

Nicholas D. Alikakos

Professor of Mathematics

Department of Mathematics
University of Athens
GR-15784 Athens
Greece

b. 1952, Athens, Greece

Education

B.Sc. in Mathematics (Summa Cum Laude), University of Massachusetts, Amherst, 1974

Ph.D. in Applied Mathematics, Brown University, Rhode Island, 1978
(under the supervision of Jack Hale and John Mallet-Paret)

Employment

Assistant Professor, Purdue University, 1978–1984

Associate Professor, University of Tennessee, 1984–1990

Professor, University of Tennessee, 1990–2000

Professor, University of Crete, 1988–1993

Professor, University of North Texas, 2002–2005

Professor, University of Athens, 1993–

Publications

A. Reaction-diffusion equations

- [1] An application of the invariance principle to reaction-diffusion equations. *J. Diff. Equations* **33** (1979), pp. 201–225
- [2] L^p bounds of solutions of reaction-diffusion equations. *Comm. Partial Diff. Equations* **4** (1979), pp. 827–868
- [3] A Liapunov functional for a class of reaction-diffusion systems. In *Modeling and differential equations in biology*, edited by T. A. Burton. Lect. Notes Pure Appl. Math. **58** (1980), pp. 153–170
- [4] Remarks on invariance in reaction-diffusion equations. *Nonlinear Anal.* **5** (1981), pp. 593–614
- [5] Regularity and asymptotic behavior for the second-order parabolic equation with nonlinear boundary conditions. *J. Diff. Equations* **39** (1981), pp. 311–344
- [6] Stabilization of solutions for a system with a continuum of equilibria and distinct diffusion coefficients. In *Systems of Nonlinear Partial Differential Equations*, edited by J. M. Ball. Proceedings of the NATO Advanced Study Institute on Systems of Nonlinear Partial Differential Equations held at the University of Oxford, UK, 1982. *NATO ASI Ser. C* **111** (1983), pp. 433–441
- [7] Quantitative maximum principles and strongly coupled gradient-like reaction-diffusion systems. *Proc. R. Soc. Edinb.* **94A** (1983), pp. 265–286
- [8] Estimates for the eigenvalues of the Jordan product of Hermitian matrices. *Linear Algebra Appl.* **57** (1984), pp. 41–56 (with Peter W. Bates)
- [9] Erratum: Estimates for the eigenvalues of the Jordan product of Hermitian matrices. *Linear Algebra Appl.* **65** (1985), p. 282 (with Peter W. Bates)

- [10] A remark on positively invariant regions for parabolic systems with an application arising in superconductivity. *Quart. Appl. Math.* **45** (1987), pp. 75–80 (with Daniel Phillips)
- [11] Blow up for a diffusion-advection equation. *Proc. R. Soc. Edinb.* **113A** No. 3/4 (1989), pp. 181–190 (with Peter W. Bates and Christopher P. Grant)
- [12] Solutions to the nonautonomous bistable equation with specified Morse index. I: Existence. *Trans. Amer. Math. Soc.* **340** No. 2 (1993), pp. 641–654 (with Peter W. Bates and Giorgio Fusco)
- [13] Periodic traveling waves and locating oscillating patterns in multidimensional domains. *Trans. Amer. Math. Soc.* **351** No. 7 (1999), pp. 2777–2805 (with Peter W. Bates and Xinfu Chen)

B. The porous medium equation

- [14] Large time behavior of solutions of Neumann boundary value problem for the porous medium equation. *Ind. Univ. Math. J.* **30** (1981), pp. 749–785 (with Rouben Rostamian)
- [15] Stabilization of solutions of the equation $\partial u/\partial t = \Delta\phi(u) - \beta(u)$. *Nonlinear Anal.* **6** (1982), pp. 637–647 (with Rouben Rostamian)
- [16] Lower bound estimates and separable solutions for homogeneous equations of evolution in Banach space. *J. Diff. Equations* **43** (1982), pp. 323–344 (with Rouben Rostamian)
- [17] Gradient estimates for degenerate diffusion equations. I. *Math. Ann.* **259** (1982), pp. 53–70 (with Rouben Rostamian)
- [18] Gradient estimates for degenerate diffusion equations. II. *Proc. R. Soc. Edinb.* **91A** (1982), pp. 335–346 (with Rouben Rostamian)
- [19] Continuity of the gradient for weak solutions of a degenerate parabolic equation. *J. Math. Pures Appl.* **62** (1983), pp. 253–268 (with Lawrence C. Evans)
- [20] Classification of initial data for the porous medium equation in \mathbb{R}^N . In *Differential Equations*, edited by I. W. Knowles and R. T. Lewis. Proceedings of the International Conference on Differential Equations held at the University of Alabama, Birmingham, AL, USA, 1983. *North-Holland Mathematics Studies* **92** (1984) pp. 19–24 (with Rouben Rostamian)
- [21] On the uniformization of the solutions of the porous medium equation in \mathbb{R}^N . *Israel J. Math.* **47** (1984), pp. 270–290 (with Rouben Rostamian)
- [22] Large time estimates for solutions to the porous medium equation with nonintegrable data via comparison. *Proc. R. Soc. Edinb.* **100A** (1985), pp. 1–10 (with Rouben Rostamian)
- [23] On the pointwise behavior of the solutions of the porous medium equations as t approaches zero or infinity. *Nonlinear Anal.* **9** (1985), pp. 1085–1113

