraduate *Intro to Partial Differential Equations* course (Math 428; Spring 2007);
- taught a freshman-level course *Honors Calculus II* (Math 122; Fall 2006);
- taught *Calculus for the Life & Social Sciences* course (Math 106; Spring 2006);
- taught a graduate course on *Partial Differential Equations* (Math 619; Fall 2005, 2007, 2009);
- taught a graduate “Topics in Analysis” course (Math 613/712; Fall 2004, Spring 2008) on *Differential Games, Optimal Control, Front Propagation, and Dynamic Programming*;
- taught a senior-level course on *Numerical Analysis* (Math 425; Fall 2004, 2005, 2007, 2008, 2009);
- taught an *Honors Linear Algebra and Calculus* course (Math 224, Spring 2005);
- member of graduate fields in Mathematics, Applied Mathematics, Theoretical & Applied Mechanics, and Computational Science & Engineering;
- current chair of the committee on Mathematical Contest in Modeling (since Fall 2002);
- co-organizer of the Scientific Computing and Numerics (SCAN) Seminar.

NSF Postdoctoral Fellow / H. C. Wang Assistant Professor, Cornell University, 2001-2004.

- taught a senior-level course on *Dynamical Systems* (Math 420) in Spring 2002;
- taught an independent-study introductory course on *Differential Topology* in Spring 2003;
- taught *Honors Calculus II* (Math 122) and *Numerical Analysis* (Math 425) in Fall 2003.

Research Assistant at Lawrence Berkeley Laboratory, 1996-2001.

Studied various numerical methods for the nonlinear hyperbolic PDEs, their connections to problems in control theory & front propagation modeling, their applications to seismic imaging & photolithography.

Graduate Student Instructor, University of California, Berkeley, 1995-1996.

Courses taught: *Multivariable and vector calculus* (Math 53); *Numerical Analysis* (Math 128A).

Undergraduate Research Project at the University of California, Berkeley, 1994-1995.

Designed & developed a portable class library of universal Genetic Algorithms (GA);
created an object-oriented framework for the multi-modular function optimization problems;
performed the rate of convergence analysis for several directed-random-search optimization techniques.

Related Work Experience

More than fifteen years of programming and software engineering experience both in the industry and in academia; independent software consultant since 1993; specialized in design & development of mathematically intensive algorithms. The areas of general expertise included:

- Architecture of Object-Oriented Databases
- Scientific Computations
- Cross-Platform Software Engineering
- Directed Random Search Algorithms (e.g., Simulated Annealing, Genetic Programming, etc)
- Graph-Theoretic & Network-Flow Algorithms
- Multi-Parametric Search Optimization
- Object-Oriented Design & Architecture

A partial list of former clients and the detailed programming resume can be found at <http://www.math.cornell.edu/~vlad/resume.html>

Conferences & Workshops

- *New connections between Games, PDEs, and Image Processing*, PIMS (Vancouver, BC), July 2009.
- *Computational Sustainability*, (Ithaca, NY), June 8-11, 2009.
- *AMS Annual Meeting*, (Washington, DC), January 5-8, 2009.
- *Nonlinear Hyperbolic Partial Differential Equations and their Applications*, (Banff), Sep. 1-5, 2008.
- * *SIAM Annual Meeting*, (San Diego, CA), July 7-11, 2008.
- * *6th International Congress on Industrial & Applied Mathematics*, (Zurich), July 16-20, 2007.
- *Advanced Algorithms for the Bifurcation Analysis of Dynamical Systems*, (Montreal), July 2-6, 2007.
- *Numerical Methods for Degenerate Elliptic Equations*, (Banff, Canada), Dec. 9-14, 2006.
- *Rutgers Finite Element Circus*, (New Brunswick, NJ), October 21-2, 2005.
- *AIM Workshop on Optimal Control in High Dimensions*, (Palo Alto, CA), August 29-Sept. 2, 2005.
- *5th EUROMECH Nonlinear Dynamics Conference*, (Eindhoven, The Netherlands), August 7-12, 2005.
- *Foundations of Computational Mathematics*, (Santander, Spain), June 30 - July 9, 2005.
- * *SIAM Annual Meeting*, (Portland, OR), July 12-16, 2004.
- *Dynamics of Structured Systems*, (Oberwolfach, Germany), December 14-20, 2003.
- *5th International Congress on Industrial & Applied Mathematics*, (Sydney, Australia), July 7-11, 2003.
- * *SIAM Conference on Applications of Dynamical Systems*, (Snowbird, UT), May 27-31, 2003.
- *SIAM Mathematical Issues in Geosciences*, (Austin, TX), March 17-20, 2003.
- *Challenges in Scientific Computing*, (Berlin, Germany), October 2-5, 2002.

- *SIAM 50th Anniversary Meeting*, (Philadelphia, PA), July 8-12, 2002.
- *First Joint AMS-UMI Meeting*, (Pisa, Italy), June 12-16, 2002.
- *Advances on Nonlinear PDEs*, (L'Aquila, Italy), June 5-8, 2002.
- *Hybrid Systems: Computation and Control*, (Stanford, CA), March 25-27, 2002.
- *Nonlinear Partial Differential Equations*, PIMS (Vancouver, BC), July-August 2001.
- *Analysis: Models and Methods*, MSRI (Berkeley, CA), March 2001.
- *The Mathematics of Imaging*, MSRI (Berkeley, CA), 1999.
- *Algebra, Algorithms, Approximations*, MSRI (Berkeley, CA), 1996.
- *IEEE Symposium on Fuzzy Logic, Genetic Algorithms, & Neural Networks*, 1994.

