Selim Esedoḡlu

August 2017

Department of Mathematics
University of Michigan
Ann Arbor, MI 48109

Phone: (734) 936-9926
Email: esedoglu@umich.edu
URL: www.math.lsa.umich.edu/~esedoglu

Education

2000   Ph.D. in Mathematics, Courant Institute of Mathematical Sciences, New York University. Thesis advisor: Professor Robert V. Kohn.

1998   M.S. in Mathematics, Courant Institute of Mathematical Sciences, New York University.

1996   Sc.B. in Mathematics, Brown University. Magna cum laude, with honors in mathematics.

Employment

09/2012-   Professor. Department of Mathematics. University of Michigan, Ann Arbor.

2008-2012   Associate Professor. Department of Mathematics. University of Michigan, Ann Arbor.

2005-2008   Assistant Professor. Department of Mathematics. University of Michigan, Ann Arbor.

2002-2005   CAM Assistant Professor. Mathematics Department. University of California Los Angeles. Mentors: Professors Tony F. Chan and Stanley J. Osher.

2000-2002   Postdoctoral Associate. Institute for Mathematics and its Applications, University of Minnesota. Mentor: Professor Fadil Santosa.

Research Interests

Image processing, computer vision, materials science; partial differential equations, calculus of variations; convergence of numerical approximations.

Honors

08/2018   Invited Speaker
           International Congress of Mathematicians 2018, Rio de Janeiro

01-07/2016 Aisenstadt Chair
           Centre de Recherches Mathematiques, Montreal

05/2010   Plenary Speaker
           SIAM Conference on Mathematical Aspects of Materials Science

02/2008   NSF CAREER Award
           Division of Mathematical Sciences, NSF

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, New York University

05/1996   David Howell Prize for Excellence in Mathematics
           Brown University

1992-1996 Granoff International National Scholarship
           Brown University

Publications

1. M. Jacobs, E. Merkurjev, S. Esedoglu. Auction dynamics: A volume constrained MBO scheme. *UCLA CAM Report 17-23. Submitted.*

2. S. Esedoglu, M. Jacobs, and P. Zhang. Kernels with prescribed surface tension & mobility for threshold dynamics schemes. *To appear in Journal of Computational Physics.*

3. S. Esedoglu, M. Jacobs. Convolution kernels and stability of threshold dynamics schemes. *To appear in SIAM Journal on Numerical Analysis.*

4. M. Elsey, S. Esedoglu. Threshold dynamics for anisotropic surface energies. *To appear in AMS Mathematics of Computation.*

5. B. Farmer, S. Esedoglu, P. Smereka. Crystallization for a Brenner-like potential. *Communications in Mathematical Physics.* **349**:3 (2017), pp. 1029 – 1061.

6. S. Esedoglu. Grain size distribution under simultaneous grain boundary migration and grain rotation. *Computational Materials Science.* **121** (2016), pp. 209 – 2016.

7. J. Calder, S. Esedoglu, A. Hero. A PDE-based approach to non-dominated sorting. *SIAM Journal on Numerical Analysis.* **53**:1 (2015), pp. 82 – 104.

8. J. Calder, S. Esedoglu, A. Hero. A Hamilton-Jacobi equation for the continuum limit of non-dominated sorting. *SIAM Journal on Mathematical Analysis.* **46**:1 (2014), pp. 603 – 638.

9. S. Esedoglu, F. Otto. Threshold dynamics for networks with arbitrary surface tensions. *Communications on Pure and Applied Mathematics.* **68**:5 (2015), pp. 808–864.

10. S. Esedoglu, A. Rätz, M. Röger. Colliding interfaces in old and new diffuse interface approximations of Willmore flow. *Communications in Mathematical Sciences.* **12**:1 (2014), pp. 125 – 147.

11. M. Elsey, S. Esedoglu, P. Smereka. Simulations of anisotropic grain growth: Efficient algorithms and misorientation distributions. *Acta Materialia.* **61** (2013), pp. 2033 – 2043.

12. M. Elsey, S. Esedoglu. Fast and accurate redistancing via directional optimization. *SIAM Journal on Scientific Computing.* **36**:1 (2014), pp. 219 – 231.

13. J. Calder, S. Esedoglu. On the circular area signature for graphs. *SIAM Journal on Imaging Sciences.* **5**:4 (2012), pp. 1355 – 1379.

14. S. Esedoglu, F. Santosa. Error estimates for a bar code reconstruction model. *Discrete and Continuous Dynamical Systems Series B (Special issue in honor of Avner Friedman).* **17**:6 (2012), pp. 1889 – 1902.

