

Malena I. Español

California Institute of Technology
Graduate Aerospace Laboratories
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EDUCATION

Tufts University, Medford, MA

Ph.D. in Mathematics

May 2009

Advisor: Misha E. Kilmer

Dissertation: *Multilevel Methods for Discrete Ill-Posed Problems: Application to Deblurring.*

Tufts University, Medford, MA

M.Sc. in Mathematics

May 2005

Advisor: Misha E. Kilmer

Universidad de Buenos Aires, Argentina

Licenciada (B.Sc.) in Mathematics

August 2003

Advisor: Gabriel Acosta, Co-Advisor: Horacio Rotstein (Boston University)

Thesis: *A Dynamical Study of Oscillatory Chemical Reactions: Control Using Periodical External Forces.*

RESEARCH EXPERIENCE

California Institute of Technology, Pasadena, CA

July 2009 – Present

Graduate Aerospace Laboratories

Postdoctoral Scholar

Supervisor: Michael Ortiz

Developing and analyzing numerical methods for the study of solid material behavior. Analyzing atomistic-to-continuum computational schemes by means of Gamma-convergence.

University of Bonn, Bonn, Germany

October – December 2011

Hausdorff Center for Mathematics – Institute for Applied Mathematics

Guest

Host: Sergio Conti

Studied the Gamma-convergence of the quasicontinuum method.

Tufts University, Medford, MA

September 2003 – May 2009

Department of Mathematics

Research Assistant

Advisor: Misha E. Kilmer

Developed iterative methods for discrete ill-posed problems arising from the discretization of Fredholm integral equations of the first kind. Developed and implemented in MATLAB wavelet-based multilevel methods for image deblurring problems.

Harvard University - Children's Hospital, Boston, MA

June – August 2007

Research Assistant

Supervisor: Gabriel Kreiman

Designed and implemented regularized classifiers in MATLAB to decode the activity of neural populations in the cerebral cortex. Applied machine learning techniques to data obtained from electroencephalograms of epileptic patients.

The MathWorks, Natick, MA

June – August 2006

Summer Intern

Supervisor: Patrick D. Quillen

Designed, implemented in C++, and tested algorithms for computing Incomplete LU (ILU) factorizations (ILU(0), ILUT, and MILU). These subroutines have been incorporated in MATLAB 2007a.

University of Minnesota, Minneapolis, MN

August 2005

Institute of Mathematics and its Applications (IMA)

Workshop participant

Mentor: Edward Keyes

Developed and implemented an algorithm for the reconstruction of integrated circuit layouts. Worked in a team of six graduate students during a 10-day workshop.

Universidad de Buenos Aires, Argentina

January 2003 – August 2003

Advisor: Gabriel Acosta, Co-Advisor: Horacio Rotstein (Boston University)

Applied dynamical system theory to oscillatory chemical reaction models. Obtained numerical solutions by a C implementation.

PUBLICATIONS

Peer-Reviewed Journal Articles

- M. I. Español and M. E. Kilmer. “*Multilevel Approach for Signal Restoration Problems with Toeplitz Matrices*”. SIAM J. Scientific Computing 32(1): 299-319 (2010).
- M. E. Kilmer, P. C. Hansen, and M. I. Español. “*A Projection-Based Approach to General-Form Tikhonov Regularization*”. SIAM J. Scientific Computing 29(1): 315-330 (2007).

Manuscripts in Preparation

- M. I. Español and M. E. Kilmer. “*A Multilevel, Modified Regularized Total Least Norm Approach to Signal Deblurring*”.
- M. I. Español, D. M. Kochmann, S. Conti, and M. Ortiz. “*A Gamma-Convergence Analysis of the Quasicontuum Method*”.

Other Publications

- M. I. Español. “*Multilevel Methods for Discrete Ill-Posed Problems: Application to Deblurring*”. Ph.D. Thesis. Department of Mathematics, Tufts University, April 2009. <http://www.its.caltech.edu/~mespanol/MalenaEspanolthesis.pdf>
- M. I. Español. “*A Dynamical Study of Oscillatory Chemical Reactions: Control Using Periodical External Forces*” (in Spanish). Tesis de Licenciatura. Departamento de Matemáticas, Universidad de Buenos Aires, August 2003. <http://cms.dm.uba.ar/academico/carreras/licenciatura/tesis/espanol.pdf>

STUDENTS SUPERVISED

Undergraduate Research Mentoring

California Institute of Technology

- Hyun Ji Jane Bae, “*Analysis of atomistic models for solid materials*”, SURF 2011.
- Ka Kin Kenneth Hung, “*Analysis of the Quasicontinuum Method*”, SURF 2011.
- Andre Pradhana, “*Solving Kohn-Sham equation via iterative methods*”, SURF 2010.
- Stephanie Tsuei, “*Developing computational tools to predict material behavior*”, SURF 2010. Stephanie presented this project in the Undergraduate Research Papers Session at the *SIAM Conference on Computational Science and Engineering*, Reno, NV, February 28-March 4, 2011.

