ROBERT V. KOHN

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Education

Harvard University, Mathematics, A.B. 1974
University of Warwick, Mathematics, M.Sc. 1975
Princeton University, Mathematics, Ph.D. 1979
New York University, Courant Institute, NSF Postdoc 1979-1981

Employment

Operations Analyst, Daniel H. Wagner Associates, Summer 1976
Research Staff, Exxon Research & Engineering, Summer 1979
Courant Institute of Mathematical Sciences, New York University, 1981–present
- Assistant Professor of Mathematics 1981–1985
- Associate Professor of Mathematics 1985–1988
- Professor of Mathematics 1988–2017
- Silver Professor of Mathematics 2017–2022
- Professor Emeritus from September 2022

Honors

Elected member, American Academy of Arts and Sciences (2017); Leroy P. Steele Prize for Seminal Contribution to Research, AMS (2014); AMS Fellow (2012); SIAM Fellow (2009); Plenary lecturer at SIAM APDE meeting (Boston, 2006), ICM (Madrid, 2006), ICIAM (Zurich, 2007), SIAM Materials Science meeting (Philadelphia, May 2008); Keith Medal (Royal Society of Edinburgh, 2007, shared with A. DeSimone, S. Müller, and F. Otto); Ralph E. Kleinman Prize (SIAM, 1999); Midwest Mechanics Lecturer (1993–4); Sloan Research Fellowship (1984–6); NSF Postdoctoral Fellowship (1979–81); NSF Graduate Fellowship (1976–78).

Research Interests

Mathematical aspects of materials science, including: cloaking; coarsening due to energy-driven motion; composite materials; effective moduli; epitaxial growth; epsilon-near-zero materials; interface motion laws; martensitic transformation; metamaterials; micromagnetics; pattern formation due to energy minimization; polycrystal plasticity; shape–memory

materials; structural optimization; surface energy as a selection mechanism; thermally-activated switching; and wrinkling of thin elastic sheets.

Nonlinear partial differential equations and nonconvex variational problems, including: bounds and extremal microstructures for composites; effective behavior of mechanism-based metamaterials; electric current tomography; homogenization and Γ–convergence; motion by curvature; relaxation of nonconvex variational problems; self-similarity in solutions of nonlinear evolution equations; and singularly perturbed variational problems or PDE's.

Optimal control methods applied to PDE, finance and machine learning, including: deterministic game interpretations of 2nd order PDE; a continuum approach to some online machine learning problems; modeling of financial bubbles; and portfolio optimization.

Selected Services

CIMS Administration: Deputy Director, Courant Institute (1997–2000 and 2016–2020); Chair, Mathematics Department (1991–92).

Financial Mathematics Masters Program: Faculty Committee most years 1998–2022 (Chair, 2003–2006 and 2010-2012); created or redesigned MS-level courses *Derivative Securities*, *Continuous Time Finance*, and *Partial Differential Equations for Finance*.

Undergraduate Curriculum Development: Taught the pioneering instance of the new course Linear and Nonlinear Optimization (Spring 2021, in collaboration with Georg Stadler).

NSF: Chair, DMS Division Director Ad-Hoc Search Committees (2005, 2009, and 2013); Member, Mathematical and Physical Sciences Advisory Committee (2004–2006), Astronomy Committee of Visitors (2005), Mathematics Committee of Visitors (2004); coauthor of NSF report *Intellectual Opportunities in the Mathematical Sciences* (2000); many proposal review panels.

NSERC: Chair, Institutes Review Committee (2013-2014 and 2014-2015).

IMA: Member, Board of Governors, 2004–2008 (Chair in 2006); Member, Community Relations Committee (2009-2012); Organizing Committee Chair, Fifth Abel Conference: Celebrating the Mathematical Impact of John F. Nash Jr and Louis Nirenberg (2015).

SIAM: Member, Board of Trustees (2011–2016), Major Awards Committee (2011–2013), and Financial Management Committee (2012–2023); Chair, SIAG on Mathematical Aspects of Materials Science (2008–10); Co-Chair, Organizing Committee for 6th SIAM Meeting on Mathematical Aspects of Materials Science (May 2010); Member, SIAM Council (1997–2002); Mathematics in Industry Project: Co-chair, Phase II (1997-1999) and Steering Committee member, Phase I (1995-1997); Chair, 1st Ad-Hoc Committee on Membership (1995–1996).

Review Panels: Member, Mathematics Department Review panels at Yeshiva University (2011), Rutgers University (2004), University of Maryland (2002), and Indiana University (2000); Chair, ARO Mathematics Program Review Panel (2000).

Prize and Speaker Selection Committees: Chair, ICIAM 2011 Materials Science Panel and ICM 2002 Applied Mathematics Panel; Member, selection committees for the 2014, 2015, and 2016 IMA Prizes, the 2013 and 2014 J. Willard Gibbs Lecturers, the 2013 SIAM Outstanding Paper Prize, the 2009 and 2010 John von Neumann Lecturers, the 2001 Ralph E. Kleinman Prizes, and the 2003 Pioneer Prize.

Editorial Boards: Communications on Pure and Applied Mathematics (since 2002); Electronic Journal of Differential Equations (since 1993); Interfaces & Free Boundaries (since 2002); Journal of Elasticity (since 2014); Journal of Nonlinear Science (since 1991).