C. Monotone systems

- [24] On stabilization of discrete monotone dynamical systems. *Isr. J. Math.* **59** (1987), pp. 185–194 (with Peter Hess)
- [25] Stabilization of solutions for a class of degenerate equations in divergence form in one space dimension. *J. Diff. Equations* **73** No. 2 (1988), pp. 363–393 (with Peter W. Bates)
- [26] An invariance principle for a class for monotone systems and applications to degenerate parabolic equations. *Rocky Mt. J. Math.* **18** No. 2 (1988), pp. 215–224 (with Peter W. Bates)
- [27] Discrete order preserving semigroups and stability for periodic parabolic differential equations. *J. Diff. Equations* **82** No. 2 (1989), pp. 322–341 (with Peter Hess and Hiroshi Matano)
- [28] Lyapunov operators and stabilization in strongly order-preserving dynamical systems. *Diff. Int. Equations* **4** No. 1 (1991), pp. 15–24 (with Peter Hess)
- [29] A dynamical systems proof of the Krein–Rutman theorem and an extension of the Perron theorem, *Proc. R. Soc. Edinb.* **117A** No. 3/4 (1991), pp. 209–214 (with Giorgio Fusco)

D. Singular perturbations / Phase transitions / Diffused interfaces

- [30] On the singular limit for a class of problems modelling phase transitions. *SIAM J. Math. Anal.* **18** (1987), pp. 1453–1462 (with Kerchung C. Shaing)