15. C. Kublik, S. Esedoglu, J. Fessler. Algorithms for area preserving flows. *SIAM Journal on Scientific Computing.* **33**:5 (2011), pp. 2382 – 2401.

16. B. Farmer, C. Hall, S. Esedoglu. Source identification from line integral measurements and simple atmospheric models. *Inverse Problems and Imaging.* **7** (2013), pp. 471 – 490.

17. M. Elsey, S. Esedoglu, P. Smereka. Large scale simulation and parameter study for a simple recrystallization model. *Philosophical Magazine.* **91**:11 (2011), pp. 1607 – 1642.

18. M. Elsey, S. Esedoglu, P. Smereka. Large scale simulation of grain growth via diffusion generated motion. *Proceedings of the Royal Society A: Mathematical, Physical & Engineering Sciences.* **467**:2126 (2011), pp. 381 – 401.

19. S. Esedoglu. Large scale simulation of grain boundary motion in polycrystals. *SIAM News.* **43**:8 (2010).

20. S. Esedoglu, S. Ruuth, Y.-H. Tsai. Diffusion generated motion using signed distance functions. *Journal of Computational Physics.* **229** (2010), pp. 1017 – 1042.

21. M. Elsey, S. Esedoglu. Analogue of the total variation denoising model in the context of geometry processing. *SIAM Journal on Multiscale Modeling and Simulation.* **7**:4 (2009), pp. 1549 – 1573.

22. 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.

23. M. Elsey, S. Esedoglu, P. Smereka. Diffusion generated motion for grain growth in two and three dimensions. *Journal of Computational Physics.* **228** (2009), pp. 8015 – 8033.

24. K. Ni, X. Bresson, T. F. Chan, S. Esedoglu. Local histogram based segmentation using the Wasserstein distance. *International Journal of Computer Vision.* **84**:1 (2009), pp. 97 – 111.

25. E. Bollt, R. Chartrand, S. Esedoglu, P. Schultz, K. Vixie. Graduated adaptive denoising: Local compromise between total variation and isotropic diffusion. *Advances in Computational Mathematics.* **31** (2009), pp. 61 – 85.

26. D. Ruan, S. Esedoglu, J. Fessler. Discriminative sliding preserving regularization in medical image restoration. *Proceedings of the IEEE International Symposium on Biomedical Imaging* (2009).

27. S. Esedoglu, D. Slepcev. Refined upper bounds on the coarsening rate of ill-posed diffusion equations. *Nonlinearity.* **21**:12 (2008), pp. 2759 – 2776.

28. S. Esedoglu and 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.

29. S. Esedoglu, S. Ruuth, Y.-H. Tsai. Threshold dynamics for high order geometric motions. *Interfaces and Free Boundaries.* **10** (2008), pp. 263 – 282.

30. D. Ruan, J. Fessler, S. Esedoglu. Discontinuity preserving regularization for modeling sliding effects in medical image registration. *Proceedings of the IEEE Nuclear Science Symposium and Medical Imaging Conference* (2008).

31. K. Kolev, M. Klodt, M. Brox, S. Esedoglu, D. Cremers. Continuous global optimization in multiview 3D reconstruction. *Proceedings of the International Conference on Energy Minimization Methods in Computer Vision and Pattern Recognition (EMMCVPR)* (2007).

32. T. F. Chan, S. Esedoglu, K. Ni. Histogram based segmentation using Wasserstein distances. *Proceedings of the International Conference on Scale Space and Variational Methods in Computer Vision (SSVM)* (2007).

33. 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.

34. A. Bertozzi, S. Esedoglu, A. Gillette. Inpainting by the Cahn-Hilliard equation. *IEEE Transactions on Image Processing.* **16**:1 (2007), pp. 285 – 291.

35. T. F. Chan, S. Esedoglu, F. Park. Image decomposition combining staircase reduction and texture extraction. *Journal of Visual Communication and Image Representation.* **18**:6 (2007), pp. 464 – 486.

36. X. Bresson, S. Esedoglu, P. Vandergheynst, J. P. Thiran, S. J. Osher. Fast global minimization of the active contours/snake model. *Journal of Mathematical Imaging and Vision.* **28**:2 (2007), pp. 151 – 167.

37. S. Esedoglu, Y.-H. Tsai. Threshold dynamics for the piecewise constant Mumford - Shah functional. *Journal of Computational Physics.* **211**:1 (2006), pp. 367 – 384.

38. T. F. Chan, S. Esedoglu, M. Nikolova. Algorithms for finding global minimizers of image segmentation and denoising models. *SIAM Journal on Applied Mathematics.* **66** (2006), pp. 1632 – 1648.