Invited Lectures at Recent Meetings

Frontiers of Soft Matter Physics: from Non-equilibrium Dynamics to Active Matter (Hong Kong Univ of Science & Technology, 1/2014)

Recent Advances in Nonlocal and Nonlinear Analysis: Theory and Applications (ETH, Zurich, 6/2014)

Park City Mathematics Institute – 2014 Graduate Summer School on Mathematics and Materials (a 5-lecture minicourse; Park City, Utah, 7/2014)

Continuum Models and Discrete Systems – CMDS 13 (Univ of Utah, 7/2014)

From Nitinol in Coffee ... to Now: a 27 Year Journey of Active Materials – a symposium marking Kaushik Bhattacharya's 50th birthday (Caltech, 1/2015)

NSF-SIAM minisymposium on Mathematical and Computational Aspects of Materials Science, at 2015 SIAM Conference on Computational Science & Engineering (3/2015)

Calculus of Variations Summer School (a 6-lecture minicourse; Univ of Texas, Austin, 5/2015)

Mathematics for Nonlinear Phenomena: Analysis and Computation – a conference in honor of Yoshikazu Giga's 60th birthday (Sapporo, Japan, 8/2015)

Waves, Spectral Theory, and Applications – a conference marking Michael Weinstein's 60th birthday (Princeton Univ, 9/2015)

NSF-DOE Materials Genome Principal Investigators' Meeting (Arlington, VA, 1/2016)

Minisymposium on Variational Methods for Rods & Shells, at the SIAM Conference on Mathematical Aspects of Materials Science (Philadelphia, 5/2016)

Calculus of Variations and Nonlinear PDE (Columbia Univ, 5/2016)

New Frontiers in Nonlinear Analysis for Materials – the 2016 CNA Summer School (a 6-lecture minicourse; Carnegie Mellon Univ, 6/2016)

Topics in Applied Nonlinear Analysis: Recent Advances and New Trends – a conference marking David Kinderlehrer's 75th birthday (Carnegie Mellon Univ, 7/2016)

Mean Curvature Flow (Clay Mathematics Institute, Oxford, 9/2016)

MCAIM Opening Symposium (Michigan Center for Applied and Interdisciplinary Mathematics, Ann Arbor, 10/2016)

From Solid Mechanics to Mathematical Analysis – a workshop on the occasion of Gilles Francfort's 60th birthday (Institut Henri Poincaré, 6/2017)

Nonconvexity, Nonlocality, and Incompatibility: from Materials to Biology – a conference in honor of Lev Truskinovsky's 60th birthday (Univ of Pittsburgh, 5/2017)

Multiscale Theory and Computation – a conference in honor of Mitchell Luskin's 65th birthday (Univ of Minnesota, 9/2017)

Multiscale Problems in Materials and Biology – a conference in honor of Leonid Berlyand's 60th birthday (Fields Institute, Toronto, 6/2018)

SIAM 2018 Annual Meeting and 2018 Conference on Mathematical Aspects of Materials Science (Portland, 7/2018)

Kent State/AMLCI – CMU/CNA Workshop on Applied Materials (Kent State, 2/2019)

CMU/CNA Workshop on Mathematical Models for Pattern Formation (Carnegie Mellon, 3/2019)

Spring 2019 MRS meeting – Symposium CP09, on Mathematical Aspects of Materials Science: Modeling, Analysis, and Computation (Phoenix, 4/2019)

New Trends in Variational Models: From Superconductors to Liquid Crystals – a conference in honor of Peter Sternberg's 60th birthday (Fields Institute, Toronto, 6/2019)

Webinar on Super-compatibility & the Design of Materials (with R.D. James and I. Fonseca, part of the NAS series "Illustrating the Impact of the Mathematical Sciences," 8/2020)

Annual meeting of the Simons Collaboration on Extreme Wave Phenomena Based on Symmetries (10/2021);

Ricordando Luciano Modica (Pisa, participating remotely, 11/2021)

International Oxford PDE Conference 2022 (Oxford, participating remotely, 7/2022)

Equilibrium and Non-equilibrium Pattern Formation in Soft Matter: From Elastic Solids to Complex Fluids (organized by BIRS, located at UBC Okanagan, 7/2022)

Recent Seminars and Colloquia

University of Leipzig (6/2014)

University of Milano (Lezioni Leonardeschi, 10/2014)

University of California, Berkeley (3/2015)

University of Toronto (3/2015)

University of Santa Barbara (2/2016)

University of British Columbia (3/2016)

Indiana University (10/2017)

University of Pennsylvania (1/2018)

Duke University (Gergen Lecturer, 3/2019)

Isaac Newton Institute (in the program "Mathematical Design of New Materials," 6/2019)

University of Connecticut (9/2019)

University of Washington (Boeing Distinguished Colloquium, 10/2019)

Rutgers University (12/2021)

Recent Organization of Meetings and Minisymposia

Minisymposium on Energy-Driven Pattern Formation at ICIAM 2015 (16 talks, Beijing, 8/2015)

Abel Conference Celebrating the Mathematical Impact of John Nash and Louis Nirenberg (Organizing Committee chair, IMA, Minneapolis, 11/2015)

SIAM Conference on Analysis of Partial Differential Equations (Organizing Committee member, Scottsdale, AZ, 12/2015)

Minisymposium on Challenges in the Mechanics of Thin Elastic Structures at the SIAM Conference on Analysis of PDE (12 talks, Scottsdale, AZ 12/2015)

NYU-Oxford Workshop on Mathematical Models of Defects and Patterns (Organizing Committee chair, NYU, 1/2016)

Minisymposium on Defects and Patterns in Thin Elastic Structures at the SIAM Conference on Mathematial Aspects of Materials Science (11 talks, Philadelphia, 5/2016)

Oberwolfach Workshop: Calculus of Variations (Organizing Committee member, 7/2018 and 8/2020)

2020 SIAM Annual Meeting and 2020 CAIMS Annual Meeting (Organizing Committee member, 7/2020)

PhD Students

Bruce D. Lowe, *A Variational Method for Parameter Identification*, 1986.

Peter Sternberg, *The Effect of a Singular Perturbation on Nonconvex Variational Problems*, 1986.