- [31] A variational approach for a class of singular perturbation problems and applications. *Proc. R. Soc. Edinb.* **107A** (1987), pp. 27–42 (with Henry C. Simpson)
- [32] On the singular limit in a phase field model of phase transitions. *Ann. Inst. H. Poincaré, Anal. Non Linéaire* **5** No. 2 (1988), pp. 141–178 (with Peter W. Bates)
- [33] Remarks on the equilibrium theory for the Cahn–Hilliard equation in one space dimension. In *Reaction-Diffusion Equations*, edited by K. J. Brown and A. A. Lacey. Proceedings of the Reaction-Diffusion Symposium Year held at Heriot-Watt University, Edinburgh, UK, 1987–1988. Clarendon Press, Oxford, 1990. pp. 75–93 (with William R. McKinney)
- [34] Slow motion for the Cahn–Hilliard equation in one space dimension. *J. Diff. Equations* **90** No. 1 (1991), pp. 81–135 (with Peter W. Bates and Giorgio Fusco)
- [35] Slow motion manifolds for a class of singular perturbation problems: The linearized equations. In *Differential equations and mathematical physics*, edited by C. Bennewitz. Proceedings of the International Conference held at the University of Alabama, Birmingham, AL, 1990. *Math. Sci. Eng.* **186** (1992), pp. 1–24 (with Peter W. Bates and Giorgio Fusco)
- [36] The spectrum of the Cahn–Hilliard operator for generic interface in higher space dimensions. *Ind. Univ. Math. J.* **42** No. 2 (1993), pp. 637–674 (with Giorgio Fusco)
- [37] Equilibrium and dynamics of bubbles for the Cahn–Hilliard equation. In *EQUADIFF 1991*, edited by C. Perelló, C. Simó, and J. de Sola-Morales. Proceedings of the International Conference on Differential Equations EQUADIFF '91, Barcelona, Spain, 1991. World Scientific, London, 1993. pp. 59–67 (with Giorgio Fusco)
- [38] Slow dynamics for the Cahn–Hilliard equation in higher space dimensions. Part I: Spectral estimates. *Comm. Partial Diff. Equations* **19** No. 9–10 (1994), pp. 1397–1447 (with Giorgio Fusco)
- [39] Convergence of the Cahn–Hilliard equation to the Hele–Shaw model. *Arch. Rat. Mech. Anal.* **128** No. 2 (1994), pp. 165–205 (with Peter W. Bates and Xinfu Chen)
- [40] Some aspects of the dynamics of the Cahn–Hilliard equation. *Resen. Inst. Mat. Estat. Univ. São Paulo* **1** No. 4 (1994), pp. 517–530 (with Giorgio Fusco)
- [41] Asymptotics of the Cahn–Hilliard flow. In *Curvature Flows and Related Topics*, edited by A. Damlamian, J. Spruck, and A. Visintin. Proceedings of the International Conference on Curvature Flows and Related Topics, Levico, Italy, 1994. *GAKUTO Int. Ser., Math. Sci. Appl.* **5** (1995), pp. 13–23 (with Peter W. Bates and Xinfu Chen)
- [42] Critical spectrum and stability of interfaces for a class of reaction-diffusion equations. *J. Diff. Equations* **126** No. 1 (1996), pp. 106–167 (with Giorgio Fusco and Vagelis Stefanopoulos)
- [43] Finite dimensional dynamics and interfaces intersecting the boundary: Equilibria and quasi-invariant manifold. *Ind. Univ. Math. J.* **45** No. 4 (1996), pp. 1119–1155 (with Giorgio Fusco and Michał Kowalczyk)
- [44] Motion by surface tension along a fixed boundary. In *Differential equations and applications*, edited by P. W. Bates, S.-N. Chow, K. Lu, and X. Pan. Proceedings of the US-China Conference, Hangzhou, China, 1996. International Press, 1997. pp. 1–13 (with Xinfu Chen and Giorgio Fusco)
- [45] Slow dynamics for the Cahn–Hilliard equation in higher space dimensions: The motion of bubbles. *Arch. Rat. Mech. Anal.* **141** No. 1 (1998), pp. 1–61 (with Giorgio Fusco)
- [46] Slow motion in the gradient theory of phase transitions via energy and spectrum. *Calc. Var.* **6** No. 1 (1998), pp. 39–66 (with Lia Bronsard and Giorgio Fusco)
- [47] Critical points of a singular perturbation problem via reduced energy and local linking. *J. Diff. Equations* **159** No. 2 (1999), pp. 403–426 (with Michał Kowalczyk)
- [48] Motion of a droplet by surface tension along the boundary. *Calc. Var.* **11** No. 3 (2000), pp. 233–305 (with Xinfu Chen and Giorgio Fusco)
- [49] Motion of bubbles towards the boundary for the Cahn–Hilliard Equation. *Eur. J. Appl. Math.* **15** No. 1 (2004), pp. 103–124 (with Giorgio Fusco and Georgia Karali)
- [50] Analysis of a corner layer problem in anisotropic Interfaces. *Discrete Contin. Dyn. Syst., Ser. B* **6** No. 2 (2006), pp. 237–255 (with Peter W. Bates, John W. Cahn, Paul C. Fife, Giorgio Fusco, and Gamze B. Tanoglu)