CONFERENCES – SEMINARS – WORKSHOPS

Invited Conference Talks

- A Gamma-Convergence Analysis of the Quasicontinuum Method. *Pattern Formation and Multiscale Phenomena in Materials Workshop*, Mathematical Institute, University of Oxford, Oxford, United Kingdom, September 26-28, 2011.
- Multilevel Methods for Deblurring Problems. *Applied Mathematics and Image Processing Summer Workshop*, University of Texas - Pan American, Edinburg, TX, May 30-June 1, 2011. **Received Workshop Travel Funding**
- A Multilevel, Modified Regularized Total Least Norm Approach to Signal Deblurring. Minisymposium at the *Applied Inverse Problems Conference*, Texas A&M University, College Station, TX, May 23-27, 2011. **Received Conference Travel Award**
- Multilevel Methods for Image Deblurring. Minisymposium at the *SIAM Conference on Computational Science and Engineering (CSE11)*, Reno, NV, February 28-March 4, 2011.
- A Multilevel, Modified Regularized Total Least Norm Approach to Signal Deblurring. Special Session at the *AMS Joint Mathematics Meetings*, San Francisco, CA, January 13-16, 2010.
- A Modified, Regularized Total Least Norm Approach to Signal Restoration. Minisymposium at the *SIAM Conference on Applied Linear Algebra (LA09)*, Monterey Bay-Seaside, CA, October 26-29, 2009. **Received SIAM Postdoctoral Travel Award**
- Multilevel Approaches for the Total Least Squares Method in Deblurring Problems. Minisymposium at the *6th International Conference on Industrial and Applied Mathematics (ICIAM07)*, Zurich, Switzerland, July 16-20, 2007. **Received SIAM Student Travel Award**
- An Iterative, Projection-Based Algorithm for General Form Tikhonov Regularization. Minisymposium at the *SIAM Annual Meeting*, New Orleans, LA, July 11-15, 2005.

Contributed Conference Talks

- A Gamma-Convergence Analysis of the Quasicontinuum Method. *11th U.S. National Congress on Computational Mechanics (USNCCM-11)*, Minneapolis, MN, July 25-29, 2011. **Received Congress Travel Award**
- A Gamma-Convergence Analysis of the Quasicontinuum Method. *7th International Conference on Industrial and Applied Mathematics (ICIAM11)*, Vancouver, BC, Canada, July 18-22, 2011. **Received SIAM Postdoctoral Travel Award**
- Multilevel Approach for Signal Restoration Problems with Toeplitz Matrices. *10th Copper Mountain Conference on Iterative Methods*, Copper Mountain, CO, April 6-11, 2008. **Received Conference Travel Funding**
- Image Deblurring with Mathematical Models. *12th Annual Graduate Student Research Symposium at Tufts University*, Medford, MA, March 29, 2008.
- Ill-Posed Problems and Regularization Methods. Graduate Student Session, *NES/MAA Fall 2005 Meeting*, Durham, NH, November 18-19, 2005.

Contributed Posters

- A Gamma-Convergence Analysis of the Quasicontinuum Method. *11th U.S. National Congress on Computational Mechanics (USNCCM-11)*, Minneapolis, MN, July 25-29, 2011. **Received Congress Travel Award**
- A Gamma-Convergence Analysis of the Quasicontinuum Method. *SIAM Conference on Computational Science and Engineering (CSE11)*, Reno, NV, February 28-March 4, 2011.
- A Gamma-Convergence Analysis of the Quasicontinuum Method. *IPAM Women in Mathematics Symposium*, Los Angeles, CA, February 24-26, 2011.
- A Multilevel, Modified Regularized Total Least Norm Approach to Signal Deblurring. *Conference on Numerical Linear Algebra: Perturbation, Performance and Portability*, Austin, TX, July 19-20, 2010. **Received Conference Travel Funding**

- Multilevel Approach for Signal Restoration Problems with Toeplitz Matrices. *CIG Workshop on Mathematical and Computational Issues in the Solid Earth Geosciences*, Santa Fe, NM, September 15-17, 2008. *Received Workshop Travel Funding*
- Multilevel Approach for Signal Restoration Problems with Toeplitz Matrices. *AWM Workshop for Women Graduate Students and recent PhDs, SIAM Annual Meeting*, San Diego, CA, July 7-11, 2008. *Received Association for Women in Mathematics (AWM) Travel Award*