Robert Lipton, *An Optimal Lower Bound on the Energy Dissipation Rate for Homogenized Stokes Flow*, 1986.

Gaetano Tepedino, *Bounds on the Effective Energy Density of Two Nonlinear Composites*, 1988.

Lia Bronsard, *Reaction Diffusion Equations & Motion by Mean Curvature*, 1988.

Vincenzo Nesi, *Extremal Microgeometries for Polycrystalline Composites*, 1989.

Oscar Bruno, *The Effective Conductivity of an Infinitely Interchangeable Mixture*, 1989.

Nick Firoozye, *Optimal Translations and Relaxations of Some Multiwell Energies*, 1990.

Piotr Rybka, *Dynamical Modelling of Phase Transitions in Solids by Means of Viscoelasticity in Many Dimensions*, 1990.

Stathis Filippas, *Center Manifold Analysis for a Semilinear Parabolic Equation Arising in the Study of the Blowup of* $u_t - \Delta u = u^p$, 1990.

Pedro Girao, *Convergence of a Crystalline Algorithm for Motion by Mean Curvature*, 1993.

Jiangbo Lu, *Extremal Microstructures for Two Isotropic Phases with Distinct Stress-free Strains in Two Space Dimensions*, 1993.

Yury Grabovsky, *Bounds and Extremal Microstructures for Two-Component Composites: A Unified Treatment Based on the Translation Method*, 1994.

Weimin Jin, *Singular Perturbation and the Energy of Folds*, 1997.

Matthew Killough, *A Diffuse Interface Approach to the Development of Microstructure in Martensite*, 1998.

Cameron Connell, *Coarsening of step bunches in step flow growth: a reaction-diffusion model and its sharp interface limit*, 2000.

Antti Pihlaja, *Modeling Grain Boundary Structures Using Energy Minimization*, 2000.

Selim Esedoglu, *Analysis of the Perona-Malik Method for Image Segmentation*, 2000.

Pedro Judice, *Dynamic Asset Pricing via Conic Duality*, 2003.

Valeriy Slastikov, *Topics in Micromagnetics*, 2003.

Oana Papazoglu-Statescu, *Maximizing the Utility of Final-Time Wealth with Little Trading*, 2004.

Maria Reznikoff, *Rare Events in Finite and Infinite Dimensions*, 2004

Irakli Odisharia, *Simulation and Analysis of the Relaxation of a Crystalline Surface*, 2006

Haiping Shen, *Two PDE Problems from Electromagnetics*, 2007

Xi Chen, *Two Problems from Mathematical Finance*, 2009

Hala Al Hajj Shehadeh, *The Evolution of a Crystal Surface: Step ODE's, PDE's, and Self-similarity*, 2010

Peter Bella, *Wrinkling as a Relaxation of Compressive Stresses*, 2012

Jens Jorgensen, *Zero Transmission in Acoustic Membranes*, 2013

Kangping Zhu, *Two problems in applications of PDE*, 2014

Ian Tobasco, *Variational analysis of compressed thin elastic sheets and the phase diagrams of mean field spin glasses*, 2016

Ethan O'Brien, *Rods with misfit and twisted ribbons: two problems in the mechanics of thin elastic objects*, 2017

Nadejda Drenska, *A PDE approach to a prediction problem involving randomized strategies*, 2017

David Padilla-Garza, *Gamma convergence in thin sheets, and a concentration inequality for Coulomb gases*, 2020

Vladimir Kobzar, *New potential-based bounds for prediction with expert advice*, 2021

Zhilei Wang, *PDE approaches to two online learning problems, and an empirical study of some neural network-based active learning algorithms*, 2021 (co-advisor: Mehryar Mohri)

Currently: Xuenan Li

Articles in Refereed Journals or Conferences

1. *An example concerning approximate differentiation*, Indiana Univ. Math. J. 26, pp. 393–397, 1977.

2. *New integral estimates for deformations in terms of their nonlinear strains*, Arch. Rat. Mech. Anal. 78, pp. 131–172, 1982.

3. *Partial regularity of suitable weak solutions of the Navier–Stokes equations*, (with L. Caffarelli and L. Nirenberg), Comm. Pure Appl. Math. 35, pp. 771–831, 1982.

4. *Geometric effects in continuous media percolation*, (with P. Sheng), Phys. Rev. B, Vol. 26, pp. 1331–1335, 1982.

5. *Principes variationnels duaux et théorème de l'énergie dans le modèle de plasticité de Hencky*, (with R. Temam), C.R. Acad. Sci. Paris 294, Ser. I, pp. 205–208, 1982.

6. *Hencky–Prandtl nets and constrained Michell trusses*, (with G. Strang), Comp. Meth. in Appl. Mech. & Eng. 36, pp 207–222, 1983.

7. *Explicit relaxation of a variational problem in optimal design*, (with G. Strang), Bull. Amer. Math. Soc. 9, pp. 211–214, 1983.

8. *Dual spaces of stresses and strains, with applications to Hencky plasticity*, (with R. Temam), Appl. Math. Opt. 10, pp. 1–36, 1983.

9. *Determining conductivity by boundary measurements*, (with M. Vogelius), Comm. Pure Appl. Math. 37, pp. 289–298, 1984.

10. *First order interpolation inequalities with weights*, (with L. Caffarelli and L. Nirenberg), Compositio Math. 53, pp. 259–275, 1984.

11. *A new model for thin plates with rapidly varying thickness*, (with M. Vogelius), Intl. J. Solids and Structures 20, pp. 333–350, 1984.

12. *A new model for thin plates with rapidly varying thickness II: A convergence proof*, (with M. Vogelius), Q. Appl. Math. 43, pp. 1–22, 1985.

13. *Asymptotically Self–Similar Blow–Up of Semilinear Heat Equations*, (with Y. Giga), Comm. Pure Appl. Math. 38, pp. 297–319, 1985.