E. Phase transitions / Geometric evolution / Sharp interfaces

- [51] The equations of Ostwald ripening for dilute systems. *J. Stat. Phys.* **95** No. 5–6 (1999), pp. 851–866 (with *Giorgio Fusco*)
- [52] Mullins–Sekerka motion of small droplets on a fixed boundary. *J. Geom. Anal.* **10** No. 4 (2000), pp. 575–596 (with *Peter W. Bates, Xinfu Chen, and Giorgio Fusco*)
- [53] The effect of distribution in space in Ostwald ripening. In *Nonlinear Dynamics and Renormalization Group*. Proceedings of the Workshop held at the Centre de recherches mathématiques, Montreal, QC, 1999. *CRM Proc. Lect. Notes* **27**, American Mathematical Society, Rhode Island, 2001. pp. 17–28 (with *Giorgio Fusco*)
- [54] The normalized mean curvature flow for a small bubble in a Riemannian manifold. *J. Diff. Geom.* **64** No. 2 (2003), pp. 247–303 (with *Alexandre Freire*)
- [55] Ostwald ripening for dilute systems under quasistationary dynamics. *Comm. Math. Phys.* **238** No. 3 (2003), pp. 429–479 (with *Giorgio Fusco*)
- [56] The effect of the geometry of the particle distribution in Ostwald ripening. *Comm. Math. Phys.* **238** No. 3 (2003), pp. 481–488 (with *Giorgio Fusco and Georgia Karali*)
- [57] Continuum limits of particles interacting via diffusion. *Abstr. Appl. Anal.* **3** (2004), pp. 215–237 (with *Giorgio Fusco and Georgia Karali*)
- [58] Ostwald ripening in two dimensions—the rigorous derivation of the equations from the Mullins–Sekerka dynamics. *J. Diff. Equations* **205** No. 1 (2004), pp. 1–49 (with *Giorgio Fusco and Georgia Karali*)
- [59] Analysis of the heteroclinic connection in a singularly perturbed system arising from the study of crystalline grain boundaries. *Int. Free Bound.* **8** No. 2 (2006), pp. 159–183 (with *Paul C. Fife, Giorgio Fusco, and Christos Sourdis*)
- [60] Singular perturbation problems arising from the anisotropy of crystalline grain boundaries. *J. Dyn. Diff. Equations* **19** No. 4 (2007), pp. 935–949 (with *Paul C. Fife, Giorgio Fusco, and Christos Sourdis*)

F. Elliptic systems

- [61] Explicit stationary solution in multiple well dynamics and non-uniqueness of interfacial energy densities. *Eur. J. Appl. Math.* **17** No. 5 (2006), pp. 525–556 (with *Santiago I. Betelú and Xinfu Chen*)
- [62] On the connection problem for potentials with several global minima. *Ind. Univ. Math. J.* **57** No. 4 (2008), pp. 1871–1906 (with *Giorgio Fusco*)
- [63] Entire solutions to nonconvex variational elliptic systems in the presence of a finite symmetry group. In *Singularities in nonlinear evolution phenomena and applications* M. Novaga and G. Orlandi eds. Publications of the Scuola Normale Superiore, CRM Series, Birkhäuser, 2009 (with *Giorgio Fusco*)
- [64] Heteroclinic travelling waves of gradient diffusion systems. *Trans. Amer. Math. Soc.* **363** No. 3 (2011), pp. 1362–1397 (with *Nikolaos I. Katzourakis*)
- [65] Some basic facts on the system $\Delta u - W_u(u) = 0$. *Proc. Amer. Math. Soc.* **139** No. 1 (2011), pp. 153–162
- [66] On an elliptic system with symmetric potential possessing two global minima. To appear in *Bull. Greek Math. Soc.* (with *Giorgio Fusco*)
- [67] Entire solutions to equivariant elliptic systems with variational structure. *Arch. Rat. Mech. Anal.* **202** No. 2 (2011), pp. 567–597 (with *Giorgio Fusco*)
- [68] The stress-energy tensor and Pohozaev’s identity for systems. *Acta Math. Scientia* **32** No. 1 (2012), pp. 433–439 (with *Apostolos Faliagas*)
- [69] Existence of lattice solutions to semilinear elliptic systems with periodic potential. *Electr. J. Diff. Equations* **2012** No. 15 (2012), pp. 1–15 (with *Panayotis Smyrnelis*)
- [70] A new proof for the existence of an equivariant entire solution connecting the minima of the potential for the system $\Delta u - W_u(u) = 0$. *Comm. Partial Diff. Eqs* **37** No. 12 (2012), pp. 2093–2115.

- [71] Plateau angle conditions for the vector-valued Allen–Cahn equation. *SIAM Journal on Mathematical Analysis* **45** No. 6 (2013), pp. 3823–3837 (with Panagiotis Antonopoulos and Apostolos Damialis)
- [72] On the structure of phase transition maps for three or more coexisting phases. In *Geometric partial differential equations* M. Novaga and G. Orlandi eds. Publications of the Scuola Normale Superiore, CRM Series, Birkhäuser, (2013)
- [73] A maximum principle for systems with variational structure and an application to standing waves. To appear in the *Journal of the European Mathematical Society* (with G. Fusco)
- [74] Asymptotic behavior and rigidity results for symmetric solutions of the elliptic system $\Delta u - W_u(u) = 0$. To appear in *Annali della Scuola Normale Superiore di Pisa* (with Giorgio Fusco)

