

Selim Esedoglu

Department of Mathematics
University of Michigan
Ann Arbor, MI 48109
(734)-936-9926
esedoglu@umich.edu

EMPLOYMENT:

08/2008 - Present

Associate Professor

07/2005 - 08/2008

Assistant Professor

Department of Mathematics
University of Michigan
Ann Arbor, MI

09/2002 - 07/2005

CAM Assistant Professor

Mathematics Department
University of California Los Angeles
Mentors: Prof. Tony F. Chan, Prof. Stanley J. Osher

09/2000 - 09/2002

Postdoctoral Associate

Institute for Mathematics and its Applications
University of Minnesota
Mentor: Prof. Fadil Santosa

EDUCATION:

09/2000

Ph.D. in Mathematics

Courant Institute of Mathematical Sciences, New York University
Advisor: Prof. Robert V. Kohn
Thesis Title: An Analysis of the Perona-Malik Scheme

09/1998

M.S. in Mathematics

Courant Institute of Mathematical Sciences, New York University

05/1996

Sc.B. in Mathematics

Brown University
Magna cum laude, with honors in mathematics

AWARDS AND FELLOWSHIPS:

02/2008 - 02/2013

♦ **NSF CAREER Award**
Divison of Mathematical Sciences, National Science Foundation.

02/2007

♦ **Alfred P. Sloan Foundation Fellowship**
Alfred P. Sloan Foundation, New York, NY.

04/2001

♦ **Kurt O. Friedrichs Prize for an Outstanding Dissertation**
Courant Institute of Mathematical Sciences, New York University

05/1996

♦ **David Howell Prize for Excellence in Mathematics**
Brown University

09/1992 - 05/1996

♦ **Granoff International National Scholarship**
Brown University

RESEARCH INTERESTS:

- ♦ Image Processing; Computer Vision.
- ♦ Partial Differential Equations; Calculus of Variations.
- ♦ Convergence of Numerical Approximations.

PUBLICATIONS:

- ♦ S. Esedoglu. **An analysis of the Perona-Malik scheme.** *Communications on Pure and Applied Mathematics.* **54** (2001), pp. 1442-1487.
- ♦ S. Esedoglu, J. Shen. **Digital image inpainting by the Mumford - Shah - Euler image model.** *European Journal of Applied Mathematics.* **13** (2002), pp. 353-370.
- ♦ S. Esedoglu, R. March. **Segmentation with depth but without detecting junctions.** *Journal of Mathematical Imaging and Vision.* **18** (2003), pp. 7-15.
- ♦ S. Esedoglu. **Blind deconvolution of bar code signals.** *Inverse Problems* **20** (2004), pp. 121-135.
- ♦ S. Esedoglu, S. J. Osher. **Decomposition of images by the anisotropic Rudin - Osher - Fatemi model.** *Communications on Pure and Applied Mathematics.* **57** (2004), pp. 1609-1626.
- ♦ T. F. Chan, S. Esedoglu. **Aspects of total variation regularized L^1 function approximation.** *UCLA CAM Report 04-07 (February 2004).* *SIAM Journal on Applied Mathematics.* **65:5** (2005), pp. 1817-1837.
- ♦ T. F. Chan, S. Esedoglu, F. Park, M. H. Yip. **Recent developments in total variation image restoration.** In *"Handbook of Mathematical Models in Computer Vision"*. N. Paragios, Y. Chen, O. Faugeras, eds. Springer 2005.
- ♦ S. Esedoglu, S. Ruuth, R. Tsai. **Threshold dynamics for shape reconstruction and disocclusion.** *Proceedings of the IEEE International Conference on Image Processing 2005.*
- ♦ T. F. Chan, S. Esedoglu, M. Nikolova. **Finding the global minimum for binary image restoration.** *Proceedings of the IEEE International Conference on Image Processing 2005.*
- ♦ S. Esedoglu. **Stability properties of the Perona-Malik scheme.** *SIAM Journal on Numerical Analysis.* **44** (2006), pp. 1297-1313.
- ♦ W. Zhu, T. F. Chan, S. Esedoglu. **Segmentation with depth: A level set approach.** *UCLA CAM Report 04-49 (August 2004).* *SIAM Journal on Scientific Computing.* **28:5** (2006), pp. 1957-1973.
- ♦ T. F. Chan, S. Esedoglu, M. Nikolova. **Algorithms for finding global minimizers of denoising and segmentation models.** *SIAM Journal on Applied Mathematics.* **66** (2006), pp. 1632-1648.
- ♦ S. Esedoglu, Y-H. Tsai. **Threshold dynamics for the piecewise constant Mumford-Shah functional.** *Journal of Computational Physics.* **211:1** (2006), pp. 367-384.
- ♦ X. Bresson, S. Esedoglu, P. Vandergheynst, J. P. Thiran, S. Osher. **Fast global minimization of the active contour/snake model.** *Journal of Mathematical Imaging and Vision.* **28:2** (2007), pp. 151-167.
- ♦ T. F. Chan, S. Esedoglu, F. Park. **Image decomposition combining staircase reduction and texture extraction.** *UCLA CAM Report 05-18 (March 2005).* *Journal of Visual Communication and Image Representation.* **18:6** (2007), pp. 464-486.
- ♦ A. Bertozzi, S. Esedoglu, A. Gillette. **Inpainting by the Cahn-Hilliard equation.** *IEEE Transactions on Image Processing.* **16:1** (2007), pp. 285-291.
- ♦ A. Bertozzi, S. Esedoglu, A. Gillette. **Analysis of a two-scale Cahn-Hilliard model for image inpainting.** *SIAM Journal on Multiscale Modeling and Simulation.* **6:3** (2007), pp. 913-936.
- ♦ T. F. Chan, S. Esedoglu, K. Ni. **Histogram based segmentation using Wasserstein distances.** *Proceedings of SSVM (2007).*
- ♦ K. Kolev, M. Klodt, M. Brox, S. Esedoglu, D. Cremers. **Continuous global optimization in multiview 3D reconstruction.** *Proceedings of EMMCVPR (2007).*
- ♦ S. Esedoglu, S. Ruuth, Y.-H. Tsai. **Threshold dynamics for high order geometric motions.** *Interfaces and Free Boundaries.* **10:3** (2008), pp. 263-282.
- ♦ S. Esedoglu, J. Greer. **Upper bounds on the coarsening rate of discrete, ill-posed, nonlinear diffusion equations.** *Communications on Pure and Applied Mathematics.* **62:1** (2009), pp. 57-81.
- ♦ E. Boltt, R. Chartrand, S. Esedoglu, P. Schultz, K. Vixie. **Graduated adaptive denoising: Local compromise between total variation and isotropic diffusion.** *Accepted for publication in the "Mathematical Methods for Image Processing" special issue of Advances in Computational Mathematics.*
- ♦ S. Esedoglu, P. Smereka. **A variational formulation for a level set representation of multiphase flow and area preserving curvature flow.** *Communications in Mathematical Sciences.* **6:1** (2008), pp. 125-148.