14. *Optimal design and relaxation of variational problems*, (with G. Strang), Comm. Pure Appl. Math. 39, pp. 113–137, 139–182, and 353–377, 1986.

15. *A new model for thin plates with rapidly varying thickness III: Comparison of different scalings*, (with M. Vogelius), Q. Appl. Math. 44, pp. 35–48, 1986.

16. *Determining conductivity by boundary measurements II: Interior results*, (with M. Vogelius), Comm. Pure Appl. Math. 38, pp. 643–667, 1986.

17. *Optimal design in elasticity and plasticity*, (with G. Strang), Intl. J. Num. Meth. Eng. 22, pp. 183–188, 1986.

18. *Numerical study of a relaxed variational problem from optimal design*, (with J. Goodman and L. Reyna), Comp. Meth. Appl. Mech. Eng. 57, pp. 107–127, 1986.

19. *Characterizing blowup using similarity variables*, (with Y. Giga), Indiana Univ. Math. J. 36, pp. 1–40, 1987.

20. *Reinforcement by a thin layer with oscillating thickness*, (with G. Buttazzo), Appl. Math. Optim. 16, pp. 247–261, 1987.

21. *Relaxation of a variational method for impedance computed tomography*, (with M. Vogelius), Comm. Pure Appl. Math. 40, pp. 745–777, 1987.

22. *A variational method for parameter identification*, (with B.D. Lowe), RAIRO–MMAN 22, pp. 119–158, 1988.

23. *Optimal bounds for the effective energy of a mixture of two isotropic, incompressible, elastic materials*, (with R. Lipton), Arch. Rational. Mech. Anal. 102, pp. 331–350, 1988.

24. *A rescaling algorithm for the numerical calculation of blowing-up solutions*, (with M. Berger), Comm. Pure Appl. Math. 41, pp. 841–863, 1988.

25. *Variational bounds on the effective moduli of anisotropic composites*, (with G. Milton), J. Mech. Phys. Solids 36, pp. 597–629, 1988.

26. *Local minimizers and singular perturbations*, (with P. Sternberg), Proc. Roy. Soc. Edinburgh 111 A, pp. 69–84, 1989.

27. *Nondegeneracy of blowup for semilinear heat equations*, (with Y. Giga), Comm. Pure Appl. Math., 42, pp. 845–884, 1989.

28. *Numerical implementation of a variational method for electrical impedance tomography*, (with A. McKenney), Inverse Problems, 6, pp. 389–414, 1990.

29. *On the slowness of phase boundary motion in one space dimension*, (with L. Bronsard), Comm. Pure Appl. Math., 43, pp. 983–997, 1990.

30. *Variational constraints for electrical impedance tomography*, (with J. Berryman), Phys. Rev. Lett. 65, pp. 325–328, 1990.

31. *Motion by mean curvature as the singular limit of Ginsburg–Landau dynamics*, (with L. Bronsard), J. Diff. Eqns. 90, pp. 211–237, 1991.

32. *The initial-value problem for measure-valued solutions of a canonical* 2×2 *system with linearly degenerate fields*, (with Weinan E), Comm. Pure Appl. Math. 44, pp. 981–1000, 1991.

33. *The relaxation of a double-well energy*, Continuum Mechanics and Thermodynamics 3, pp. 193–236, 1991.

34. *Refined asymptotics for the blowup of* $u_t - \Delta u = u^p$, (with S. Filippas), Comm. Pure Appl. Math. 45, pp. 821-869, 1992.

35. *Branching of twins near an sustenite-twinned-martensite interface*, (with S. Muller), Phil. Mag. 66A, pp. 697–715, 1992.

36. *Relaxation and regularization of nonconvex variational problems*, (with S. Muller), Rend. Sem. Mat. Fis. Univ. Milano 62, pp. 89–113, 1992.

37. *Optimal bounds on the effective behavior of a mixture of two well-ordered elastic materials*, (with G. Allaire), Quart. Appl. Math. 51, pp. 643–674, 1993.

38. *Explicit optimal bounds on the elastic energy of a two-phase composite in two space dimensions*, (with G. Allaire), Quart. Appl. Math. 51, pp. 675–699, 1993.

39. *Optimal design for minimum weight and compliance in plane stress*, (with G. Allaire), European J. Mech. A/Solids 12, pp. 839-878, 1993.

40. *Surface energy and microstructure in coherent phase transitions*, (with S. Muller), Comm. Pure Appl. Math. 47, pp. 405–435, 1994.

41. *Optimal lower bounds on the elastic energy of a composite made from two non-well-ordered isotropic materials*, (with G. Allaire), Quart. Appl. Math. 52, pp. 311–333, 1994.

42. *Restrictions on microstructure*, (with K. Bhattacharya, N. Firoozye, and R.D. James), Proc. Roy. Soc. Edinburgh 124A, pp. 843–878, 1994.

43. *Convergence of a crystalline algorithm for the heat equation in one dimension and for the motion of a graph by weighted curvature*, (with P. Girao), Numer. Math. 67, pp. 41–70, 1994.

44. *Microstructures minimizing the energy of a two phase elastic composite in two space dimensions. I: the confocal ellipse construction*, (with Y. Grabovsky), J. Mech. Phys. Solids 43, pp. 933–947, 1995.

45. *Microstructures minimizing the energy of a two phase elastic composite in two space dimensions. II: the Vigdergauz microstructure*, (with Y. Grabovsky), J. Mech. Phys. Solids 43, pp. 949–972, 1995.

46. *Anisotropy of the Vigdergauz microstructure*, (with Y. Grabovsky), ASME J. Appl. Mechanics 62, pp. 1063–1065, 1995.