39. W. Zhu, T. F. Chan, and S. Esedoglu. Segmentation with depth: A level set approach. *SIAM Journal on Scientific Computing.* **28**:5 (2006), pp. 1957 – 1973.

40. S. Esedoglu. Stability properties of the Perona-Malik scheme. *SIAM Journal on Numerical Analysis.* **44** (2006), pp. 1297 – 1313.

41. T. F. Chan, S. Esedoglu, M. Nikolova. Finding the global minimum for binary image restoration. *Proceedings of the IEEE International Conference on Image Processing (ICIP)* (2005).

42. S. Esedoglu, S. Ruuth, R. Tsai. Threshold dynamics for shape reconstruction and disocclusion. *Proceedings of the IEEE International Conference on Image Processing (ICIP)* (2005).

43. 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 edts. Springer 2005.

44. T. F. Chan, S. Esedoglu. Aspects of total variation regularized L^1 function approximation. *SIAM Journal on Applied Mathematics.* **65**:5 (2005), pp. 1817 – 1837.

45. 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.

46. S. Esedoglu. Blind deconvolution of bar code signals. *Inverse Problems.* **20** (2004), pp. 121 – 135.

47. S. Esedoglu, R. March. Segmentation with depth but without detecting junctions. *Journal of Mathematical Imaging and Vision.* **18** (2003), pp. 7 – 15.

48. S. Esedoglu, J. Shen. Digital inpainting by the Mumford - Shah - Euler image model. *European Journal of Applied Mathematics.* **13** (2002), pp. 353 – 370.

49. S. Esedoglu. An analysis of the Perona-Malik scheme. *Communications on Pure and Applied Mathematics* **54** (2001), pp. 1442 – 1487.

External Funding

- Principal Investigator: *Advanced methods for the analysis of image and image-like data.* Source: Los Alamos National Laboratory. Duration: 2006 – 2008. Amount: $150,000.

- Principal Investigator: *Geometric and multiscale aspects of image denoising models.* Source: NSF DMS. Transferred from UCLA to UM. Duration: 2005 – 2007. Amount: $72,651 at UM.

RESEARCH SUPERVISED

Ph.D. Students:

1. Alexander Zaitzeff. 3rd year AIM Ph.D. student.

2. Matt Jacobs. Thesis: *Algorithms for multiphase partitioning.* Completed May 2017. First job: 3 year postdoctoral position at the Department of Mathematics, UCLA.

3. Brittan Farmer. Thesis: *Modeling and simulation of carbon nanotube growth.* Completed April 2015. First job: 3 year postdoctoral position at School of Mathematics, University of Minnesota.

4. Jeff Calder. Thesis: *Hamilton-Jacobi equations for sorting and percolation problems.* Completed April 2014. First job: Charles B. Morrey Assistant Professorship, UC Berkeley.

5. Matt Elsey. Thesis: *Algorithms for multiphase motion with applications to materials science.* Completed April 2011. First job: Postdoctoral researcher at the Courant Institute of Mathematical Sciences (NYU), and at the Max Planck Institute for Mathematics in the Sciences (Leipzig).

6. Catherine Kublik. Thesis: *Topics in PDE based image processing.* Completed August 2010. First job: Bing Instructor at Department of Mathematics, UT Austin.

M.S. Students:

1. Louis Ly. MLB Scholar (Enhanced AIM Masters program). Currently a Ph.D. student at UT Austin.

Undergraduate Research:

- Faculty mentor in the *Research Experience for Undergraduates (REU) Program*, University of Michigan. Summers of 2006, 2008, 2009, 2011, 2015 & 2016.

- Faculty mentor for the summer internship of Benedicte Dupuis (ENSPS) at the University of Michigan. Summer 2008.

- Faculty mentor for the summer internship of Michael Goldman (ENS Lyon) at the University of Michigan. Summer 2007.

- Faculty mentor in the *Research Experience for Undergraduates (REU) Program*, UCLA. Summer 2004.

- Faculty mentor in the *Research in Industrial Problems for Undergraduates Program*, UCLA. Summers of 2003 & 2004.

LECTURE SERIES & MINICOURSES

- *Aisenstadt Lectures*
  Centre de Recherches Mathematiques, Montreal. April 2016.

- 4 hour short course. *Algorithms for models involving interfaces in image processing and vision.*
  Fields Institute, University of Toronto. May 2012.

- 3 hour tutorial. *Computing and Image Processing with Data Related to Human Activities Workshop.*
  Institute for Mathematics and its Applications, University of Minnesota. March 2011.

- 5 lectures. *New Vistas in Image Processing and PDEs Workshop.*
  Center for Nonlinear Analysis, Carnegie Mellon University. June 2010.