- ♦ M. Elsey, S. Esedoglu. **Analogue of the total variation denoising model in the context of geometry processing.** *Accepted for publication in SIAM Journal on Multiscale Modeling and Simulation.*
- ♦ S. Esedoglu, D. Slepcev. **Refined upper bounds on the coarsening rate of ill-posed diffusion equations.** *Nonlinearity.* **21**:12 (2008), pp. 2759-2776.
- ♦ D. Ruan, J. Fessler, S. Esedoglu. **Discontinuity preserving regularization for modeling sliding effects in medical image registration.** *Proc. IEEE Nuc. Sci. Symp. Med. Im. Conf. (2008).*
- ♦ K. Ni, X. Bresson, T. F. Chan, S. Esedoglu. **Local histogram based segmentation using the Wasserstein distance.** *Accepted for publication in International Journal of Computer Vision..*
- ♦ S. Esedoglu, S. Ruuth, Y.-H. Tsai. **Diffusion generated motion using signed distance functions.** *Submitted.*
- ♦ M. Elsey, S. Esedoglu, P. Smereka. **Diffusion generated motion for grain growth in two and three dimensions.** *Preprint.*

GRANTS:

- ♦ **Principal Investigator:** *Analysis and Modeling for Image Processing.* National Science Foundation CAREER Award DMS-0748333. February 2008 -- February 2013. \$400,000.
- ♦ **Principal Investigator:** *New models and algorithms in image processing with partial differential equations.* National Science Foundation DMS-0713767. July 2007 -- July 2010. \$257,360.
- ♦ **Principal Investigator:** *Segmenting hyperspectral scenes with occlusions.* National Geospatial Intelligence Agency. \$301,289 (\$85,777 allocated to UMich). Initially for Sept. 2007 -- Sept 2008. Extendible.
- ♦ **Co-PI:** *Sharp characterization of minimizers for image models involving interfaces.* Los Alamos National Laboratory. \$955,661 for the 3 years 2006 -- 2009. (\$158,859 allocated to UMich).
- ♦ **Principal Investigator:** *Advanced methods for the analysis of image and image-like data.* Los Alamos National Laboratory research contract. Up to \$100,000 per year for 2005 -- 2007.
- ♦ **Principal Investigator:** *Geometric and multiscale aspects of image denoising models.* National Science Foundation DMS-0410085. Aug. 2004 -- Aug. 2007. Transferred from UCLA to University of Michigan as DMS-0605714. Original amount \$85,123.
- ♦ **Rackham Faculty Research Grant:** University of Michigan, 2006. \$9,963.