47. *Symmetry, texture, and the recoverable strain of shape memory polycrystals*, (with K. Bhattacharya), Acta Materialia 44, pp. 529–542, 1996.

48. *Elastic energy minimization and the recoverable strains of polycrystalline shape-memory materials*, (with K. Bhattacharya), Arch. Rat. Mech. Anal. 139, pp. 99–180, 1997.

49. *Bounds on the micromagnetic energy of a uniaxial ferromagnet*, (with R. Choksi), Comm. Pure Appl. Math. 51, pp. 259–289, 1998.

50. *Some model problems of polycrystal plasticity with deficient basic crystals*, (with T. Little), SIAM J. Appl. Math. 59, pp. 172–197, 1998.

51. *Duality relations for non-ohmic composites, with applications to behavior near percolation*, (with O. Levy), J. Stat. Phys. 90, pp. 159–189, 1998.

52. *Domain branching in uniaxial ferromagnets: a scaling law for the minimum energy*, (with R. Choksi and F. Otto), Comm. Math. Phys. 201, pp. 61–79, 1999.

53. *Some examples of nonlinear homogenization involving nearly degenerate energies*, (with K. Bhattacharya and S. Kozlov), Proc. Roy. Soc. London 455A, pp. 567–583, 1999.

54. *Partial regularity for optimal design problems involving both bulk and surface energies*, (with F.H. Lin), Chinese Annals of Math. 20, pp. 137–158, 1999.

55. *A geometric model for coarsening during spiral-mode growth of thin films*, (with T. Schulze), Physica D 132, pp. 520–542, 1999.

56. *Singular perturbation and the energy of folds*, (with W. Jin), J. Nonlin. Sci. 10, pp. 355–390, 2000.

57. *Geometrically nonlinear shape-memory polycrystals made from a two-variant material*, (with B. Niethammer), Math. Modeling and Numer. Anal. 34, pp. 377–398, 2000.

58. *A compactness result in the gradient theory of phase transitions*, (with A. DeSimone, S. Muller, and F. Otto), Proc. Royal Soc. Edinburgh 131A, pp. 833–844, 2001.

59. *Two-dimensional modeling of soft ferromagnetic films*, (with A. DeSimone, S. Muller, F. Otto, and R. Schafer), Proc. Roy. Soc. London 457A, pp. 2983–2991, 2001.

60. *Bending martensite needles in $Ni_{65}Al_{35}$ investigated by two-dimensional elasticity and high-resolution transmission electron microscopy*, (with Ph. Boullay and D. Schryvers), Phys. Rev. B 64, paper 144105, 2001.

61. *A new approach to the continuum modeling of epitaxial growth: slope selection, coarsening, and the role of the uphill current*, (with T. Lo), Physica D 161, pp. 237–257, 2002.

62. *Upper bounds on coarsening rates*, (with F. Otto), Comm. Math. Phys. 229, pp. 375–395, 2002.

63. *A reduced theory for thin-film micromagnetics*, (with A. DeSimone, S. Muller, and F. Otto), Comm. Pure Appl. Math. 55, pp. 1408–1460, 2002.

64. *Microstructures and interfaces in Ni-Al martensite: comparing HRTEM observations with continuum theories*, (with D. Schryvers, P. Boullay, P.L. Potapov, and J.M. Ball), Int. J. Solids & Structures 39, pp. 3543–3554, 2002.

65. *Low energy domain patterns in soft ferromagnetic films*, (with A. DeSimone, S. Muller, F. Otto, and R. Schafer), J. Magnetism & Magnetic Materials 242, 1047-1051, 2002.

66. *Repulsive interaction of Neel walls, and the internal length scale of the cross-tie wall*, (with A. Desimone, S. Muller, and F. Otto), Multiscale Modeling & Simulation 1, pp. 57–104, 2003.

67. *Representation and self-similarity of shapes*, (with D. Geiger and T.-L. Liu), IEEE Trans. Pattern Anal. and Mach. Intell. 25, pp. 86–99, 2003.

68. *Some three-dimensional problems related to dielectric breakdown and polycrystal plasticity*, (with A. Garroni), Proc. Roy. Soc. London 459A, pp. 2613–2625, 2003.

69. *Upper bounds on the coarsening rate for an epitaxial growth model*, (with X. Yan), Comm. Pure App. Math. 56, pp. 1549–1564, 2003.

70. *Energy minimization and flux domain structure in the intermediate state of a type-I superconductor*, (with R. Choksi and F. Otto), J. Nonlin. Sci. 14, pp. 119–171, 2004.

71. *Coarsening rates for models of multicomponent phase separation*, (with X. Yan), Interfaces and Free Boundaries 6, pp. 135–149, 2004.

72. *Another thin-film limit of micromagnetics*, (with V. Slastikov), Arch. Rational Mech. Anal. 178, pp. 227–245, 2005.

73. *Effective dynamics for ferromagnetic thin films: a rigorous justification*, (with V. Slastikov), Proc. Roy. Soc. London 460A, pp. 1–12, 2004.

74. *A deterministic-control-based approach to motion by curvature*, (with S. Serfaty), Comm. Pure Appl. Math 59, pp. 344–407, 2005.

75. *On the equivalence of the static and dynamic asset allocation problems*, (with O. Papazoglu-Statescu), Quantitative Finance 6, pp. 173–183, 2006.

76. *Magnetic elements at finite temperature and large deviation theory*, (with M. Reznikoff and E. Vanden-Eijnden), J. Nonlinear Science 15, pp. 223–253, 2005.

77. *Action minimization and sharp interface limits for the stochastic Allen-Cahn equation*, (with M. Reznikoff, F. Otto, and E. Vanden-Eijnden), Comm. Pure Appl. Math. 60, pp. 393–438, 2007.