* - mini-symposium (co)organizer

Seminar & Colloquium Talks Delivered at

Lawrence Berkeley National Laboratory, CA; Courant Institute, NY; Cornell University, NY; Stanford University, CA; Università di Padova, Italy; Universität Paderborn, Germany; UC Berkeley, CA; Clarkson University, NY; University of Toronto, Canada; Rensselaer Polytechnic Institute, NY; Universitat Autònoma de Barcelona, Spain; Universitat de Barcelona, Spain; Northwestern University, IL; Université de Montréal, Canada; University of British Columbia, Canada; Simon Fraser University, Canada; University of Maryland, MD; Brown University, RI; Instituto Superior Técnico, Lisbon, Portugal; UC Davis, CA; University of Washington, WA; Massachusetts Institute of Technology, MA; Harvard University, MA; United Technologies Research Center; CT.

Other Mathematical Interests

- * Control Theory & Differential Games * Front Propagation Problems
- * Anisotropy & Homogenization * Bifurcation Theory * Dimension Reduction
- * Pareto & Multi-modular Optimization * Mathematical Economics
- * Elimination Theory * Computability & Complexity * Computational Geometry
- * Approximate & Probabilistic Algorithms * Network Optimization
- * Rigorous/Auto-validating Numerical Methods * Computational Error Analysis

Professional Memberships

- American Mathematical Society
- Society for Industrial and Applied Mathematics

Reviewer for

- SIAM Journal on Numerical Analysis
- SIAM Journal on Applied Dynamical Systems
- SIAM Journal on Scientific Computing
- Journal of Computational Physics
- European Journal of Operational Research
- ACM Transactions on Graphics
- Proceedings of the National Academy of Sciences

NSF Panel member: NSF, Applied & Computational Mathematics (2006 and 2008).

Partially Supported by

2005 – NSF grant DMS-0514487 “*Non-iterative Numerical Methods for Boundary Value Problems*”.

2004 – NSF-ITR Collaborative Research Grant #0426787 “*Algorithms for Large-Scale Simulations of Turbulent Combustion*” (PI: Stephen Pope, Mechanical and Aerospace Engineering, Cornell University).

2001-2004 NSF Mathematical Sciences Postdoctoral Research Fellowship.

Publications

A. Vladimírsky, *Fast Methods for Static Hamilton-Jacobi Partial Differential Equations*, Ph.D. Dissertation, Dept. of Mathematics, University of California, Berkeley, 2001.

J.A. Sethian and A. Vladimírsky, *Fast methods for the Eikonal and related Hamilton-Jacobi equations on unstructured meshes*, Proc. Natl. Acad. Sci. USA, 97/11: 5699-5703 (2000).

J.A. Sethian and A. Vladimírsky, *Ordered upwind methods for static Hamilton-Jacobi equations*, Proc. Natl. Acad. Sci. USA, 98/20: 11069-11074 (2001).

J.A. Sethian and A. Vladimírsky, *Ordered Upwind Methods for Hybrid Control*. 5th International Workshop, HSCC 2002, Stanford, CA, USA, March 25-27, 2002, Proceedings (LNCS 2289).

J.A. Sethian and A. Vladimírsky, *Ordered Upwind Methods for Static Hamilton-Jacobi Equations: Theory & Algorithms*, SIAM J. on Numerical Analysis, 41/1: 325-363 (2003).

J. Guckenheimer and A. Vladimírsky, *A fast method for approximating invariant manifolds*, SIAM J. on Applied Dynamical Systems 3/3: 232-260 (2004).

B. Krauskopf, H.M. Osinga, E.J. Doedel, M.E. Henderson, J. Guckenheimer, A. Vladimírsky, M. Dellnitz, and O. Junge, *A survey of methods for computing (un)stable manifolds of vector fields*; Int. J. Bifurcation and Chaos 15/3: 763-791 (2005).

Z. Ren, S.B. Pope, A. Vladimírsky, and J.M. Guckenheimer, *The invariant constrained equilibrium edge preimage curve method for the dimension reduction of chemical kinetics*, Journal of Chem. Phys. 124, 114111 (2006).

A. Vladimírsky, *Static PDEs for Time-Dependent Control Problems*, Interfaces and Free Boundaries, 8/3: 281-300 (2006).

Z. Ren, S.B. Pope, A. Vladimírsky, and J.M. Guckenheimer, *Application of the ICE-PIC method for the dimension reduction of chemical kinetics coupled with transport*, Proceedings of the Combustion Institute 31, 473-481 (2007).

A. Vladimírsky, *Label-setting methods for Multimode Stochastic Shortest Path problems on graphs*, Mathematics of Operations Research, 33/4: 821-838 (2008).

T. Sahai, A. Vladimírsky, *Numerical methods for approximating invariant manifolds of delayed systems*, SIAM J. on Applied Dynamical Systems, 8/3: 1116-1135 (2009).

Accepted / To appear

A.M. Oberman, R. Takei, and A. Vladimírsky, *Homogenization of metric Hamilton-Jacobi equations*, accepted by Multiscale Modeling and Simulation; preprint available from http://www.math.cornell.edu/~vlad/papers/HomogMain_revised.pdf

A. Kumar and A. Vladimírsky, *An efficient method for multiobjective optimal control and optimal control subject to integral constraints*, accepted by the Journal of Computational Mathematics; preprint available from <http://arxiv.org/abs/0901.3977>

In preparation

J. Andrews and A. Vladimírsky, *Deterministic control of randomly-terminated processes*, in progress.

J.M. Guckenheimer, J.A. Sethian, and A. Vladimírsky, *Multi-valued solutions to boundary value problems: the invariant manifold approach*, in progress.

A. Vladimírsky, *Fast methods for optimal traveling without a map*, in progress.