

Maria Emelianenko

CONTACT INFORMATION

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Department of Mathematical Sciences
Carnegie Mellon University
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RESEARCH INTERESTS

Numerical methods and applied PDE, modeling of nonlinear systems, multigrid methods, optimization, stochastic processes, applications to materials science, physics and biology

POSITIONS

Carnegie Mellon University, Pittsburgh, Pennsylvania, USA

CNA Postdoctoral Research Associate, Center for Nonlinear Analysis 08/2005 - present

Studied theoretical and simulation aspects of modeling grain growth in complex materials. Developed PDE models for grain boundary distributions capable of bridging the gap between microscopic and mesoscopic level dynamics.

Lectured junior/senior level Numerical Analysis courses enhanced with in class digital presentations and hands-on computer lab sessions. Supervised undergraduate research projects. Average evaluation scores: 4.5 on the scale from 5(excellent) to 1(poor).

Pennsylvania State University, University Park, Pennsylvania, USA

Research Assistant, Mathematics Department 2003 - 2005

Designed fast new quasi-Newton and multilevel algorithms for quantization and clustering using centroidal Voronoi tessellations and proved its superior convergence properties. Developed optimization methods and computational tools to automate phase diagram calculation for multicomponent materials. New algorithm based on adaptive local optimization and quasirandom high-dimensional sampling techniques has been proposed and implemented.

Teaching Assistant/Associate, Mathematics Department 1999 - 2005

Lectured ODE, PDE, Matrix Algebra and College Algebra I-II courses. At various times wrote reports, designed syllabi, prepared and graded exams, supervised graders. Average evaluation scores: 1.6 on the scale from 1(excellent) to 6(poor).

EDUCATION

Pennsylvania State University, University Park, Pennsylvania, USA

Department of Mathematics

Ph.D. Mathematics, Minor in High Performance Computing 08/2005

Thesis: "Multilevel and Adaptive Methods for Some Nonlinear Optimization Problems"

Advisor: Prof. Qiang Du

M.A. Mathematics 08/2002

Thesis: "Analysis of Constrained Multidimensional Birth-Death Processes"

Advisor: Prof. N. Gautam

Moscow State University, Moscow, Russia

Department of Computational Mathematics and Cybernetics

M.S. Applied Mathematics, *summa cum laude* 06/2001

Thesis: Numerical approach to solving Andronov-Hopf and Bogdanov-Takens systems of differential equations

Advisor: Prof. A. Bratus

B.S. Computer Science/Math, *summa cum laude* 06/1999

HONORS AND
AWARDS

First Place in Poster Competition, Gordon Research conference on Physical Metallurgy	07/2006
Travel Award, Gordon Research conference on Physical Metallurgy	07/2006
Dean's Recognition for Outstanding Teaching, CMU	2005
SIAM Student Travel Award, SIAM Meeting, New Orleans	07/2005
Honorable Mention in Student Paper Competition, Copper Mountain Conference	04/2005
Graduate Assistant Outstanding Teaching Award Nomination, PSU	2004
Graduate School Teaching Certificate, PSU	2004
Teaching with Technology Certificate, PSU	2004
Teaching Associate Certificate, Department of Mathematics, PSU	2003
Davey Fellowship, Department of Mathematics, PSU	2003
Eberly College of Science Fellowship, PSU	1999
Moscow City Mayor's stipend for Distinguished Students, Moscow State University	1998
Dean's List, Moscow State University	1996-1999
Dubna Foundation of Science and Education Scholarship	1995-1996
Highest Distinction ("Gold Medal") on graduation from high school	1996