RESEARCH SUPERVISED:

- ♦ Ph.D. Advisor of Catherine Dupuis and Matthew Elsey. Mathematics Department, University of Michigan.
- ♦ Faculty mentor for undergraduate summer internship of Michael Goldman from Ecole Normale Supérieure de Lyon. Mathematics Department, University of Michigan. Summer 2007.
- ♦ Faculty mentor. *Research Experience for Undergraduates (REU).* Mathematics Department, University of Michigan. Summer 2006 & 2008.
- ♦ Faculty mentor. *Research Experience for Undergraduates (REU).* Mathematics Department, UCLA. Summer 2004.
- ♦ Faculty mentor. *Research in Industrial Problems for Undergraduates.* Institute for Pure and Applied Mathematics. Summer 2003 & 2004.

RECENT INVITED TALKS:

- ♦ Center for Scientific Computing Seminar. Simon Fraser University. *Burnaby, Canada. January 2009.*
- ♦ 8th Pacific Northwest PDE Meeting. Pacific Institute for the Mathematical Sciences. *Vancouver, Canada. January 2009.*
- ♦ CSCAMM Seminar. University of Maryland. *College Park, MD. October 2008.*
- ♦ Center for Nonlinear Analysis Seminar. Carnegie Mellon University. *Pittsburgh, PA. September 2008.*
- ♦ Minisymposium on Practical Minimization Methods for Nonconvex Energies. SIAM Conf. on Imaging Science. *San Diego, CA. July 2008.*
- ♦ Minisymposium on Variational and PDE based Image Inpainting. SIAM Conference on Imaging Science. *San Diego, CA. July 2008.*

- ♦ Minisymposium on Nonsmooth Optimization and Primal-Dual Techniques in Image Restoration. SIAM Conf. on Imaging Science. *San Diego, CA. July 2008.*
- ♦ Workshop on Image and Signal Processing. Foundations of Computational Mathematics Conference. *Hong Kong. June 2008.*
- ♦ Conference on Nonlinear Approximation Techniques Using L1. Texas A&M University. *College Station, TX. May 2008.*
- ♦ Minisymposium on PDE Based Models in Image Processing. SIAM Conference on Analysis of PDE. *Phoenix, AZ. December 2007.*
- ♦ Minisymposium on Energy Based Approaches to Nonlinear PDEs. SIAM Conference on Analysis of PDE. *Phoenix, AZ. December 2007.*

DEPARTMENTAL SERVICE:

- ♦ **Committees:** Undergraduate Advising (2007-); Executive (2006-2007); REU (2006-); Computer (2005-2006).

EXTERNAL SERVICE:

- ♦ **Editorial Board:** Inverse Problems and Imaging (January 2009-).
- ♦ **Co-organizer:** (with P. Smereka and W. Zheng) SIAM Great Lakes Section 2008 Spring Meeting: “Snapshots of Applied Mathematics”, 4 speakers. *Ann Arbor, MI. April 2008.*
- ♦ **Co-organizer:** (with T. Chan and H. Zhou) Minisymposium on “Recent Progress in Total Variation Based Models”. Three sessions, 12 speakers. *SIAM Imaging Science Conference. Minneapolis, MN. May 2006.*
- ♦ **Co-organizer:** (with M. Pugh, S. Kang, and J. Shen) Mathematical Image Processing and Analysis Workshop. *Banff International Research Station. Banff, Canada. October 2004.*
- ♦ **Co-organizer:** (with L. A. Vese and A. Yuille) Image Processing Seminar. *Mathematics Department, UCLA. 2003-2004.*
- ♦ **Referee work:** Comm. Pure Appl. Math.; SIAM J. Math. Anal.; SIAM J. Appl. Math.; SIAM J. Sci. Comput.; Euro. J. Appl. Math.; Math. Meth. Appl. Sci.; M2AN; IEEE Trans. Imag. Proc.; IEEE PAMI; JCP; Bioinformatics; Calc. Var. PDE.; Interfaces and Free Boundaries; Comm. Math. Sci.; Physics Letters A; etc.
- ♦ **Panelist:** National Science Foundation. June 2004, March 2006, and March 2008.

OTHER:

- ♦ **Patent:** “Fast image inpainting using a modified Cahn-Hilliard equation” with A. Bertozzi, A. Gillette (pending).
- ♦ **Consulting:** iCRco, Inc. (Torrance, CA) on image processing for computed radiography (2005-Present).