- 5 lectures. *Summer School on Imaging Sciences and Medical Imaging.*
  University of Coimbra (Portugal). June 2010.

SOME RECENT SEMINARS

- Applied and Computational Mathematics Colloquium.
  School of Mathematics, University of Minnesota. October 2016.

- Conference on Calculus of Variations, Geometric Measure Theory, Optimal Transportation.
  Universite Lyon 1. July 2016.

- Minisymposium on Computational Techniques for Multiscale Materials Modeling.
  SIAM Conference on Mathematical Aspects of Materials Science. May 2016.

- Minisymposium on Analysis, Modeling, and Simulation in Materials Sicence.
  (in memory of Peter Smereka).
  SIAM Conference on Mathematical Aspects of Materials Science. May 2016.

- Applied Mathematics Seminar.
  Department of Mathematics, McGill University. February 2016.

- Computational / Applied Mathematics and PDE Seminar.
  Department of Mathematics, University of Chicago. February 2016.

- Minisymposium on Numerical Methods for PDEs in Data Science.
  SIAM Conference on Analysis of PDE. December 2015.

- Analysis – Probability Seminar.
  Max Planck Institute for Mathematics in the Sciences. November 2015.

- PIRE Workshop: From Grain Boundaries to Stochastic Homogenization.
  Max Planck Institute for Mathematics in the Sciences. Leipzig, Germany. July 2015.

- Mathematics Colloquium.
  University of Tennessee. Knoxville, TN. March 2015.

- Applied Mathematics and Analysis Seminar.
  Duke Univeristy. February 2015.

DEPARTMENTAL SERVICE

AIM Director (2014–2015), Personnel Committee (2014–2015), Undergraduate advising (2007–2012), Executive Committee (2006–2007, 2012–2014), REU Committee (2006–2012, W2014), Computer Committee (2005–2006, 2010–2012, W2014, W2017), and AIM QR Committee (2009–2012).

EXTERNAL SERVICE

- Associate editor: EMS Interfaces and Free Boundaries (01/2017–Present).

- Co-organizer: Minisymposium on Recent Developments in Mathematical Modeling of Recrystallization and Grain Growth at the SIAM Materials Science Conference (May 2016). 22 speakers.

- SIAM Germund Dahlquist Prize Committee Member (2014).

- Co-organizer: IMA Hot Topics Workshop on Mathematics at the Interface of Partial Differential Equations, the Calculus of Variations, and Materials Science (June 2014).

- Associate editor in chief: Journal of Mathematical Imaging and Vision (08/2011–12/2016).

- Associate editor: Inverse Problems and Imaging (09/2008–12/2015).

- Vice chair: SIAM Activity Group on Imaging Science (01/2010–01/2011).

- Chair: Best paper award committee. SIAM Activity Group on Imaging Science (2011).

- Organizer: Symposium on Modeling and Simulation of Grain Boundary Motion.
  48th Annual Technical Conference of Society of Engineering Sciences. Evanston, IL. October 2011.

- Co-organizer (with P. Smereka): Minisymposium on Grain Boundary Motion.
  SIAM Conference on Mathematical Aspects of Materials Science. Philadelphia, PA. May 2010.

- Co-organizer (with P. Smereka and W. Zheng): SIAM Great Lakes Section 2008 Spring Meeting: "Snapshots of Applied Mathematics". Ann Arbor, MI. April 2008.

- Co-organizer (with T. F. Chan and H. Zhou) of "Recent Developments in Total Variation Based Models" Minisymposium at the SIAM Conference on Imaging Science (May 2006).

- Co-organizer (with M. Pugh, S. Kang, and J. Shen) of "Mathematical Image Processing and Analysis" Workshop at the Banff International Research Station (October 2004).

- Co-organizer (with T. F. Chan and J. Shen) of "Geometric Regularization in Image Analysis and Processing" Minisymposium at the SIAM Conference on Imaging Science (May 2004).

- Co-organizer (with L. Vese and A. Yuille) of the Image Processing Seminar at the UCLA Mathematics Department (2003 – 2004).

- Referee work: Inventiones, CPAM, SIAP, SIMA, SISC, SINUM, SIMS, JCP, M2AN, IEEE TIP, IEEE PAMI, IJCV, JMIV, Bioinformatics, Calc. Var. PDE, Interfaces and Free Boundaries, Comm. Math. Sci., Physics Letters A, etc.

- NSF Panels: June 2004, March 2006, March 2008, July 2009, March 2010, March 2012, March 2013, and August 2016.

OTHER

- US Patent #7,840,086: *Method for Inpainting of Images* with A. Bertozzi and A. Gillette.

- Consultant for iCRco, Inc. (Torrence, CA) on image processing for computed radiography (2005–2012).