78. *The sharp interface limit of the Allen-Cahn action functional in one space dimension*, (with M. Reznikoff and Y. Tonegawa), Calc. Var. PDE 25, pp. 503–534, 2006.

79. *Geometrically constrained walls*, (with V. Slastikov), Calc. of Var. and PDE, 28, pp. 33–57, 2006

80. *Continuum relaxation of interacting steps on crystal surfaces in 2+1 dimensions*, (with D. Margetis), Multiscale Modeling and Simulation 5, pp. 729–758, 2006.

81. *Ground state energy scaling laws during the onset and destruction of the intermediate state in a type-I superconductor*, (with R. Choksi, S. Conti, and F. Otto), Comm. Pure Appl. Math. 61, pp. 595–626, 2008.

82. *Magnetism and the homogenization of micro-resonators*, (with S. Shipman), Multiscale Modeling and Simulation 7, pp. 62–92, 2008.

83. *Cloaking via change of variables in electric impedance tomography*, (with H. Shen, M.Vogelius, and M.Weinstein), Inverse Problems 24, 015016 (21pp), 2008.

84. *Optimization of structural topology in the high-porosity regime*, (with B. Bourdin), J. Mech. Phys. Solids 56, pp. 1043–1064, 2008.

85. *Optimization of scattering resonances*, (with P. Heider, D. Berebichez, and M.Weinstein), Structural and Multidisciplinary Optimization 36, pp. 443–456, 2008.

86. *Asset price bubbles from heterogeneous beliefs about mean reversion rates*, (with X. Chen), Finance and Stochastics 15, pp. 221–241, 2010; also a short erratum, 2012.

87. *Numerical analysis of a steepest-descent PDE model for surface relaxation below the roughening temperature*, (with H. Versieux), SIAM J. Numer. Anal. 48, pp. 1781–1800, 2010.

88. *The string method as a dynamical system*, (with M. Cameron and E. Vanden-Eijnden), J. Nonlin. Sci. 21, pp. 193–230, 2011.

89. *A deterministic-control-based approach to fully nonlinear parabolic and elliptic equations*, (with S. Serfaty), Comm. Pure Appl. Math. 63, pp. 1298–1350, 2010.

90. *Cloaking via change of variables for the Helmholtz equation*, (with D. Onofrei, M. Vogelius, and M. Weinstein), Comm. Pure Appl. Math. 63, pp. 973–1016, 2010.

91. *Scale-invariant extinction time estimates for some singular diffusion equations*, (with Y. Giga), Discr Cont Dyn Sys A 30, pp. 509–535, 2011.

92. *Minimal energy for elastic inclusions*, (with H. Knuepfer), Proc Roy Soc A 467, pp. 695–717, 2011.

93. *The evolution of a crystal surface: analysis of a 1D step train connecting two facets in the ADL regime*, (with H. Al Hajj Shehadeh and J. Weare), Physica D 240, pp. 1771–1784, 2011.

94. *Viewpoint: Irreversibility and the statistics of grain boundaries*, Physics 4, 33 (2011).

95. *Nucleation barriers for the cubic-to-tetragonal transformation*, (with H. Knuepfer and F. Otto), Comm. Pure Appl. Math. 66, pp. 867–904, 2013.

96. *Analysis of a compressed thin film bonded to a compliant substrate: the energy scaling law* (with H.-M. Nguyen), J. Nonlin. Sci. 23, 343–362, 2013.

97. *Wrinkles as the result of compressive stresses in an annular thin film*, (with P. Bella), Comm. Pure Appl. Math. 67, pp. 693–747, 2014.

98. *Energy scaling laws for conically constrained thin elastic sheets*, (with J. Brandman and H.-M. Nguyen), J. Elasticity 113, 251–264, 2013.

99. *A variational perspective on cloaking by anomalous localized resonance*, (with J. Lu, B. Schweizer, and M.I. Weinstein), Comm. Math. Phys. 328, 1–27, 2014.

100. *Blister patterns and energy minimization in compressed thin films on compliant substrates* (with J. Bedrossian), Comm. Pure Appl. Math. 68, 472–510, 2015.

101. *Metric-induced wrinkling of a thin elastic sheet* (with P. Bella), J. Nonlin. Sci. 24. 1147–1176, 2014.

102. *Optimal fine-scale structures in compliance minimization for a uniaxial load* (with B. Wirth), Proc. Roy. Soc. A 470, 20140432, 2014.

103. *Optimal fine-scale structures in compliance minimization for a shear load* (with B. Wirth), Comm. Pure Appl. Math. 69, 1572–1610, 2016.

104. *Coarsening of folds in hanging drapes* (with P. Bella), Comm. Pure Appl. Math. 70, 978–1021, 2017.

105. *Wrinkling of a thin circular sheet bonded to a spherical substrate* (with P. Bella), Phil. Trans. Roy. Soc. A 375, 20160157, 2017.

106. *Effect of step anisotropy on crystal growth inhibition by immobile impurity stoppers* (with J.P. Lee-Thorp and A.G. Shtukenberg), Crystal Growth & Design 17, 5474–5487, 2017.

107. *Dynamics and unsteady morphologies at ice interfaces driven by D_2O–H_2O exchange* (with R. Drori, M. Holmes-Cerfon, B. Kahr, and M.D. Ward), Proc. Nat'l. Acad. Sci. 114, 11627–11632, 2017

108. *On the bending and twisting of rods with misfit* (with E. O'Brien), J Elasticity 130, 115–143, 2018.

109. *The wrinkling of a twisted ribbon* (with E. O'Brien), J. Nonlin. Sci. 28, 1221–1249, 2018.

110. *Prediction with expert advice: a pde perspective* (with N. Drenska), J. Nonlin. Sci. 30, 137–173, 2020.