Seminars and Other Talks

- A Gamma-Convergence Analysis of the Quasicontinuum Method. Mathematics in the Sciences Seminar, Institute for Mathematics, University of Wurzburg, Wurzburg, Germany, December 8, 2011.
- A Gamma-Convergence Analysis of the Quasicontinuum Method. Applied Analysis Seminar, Institute for Applied Mathematics, University of Bonn, Bonn, Germany, December 1, 2011.
- A Gamma-Convergence Analysis of the Quasicontinuum Method. Seminar Series in Numerical Mathematics and Mechanics, Institute for Mechanics, University of Duisburg-Essen, Essen, Germany, November 28, 2011.
- A Gamma-Convergence Analysis of the Quasicontinuum Method. Differential Equations and Numerical Analysis Seminar, Departamento de Matemáticas, Universidad de Buenos Aires, Argentina, September 13, 2011.
- Multilevel Methods for Image Deblurring. Statistics/OR/Math Finance Seminar, Claremont Center for the Mathematical Sciences, Claremont, CA, November 4, 2010.
- Multilevel Methods for Deblurring Problems. Center for Engineering Science Advanced Research (CESAR) Seminar, Oak Ridge National Laboratory, Oak Ridge, TN, May 12, 2009.
- Multilevel Methods for Deblurring Problems. Computational Solid Mechanics Group Seminar, California Institute of Technology, Pasadena, CA, May 8, 2009.
- A Multilevel, Modified Regularized Total Least Norm Approach to Signal Deblurring. Numerical Analysis Seminar, Department of Mathematics, University of Maryland, College Park, MD, April 21, 2009.
- Multilevel Methods for Ill-Posed Problems. SIAM Student Chapter Luncheon Seminar, Tufts University, Medford, MA, November 19, 2008.
- Multilevel Methods for Ill-Posed Problems. Applied Mathematics and Scientific Computing Seminar, Department of Mathematics, Temple University, Philadelphia, PA, November 12, 2008.
- Multilevel Methods for Ill-Posed Problems. Differential Equations and Numerical Analysis Seminar, Departamento de Matemáticas, Universidad de Buenos Aires, Argentina, May 14, 2008.
- Neural Decoding: Classifiers in Action. SIAM Student Chapter Luncheon Seminar, Tufts University, Medford, MA, November 19, 2007.
- Neural Decoding: Classifiers in Action. Kreiman Lab Seminar, Children's Hospital Boston, Boston, MA, August 31, 2007.
- Discrete Ill-Posed Problems and Regularization Methods. Kreiman Lab Seminar, Children's Hospital Boston, Boston, MA, June 17, 2007.
- Singular Value Decomposition and its Applications to Ill-Posed Problems. Student Seminar, Departamento de Matemáticas, Universidad de Buenos Aires, Argentina, May 14, 2007.
- A Summer Experience at The MathWorks. Presentation for Computer Science, Engineering, and Mathematics Scholars (CSEMS) at Tufts University, Medford, MA, November 8, 2006.
- A Summer Experience at The MathWorks. SIAM Student Chapter Luncheon Seminar, Tufts University, Medford, MA, November 1, 2006.
- Image Deblurring. Image Processing Team Meeting, The MathWorks, Natick, MA, August 24, 2006.
- A Multilevel Method for Ill-Posed Problems. MATLAB Math Team, The MathWorks, Natick, MA, January, 2006.

Workshop Participation

- Institute for Mathematics and Its Applications (IMA) Large-scale Inverse Problems and Quantification of Uncertainty Workshop, University of Minnesota, Minneapolis, MN, June 6-10, 2011. *Received Workshop Travel Funding*
- Institute for Pure and Applied Mathematics (IPAM) Women in Mathematics Symposium, UCLA, Los Angeles, CA, February 24-26, 2011.
- Mathematical Sciences Research Institute (MSRI) Introductory Workshop on Inverse Problems and Applications, Berkeley, CA, August 23-27, 2010. *Received Workshop Travel Funding*
- Summer School in Seismic Imaging, University of Washington, Seattle, WA, August 10-14, 2009. *Received Summer School Travel Funding*
- American Mathematical Society Mathematics Research Communities (AMS MRC) Program in Inverse Problems, Snowbird Resort, UT, June 20-26, 2009. *Received Program Travel Funding*
- Graduate Student Workshop in Inverse Problems, Colorado State University, Ft. Collins, CO, July 30-August 3, 2007. *Received Workshop Travel Funding and Tufts GSAS Travel Award*
- Mathematical Modeling in Industry: A Workshop for Graduate Students, Institute for Mathematics and Its Applications (IMA), University of Minnesota, Minneapolis, MN, August 1-10, 2005. *Received Workshop Travel Funding and Tufts GSAS Travel Award*