PUBLICATIONS

1. M. Emelianenko, D. Golovaty, D. Kinderlehrer, S. Taasan, "*Towards a statistical theory of texture evolution*", submitted to SIAM J. Sci. Comp., 2007
2. M. Emelianenko, L. Ju, A. Rand, "*Weak global convergence of the Lloyd method for computing centroidal Voronoi tessellations in \mathbb{R}^d* ", submitted to SIAM J. Numer. Anal., 2007
3. M. Emelianenko, D. Golovaty, D. Kinderlehrer, S. Taasan, "*Texture evolution via continuous time random walk theory*", Center for Nonlinear Analysis, No. 06-CNA-011, 2006
4. M. Emelianenko, D. Golovaty, D. Kinderlehrer, S. Taasan, "*Grain boundary evolution: new perspectives*", Center for Nonlinear Analysis, No. 06-CNA-010, 2006
5. Q. Du, M. Emelianenko "*Uniform convergence of a nonlinear energy-based multilevel quantization scheme via centroidal Voronoi tessellations*", under revision for SIAM J. Numer. Anal., 2006
6. Q. Du, M. Emelianenko and L. Ju "*Convergence properties of the Lloyd algorithm for computing the centroidal Voronoi tessellations*", SIAM J. Numer. Anal., 44, Issue 1 (2006), 102-119
7. M. Emelianenko, Z.-K. Liu, Q. Du "*A New Algorithm for the Automation of Phase Diagram Calculation*", Comp. Mater. Sci., 35, issue 1 (2006), 61-74 (In ScienceDirect Top 25 Hottest Articles)
8. Q. Du, M. Emelianenko "*Acceleration schemes for computing the centroidal Voronoi tessellations*", Numer. Linear Algebra Appl., 13, Issue 2-3 (Special Issue on Multigrid Methods) (2006), 173-192
9. Q. Du, M. Emelianenko, H.-C. Lee and X. Wang "*Ideal point distributions, best mode selections and optimal spatial partitions via centroidal Voronoi tessellations*", in proceedings of the 2nd International Symposium on Voronoi Diagrams in Sciences and Engineering, Seoul, Korea, Oct 2005 (VD2005), pp. 325-333, 2005
10. Q. Du, M. Emelianenko "*Uniform convergence of a multilevel energy-based quantization scheme*", to appear in Lect. Notes Comput. Sci. Eng., in proceedings of the DD16 conference, Courant Inst., New York, 2005
11. M. Yacoubi, M. Emelianenko and N. Gautam "*Pricing in next generation network queuing model to guarantee QoS*", Perform. Evaluation, 5, issue 1 (2003), 59-84 (In Top 10 downloads from Performance Evaluation website in 2003)
12. E.B. Dushanov, M.G. Emelianenko and G.Yu. Konovalova "*On formats of the representation of*

real numbers and algorithm for automatic declaration of constants of the computer real arithmetic", J. Comput. Meth. Sci. Eng., 2, issue 1-2 (2002), 57-62

13. G.A. Emelyanenko, V.N. Samoilo and M.G. Emelianenko "*The uncertainty principle in numerical linear algebra*", in International Conference on Computational Mathematics. Part I, II, (2002), 104–106, ICMMG, Novosibirsk

PAPERS IN
PREPARATION

1. "*Boltzmann-type kinetic approach to grain growth dynamics*", with Shlomo Ta'asan, David Kinderlehrer and Dmitry Golovaty.

2. "*Automation of high-dimensional phase diagram calculation*", with Zi-Kui Liu and Qiang Du.

3. "*Uniformly convergent two-dimensional nonlinear quantization scheme*", with Ludmil Zikatanov and Qiang Du.

PRESENTATIONS:

- "Mathematical modeling and simulation of texture evolution", poster presentation, Barrett Lectures, U. Tennessee, Knoxville, TN, April 29-30, 2007
- "Centroidal Voronoi tessellations: concepts and applications", Undergraduate Colloquium series, CMU, Pittsburgh, PA, April 12, 2007
- "Texture evolution: mathematical aspects", MIMP Seminar, MRSEC, CMU, Pittsburgh, PA, March 27, 2007
- "Toward a Statistical Theory of Texture Evolution", contributed talk, SIAM CSE07, Costa Mesa, CA, February 19-23, 2007
- "Multidimensional Energy-based Multilevel Quantization Scheme and its Applications", invited talk, SIAM CSE07, Costa Mesa, CA, February 19-23, 2007
- "Centroidal Voronoi tessellations: theory and applications", invited talk, CSUCI, Camarillo, CA, Feb 16, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, US Naval Academy, Annapolis, MD, Feb 9, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, Clarkson Univ., Potsdam, NY, Feb 5, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, American Univ., Washington, DC, Feb 2, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, Purdue Univ., West Lafayette, IN, Jan 31, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, U. Tennessee, Knoxville, TN, Jan 29, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, George Mason Univ., Fairfax, VA, Jan 26, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, Illinois Inst. Tech., Chicago, IL, Jan 22, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, U. Minnesota, Minneapolis, MN, Jan 19, 2007
- "Mathematical modeling and simulation of texture evolution", contributed talk, Joint AMS Meetings, Jan 4-8, 2007
- "Mathematical modeling and simulation of texture evolution", invited talk, U. Akron, Akron, OH, Dec 13, 2006