111. *Crystal growth inhibition by mobile randomly distributed stoppers*, Crystal Growth and Design 20, 1940–1950, 2020

112. *New potential-based bounds for prediction with expert advice* (with V. Kobzar and Z. Wang), in Proc. 33rd Annual Conf. on Learning Theory (COLT), PMLR 125:2370-2405, 2020

113. *New potential-based bounds for the geometric-stopping version of prediction with expert advice* (with V. Kobzar and Z. Wang), in Proc. 1st Annual Conf. on Mathematical and Scientific Machine Learning (MSML 2020), PMLR 107:537-554, 2020

114. *A PDE approach to the prediction of a binary sequence with advice from two history-dependent experts* (with N. Drenska), Comm. Pure Appl. Math. 2022, in press, available online at https://doi.org/10.1002/cpa.22071

115. *Energy minimizing twinning with variable volume fraction, for two nonlinear elastic phases with a single rank-one connection* (with S. Conti and O. Misiats), Math. Models Methods Appl. Sci. 2022, in press, available online at https://doi.org/10.1142/S0218202522500397

Preprints

1. *Complex analytic dependence on the dielectric permittivity in ENZ materials: the photonic doping example* (with R. Venkatraman), https://arxiv.org/abs/2203.08911

2. *An energy minimization approach to twinning with variable volume fraction* (with S. Conti and O. Misiats), https://arxiv.org/abs/2206.09882

3. *A PDE-based analysis of the symmetric two-armed Bernoulli bandit* (with V. Kobzar), https://arxiv.org/abs/2202.05767

Book Chapters and Non-refereed Conference Proceeding Articles

1. *Rigidity and nonlinear elasticity*, in Nonlinear Partial Differential Equations in Engineering and Applied Sciences, A.J. Kalinowski and J.S. Papadakis eds., Marcel Dekker, 1980.

2. *Existence of optimal geometries for a model problem of antiplane shear*, in Optimization of Distributed Parameter Structures II, E. Haug and J. Cea eds., Sijthoff and Noordhoff, 1981.

3. *Optimal design for torsional rigidity*, (with G. Strang), in Proceedings of Conference on Mixed and Hybrid Finite Elements, Atlanta, 1981, S.N. Atluri, R.H. Gallagher and Zienkiewicz eds., J. Wiley & Sons, 1982.

4. *Optimal design of cylinders in shear*, (with G. Strang), in The Mathematics of Finite Elements and Applications, J.R. Whiteman, ed., Academic Press, 1982.

5. *Structural design optimization, homogenization and relaxation of variational problems*, (with G. Strang), in Macroscopic Properties of Disordered Media, R. Burridge, S. Childress and G. Papanicolaou eds., Springer Lecture Notes in Physics 154, 1982.

6. *Partial regularity and the Navier–Stokes equations*, in Nonlinear Partial Differential Equations, Proc. of US–Japan Seminar, Tokyo, 1982, H. Fujita, P.D. Lax and G. Strang eds., North–Holland Math. Studies 81, 1984.

7. *Identification of an unknown conductivity by means of measurements at the boundary*, (with M. Vogelius), in Inverse Problems, D.W. McLaughlin ed., SIAM–AMS Proc. No. 14, Amer. Math. Soc., Providence, 1984.

8. *The method of partial regularity as applied to the Navier–Stokes equations*, in Lectures on PDE, S.S. Chern, ed., Math. Sci. Res. Inst. Publ. 2, Springer–Verlag, 1984.

9. *Thin plates with rapidly varying thickness, and their relation to structural optimization*, (with M. Vogelius), in Homogenization and Effective Moduli and Media, J. Ericksen et al. eds., Springer–Verlag, 1986.

10. *On bounding the effective conductivity of anisotropic composites*, (with G. Milton), in Homogenization and Effective Moduli of Materials and Media, J. Ericksen et al., eds., Springer–Verlag, 1986.

11. *Fibered structures in optimal design*, (with G. Strang), in Theory of Ordinary and Partial Differential Equations, B.D. Sleeman and R.J. Jarvis eds., Longman, 1986.

12. *The effective viscosity of a mixture of two Stokes fluids*, (with R. Lipton), in Advances in Multiphase Flow and Related Problems, G. Papanicolaou ed., SIAM, pp. 123–135, 1986.

13. *The constrained least gradient problem*, (with G. Strang), in Nonclassical Continuum Mechanics, R. Knops and A. Lacey eds., Cambridge Univ. Press, pp. 226–243, 1987.

14. *Optimal design of a two–way conductor*, (with G. Strang), in Topics in Nonsmooth Mechanics, J. Moreau et al. eds., Birkhauser, pp. 143–155, 1988.

15. *Recent progress in the mathematical modelling of composite materials*, in Composite Material Response: Constitutive Relations and Damage Mechanisms, G. Sih et al. eds., Elsevier, pp. 155–176, 1988.

16. *Removability of blowup points for semilinear heat equations*, (with Y. Giga), in Differential Equations, C. Dafermos et al. eds., M. Dekker, pp. 257–264, 1989.

17. *Composite materials and structural optimization*, in Smart Materials, Structures, and Mathematical Issues, C. Rogers ed., Technomic, pp.179–182, 1989.

18. *The relationship between linear and nonlinear variational models of coherent phase transitions*, in Proc. Seventh Army Conference Appl. Math. & Computing, West Point, June 1989, ARO Report 90–1, 1990.

19. *Composite materials and structural optimization*, in U.S.-Japan Workshop on Smart-Intelligent Materials and Systems, I. Ahmad et al. eds., Technomic, pp. 272–286, 1990.

20. *Extremal microstructures for composite materials*, (with G. Milton), in S. C. Chou ed., Synergism of Mechanics, Mathematics, and Materials, U.S. Army Symposium on Solid Mechanics, 1991.