Special Event Attendance

- MIT Women in Mathematics: A Celebration, Cambridge, MA, April 12-13, 2008.
- Research by Undergraduates in Mathematics Boston University Symposium, Boston, MA, April 24, 2004.

TEACHING EXPERIENCE

California Institute of Technology, Pasadena, CA

March 2010 – December 2010

Instructor

Undergraduate Reading and Independent Study: Electronic Structure of Materials, and Computational Physics.

Tufts University, Department of Mathematics, Medford, MA

September 2005 – May 2009

Instructor

Introduction to Calculus, Calculus I, and Calculus II.

Teaching Assistant

Applications of Advanced Calculus, Numerical Analysis, Numerical Linear Algebra, and Symmetry.

Universidad de Buenos Aires, Argentina

April 1998 – June 2001

Instructor

Calculus for Economists, and Algebra for Economists.

OTHER PROFESSIONAL EXPERIENCE

BC Alejandro Bloise Consulting, Buenos Aires, Argentina

October 1998 – June 2001

Actuarial Assistant

Priced life and health insurance products.

PROFESSIONAL AND COMMUNITY SERVICE

- Referee for SIAM Journal on Scientific Computing, Inverse Problems, Applied Numerical Mathematics.
- Mentor, Women Mentoring Women Program at Caltech. September 2009 – Present
- Facilitator, SFP Journal Club: Mathematics in Image Processing. Summer 2011
- Co-mentor, Summer Undergraduate Research Fellowship Program at Caltech. Summer 2010, 2011
- Co-mentor Advisory Council Member, Student Faculty Programs (SFP) at Caltech. Summer 2010, 2011
- Judge, Doris S. Perpall SURF Speaking Competition at Caltech. October 16, 2010
- President and Founder, SIAM Student Chapter at Tufts University. November 2004 – August 2006
- Co-President, Math Club at Tufts University. February 2004 – March 2006

Recognition

- SIAM Student Chapter Certificate of Recognition, 2008.

Organized Minisymposia

- Atomistic/Continuum Multiscale Methods of Solids with P. Lin, M. Luskin, C. Ortner, and M. Ortiz, 7th *International Conference on Industrial and Applied Mathematics (ICIAM11)*, Vancouver, BC, Canada, July 18-22, 2011. **Received SIAM Postdoctoral Travel Award**
- Inverse Problems in Industrial Applications with J. Chung, *SIAM Conference on Computational Science and Engineering (CSE09)*, Miami, March 2-6, 2009. **Received SIAM Student Travel Award and Tufts GSAS Travel Award**

Outreach

- Judge, Intel International Science and Engineering Fair, an international science competition for students in grades 9-12, Los Angeles, CA, May 8-13, 2011.
- Board Member, The Somerville Mathematics Fund, a community organization that provides scholarships and math enrichment to the Somerville Community, Somerville, MA, May 2005 – June 2009.
- Volunteer, Scrapheap Showdown, a competition and fundraiser for the Somerville Mathematics Fund, where teams of three students have to solve a creative engineering problem in a single afternoon using salvage materials provided at the site of the competition, Medford, MA, 2006 and 2008.
- Volunteer, Family Math Night, a community event that consisted of math games and activities for middle school students and their families hold at the East Somerville Community School, Somerville, MA, April 9, 2007.
- Invited Speaker, “A Summer Experience at The MathWorks”, a presentation for Computer Science, Engineering, and Mathematics Scholars (CSEMS) at Tufts University, Medford, MA, November 8, 2006.
- Volunteer, KEYS - Keys to empowering youths, a motivational program for 11-13 year old girls to participate in workshops held periodically throughout the year at MIT, Cambridge, MA, 2002.

MEMBERSHIP

- American Mathematical Society (AMS) Since 2003
- Association for Women in Mathematics (AWM) Since 2003
- Society of Industrial and Applied Mathematics (SIAM) Since 2003
Activity Groups: Computational Science and Engineering, Imaging Science, Linear Algebra, Material Science
- United States Association for Computational Mechanics (USACM) Since 2011

LANGUAGES

Spanish native speaker, fluency in English.