- "Mathematical modeling and simulation of texture evolution", invited talk, U. Pittsburgh, Pittsburgh, PA, Dec 5, 2006
- "Mathematical Modeling and Simulation of Texture Evolution", invited presentation, A Conference on Applied Analysis on the Occasion of the 65th Birthday of David Kinderlehrer, CNA, CMU, Pittsburgh, PA, Oct 19 - 21, 2006
- "Mathematical modeling and simulation of the grain boundary character distribution", invited poster presentation, Gordon Research Conference on Physical Metallurgy, Plymouth, NH, July 23-28, 2006
- "Uniform convergence of a nonlinear energy-based multilevel quantization scheme via centroidal Voronoi tessellations", invited presentation, Joint MAA-SIAM Meeting, Auburn, AL, March 31-April 2, 2006
- "A nonlinear energy-based multilevel quantization scheme", invited presentation, Frontiers in Nonlinear Analysis, CNA, CMU, Pittsburgh, Sept 8-10, 2005
- "Uniform convergence of a multilevel energy-based quantization scheme", invited presentation, Minisymposium on centroidal Voronoi tessellations, New Orleans, July 11-15, 2005
- "A Nonlinear Energy-based Multilevel Quantization Scheme", invited presentation, XII Copper Mountain Conference on Multigrid Methods, Colorado, April 3-8, 2005
- "A New Algorithm for the Automation of Phase Diagram Calculation", invited talk, MCS D Seminar Series, NIST, Gaithersburg, MD, March 22, 2005
- "Uniform Convergence of a Multigrid Energy-based Quantization Scheme", poster presentation, 16th International Conference on DDM, Courant Institute, January 12-15, 2005
- "A New Algorithm for the Automation of Phase Diagram Calculation", poster presentation, NSF Division of Materials Research ITR Computational Workshop, UIUC, Urbana, IL, June 17-19, 2004

PROFESSIONAL
ACTIVITIES

- Conference organization:
co-organizer, "Centroidal Voronoi Tessellations: Theory, Algorithms and Applications" minisymposium for SIAM Workshop on Combinatorial Scientific Computing (CSC07), Costa Mesa, CA, Feb 17-19, 2007
- Refereeing for:
CALPHAD, Intl. J. Num. Methods in Fluids
- Undergraduate research activities:
Summer Undergraduate Applied Math Institute, CMU, May 30 - July 17, 2007
- Diversity programs:
Panelist, Women in Science group, CMU 2006
Member, Women of Mathematics group, PSU 2000-2005
Sponsored participant, "Career Options for Women in Mathematics" workshop, IMA, Minneapolis, Feb 4-5, 2005
- Professional memberships:
SIAM, AMS, MAA.

ADDITIONAL
INFORMATION

Computer skills: MATLAB, C, C++, Java, Fortran, Pascal, MPI, LaTeX, Windows, Linux
Foreign languages: fluent English, spoken French, basic German, native fluency in Russian
Interests: long distance running, tennis, music

REFERENCES

Prof. David Kinderlehrer
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Carnegie Mellon University, Pittsburgh, PA
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Prof. Qiang Du
Department of Mathematics
Penn State University, University Park, PA
Email: qdu@math.psu.edu

Prof. Ludmil Zikatanov
Department of Mathematics
Penn State University, University Park, PA
Email: ltz@math.psu.edu

Prof. Shlomo Ta'asan
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Carnegie Mellon University, Pittsburgh, PA
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Prof. James A. Sellers (teaching)
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Prof. Zi-Kui Liu
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Penn State University, University Park, PA
Email: zikui@psu.edu