21. *Numerical structural optimization via a relaxed formulation*, (with G. Allaire), in M. Delfour ed., Shape Optimization and Free Boundaries, Kluwer, pp. 173–210, 1992.

22. *Surface energy and microstructure*, (with S. Muller), in Shape Memory Materials and Phenomena – Fundamental Aspects and Applications, C. T. Liu et al. eds., Materials Research Society Proceedings Vol. 246, 1992.

23. *Geometric parameters and the relaxation of multiwell energies*, (with N. Firoozye), in Microstructure and Phase Transitions, D. Kinderlehrer et al. eds., Springer-Verlag, 1993.

24. *Topology optimization and optimal shape design using homogenization*, (with G. Allaire), in Topology Design of Structures, M. Bendsoe and C. Mota Soares, eds., Kluwer, pp. 207–218, 1993.

25. *Surface energy and the length scale of twinning in martensite*, (with S. Muller), in Proceedings of ICOMAT-92, J. Perkins and C. Wayman eds., Monterey Institute of Advanced Studies, pp. 77-82, 1993.

26. *The relaxed approach to structural optimization*, in Mathematics of Smart Materials, H.T. Banks ed., SPIE, pp. 325-327, 1993.

27. *Effective behavior of polycrystals that undergo martensitic phase transformation*, (with K. Bhattacharya), in Mathematics of Smart Materials, H.T. Banks ed., SPIE, pp. 207-213, 1993.

28. *The behavior of polycrystalline shape memory materials*, (with K. Bhattacharya), in proceedings of the symposium "Mechanics of Phase Transformations and Shape Memory Alloys," held at ASME WAM '94, 11/94 in Chicago, IL.

29. *Recoverable strains in shape-memory polycrystals*, (with K. Bhattacharya), in Proc. ICOMAT-95, J. de Physique IV – Colloque C8, pp. 261–266, 1995.

30. *Modeling of branched needle microstructures at the edge of a martensite laminate*, (with R. James and T. Shield), in Proc. ICOMAT-95, J. de Physique IV – Colloque C8, pp. 253–259, 1995.

31. *The crystalline algorithm for computing motion by curvature*, (with P. Girao), in Variational Methods for Discontinuous Structures, R. Serapioni and F. Tomarelli eds., Birkhauser, pp. 7–18, 1996.

32. *Small surface energy, coarse-graining, and selection of microstructure*, (with F. Otto), Physica D 107, pp. 272–289, 1997.

33. *Analogies between bone adaptation and homogenization-based methods for structural optimization*, Forma 12 301–303, 1997.

34. *The Taylor estimate of recoverable strains in shape-memory polycrystals*, (with K. Bhattacharya and Y.-C. Shu), in proceedings of the IUTAM Symp. on Transformation Problems in Composite and Active Materials (Y.A. Bahei-El-Din and G.J. Dvorak, eds.), Kluwer, 1998.

35. *Representation and self-similarity of shapes*, (with T-L Liu and D. Geiger), in Proc. Int'l. Conf. Computer Vision, Bombay, pp. 1129–1138, 1998.

36. *Magnetic microstructures – a paradigm of multiscale problems*, (with A. DeSimone, S. Müller, and F. Otto), in ICIAM 99: Proceedings of the Fourth International Congress on Industrial and Applied Mathematics, J.M. Ball and J.C.R. Hunt eds., Oxford University Press, pp. 175–190, 2000.

37. *Modeling MOCVD growth of YBCO thin films*, (with T. Lo), in Growth, Evolution and Properties of Surfaces, Thin Films and Self-Organized Structures, S.C. Moss ed., MRS Symposia Proceedings 648, 2001.

38. *Lattice deformations at martensite-martensite interfaces in Ni-Al*, (with D. Schryvers, Ph. Boullay, and J. Ball), Le Journal de Physique IV 11, Pr8-23–Pr8-30, 2001.

39. *Continuum Limit of a Step Flow Model of Epitaxial Growth*, (with T. Lo and N.K. Yip), in Materials Research Society Symp. Proc. vol 696, pp. T1.7.1-T1.7.7, 2002.

40. *Recent analytical developments in micromagnetics*, (with A. DeSimone, F. Otto, and S. Mueller), in The Science of Hysteresis II: Physical Modeling, Micromagnetics, and Magnetization Dynamics, G. Bertotti and I. Mayergoyz eds., pp. 269–381, Elsevier 2006.

41. *Energy-driven pattern formation*, in Proceedings of the International Congress of Mathematicians, Madrid, August 22-30, 2006, ed. M. Sanz-Solé et al., Euro Math Society, vol 1, pp 359-384, 2007.

42. *Second-order PDE's and deterministic games*, (with S. Serfaty), in 6th Int'l Congr. on Industr. and Appl. Math. – Zurich, Switzerland, 16-20 July 2007 – Invited Lectures, R. Jeltsch and G. Wanner eds, Euro Math Society, pp 239–249, 2009.

43. *Surface relaxation below the roughening temperature: some recent progress and open questions*, in Nonlinear Partial Differential Equations: The Abel Symposium 2010, H. Holden and K. Karlsen eds, Springer-Verlag, pp. 207–222, 2012.

44. *A few of Louis Nirenberg's many contributions to the theory of partial differential equations*, in The Abel Prize 2013–2017, H. Holden and R. Piene eds, Springer-Verlag, pp. 501–528, 2019.

Books Edited

1. *Homogenization and Effective Moduli of Materials and Media*, (with J. Ericksen, D. Kinderlehrer, and J.-L. Lions), IMA Volumes in Applied Mathematics No. 1, Springer–Verlag, 1986.

2. *Random Media and Composites*, (with G. Milton), SIAM, 1989.

3. *Topics in the Mathematical Modelling of Composite Materials*, (with A.V. Cherkaev), Birkhauser, 1997.