G. Books

- [75] *Ordinary Differential Equations*, in Greek, third edition, Synchroni Ekdotiki Publications, Athens, 2007 (with Grigoris Kalogeropoulos)
- [76] *Partial Differential Equations*, in Greek, Synchroni Ekdotiki Publications, Athens, 2012 (with Georgios Akrivis)

H. Reviews

- [77] *Blow-up in Quasilinear Parabolic Equations*, by A. A. Samarski, V. A. Galaktionov, S. P. Kurdyumov, and A. P. Mikhailov. *Bull. Amer. Math. Soc.* **33** (1996), pp. 483–486
- [78] *Nonlinear Differential Equations of Monotone Type in Banach Spaces*, by V. Barbu. *SIAM Review* **53** No. 3 (2011), p. 583.

I. Unpublished

- [79] A homogenization estimate for a class of parabolic equations, 1981
- [80] On a singularly perturbed semilinear parabolic problem, 1991 (with Peter Hess)

J. Preprints

- [81] Density estimates for vector minimizers and applications. arXiv:1403.7608 (with Giorgio Fusco)

Editorial boards

Abstract and Applied Analysis
 Bulletin of the Greek Mathematical Society

Honors

Invited AMS address, Birmingham, Alabama, 2000
 Keynote Lecture, EQUADIFF 1999, Berlin

Invited presentations (recent selection)

Invited address in honor of John W. Cahn, Rutgers University, NJ, May 1998
 Invited address in honor of Jack K. Hale, IST Lisbon, Portugal, November 1998
 Invited address in honor of Paul C. Fife, Université Paris-Sud 11, Orsay, France, March 1999
 Plenary lecturer at the Interdisciplinary Conference of the National Technical University of Athens, Athens, Greece, January 2000
 Invited lecturer at the 9th Panhellenic Conference in Mathematical Analysis, Technical University of Crete, Chania, Greece, September 2002

Invited lecturer at Brown University

Invited address in honor of Peter W. Bates, Jinhua, China, June 2007

Invited lecturer at the INdAM conference “Liouville Theorems and Detours”, Cortona, Italy, May 18–25, 2008

Invited lecturer at the conference “Singularities in nonlinear evolution phenomena and applications”, Centro Ennio De Giorgi, Pisa, Italy, May 25–31, 2008

Invited address in honor of Constantine Dafermos, Archimedes Center, Crete, Greece, June 2011

Invited three times to the Mathematisches Forschungsinstitut Oberwolfach, three times to the Institut de Mathématiques de Luminy and two times to the Isaac Newton Institute for Mathematical Sciences, Cambridge.

Institutions visited the current year: Freie Universität Berlin (January 2014), University of Reading (February 2014, 3 days), Ecole Polytechnique Fédérale de Lausanne (June 2014), Universität Bonn (July 2014), University of Ioannina (Conference in Contemporary Geometry, September 2014).

Colloquia/seminars at the following universities (in the last twenty years): Stanford University, Columbia University, Université Pierre et Marie Curie Paris VI, Università di Roma Tor Vergata, Princeton University, Max-Planck-Institut für Mathematik in den Naturwissenschaften Leipzig, Max-Planck-Institut für Gravitationsphysik Golm, University of Tokyo, University of Minnesota, Universität Bonn, University of Crete, University of Patras, Università dell’Aquila, Clarkson University, Iowa State University, University of Wisconsin at Madison, University of Maryland at College Park, University of Maryland at Baltimore County, University of Pittsburgh, University of Indiana, Virginia Tech, University of California at Santa Barbara, University of Arizona, Duke University, Lehigh University, McMaster University, Cornell University, Arizona State University, University of North Carolina, University of Zürich, Comenius University in Bratislava, University of Hong Kong, University of Chicago, Northwestern University, University of Utah, Universiteit Leiden, Mississippi State University, University of Texas at Arlington, Oklahoma State University, Boston University.

Ph.D. students

Vangelis Stefanopoulos, 1993 (Assistant Professor, University of the Aegean)

Michał Kowalczyk, 1995 (Professor, University of Chile)

Georgia Karali, 2002 (Associate Professor, University of Crete)

Christos Sourdis, 2006 (Post-Doc, University of Chile 2007–09; Post-Doc, Archimedes Center, University of Crete, 2011–present)

Nikolaos Katzourakis, 2011 (Lecturer, University of Reading, UK)

Panayiotis Smyrnelis, 2012 (Postdoctoral Fellow, University of Athens)

Apostolos Damialis, 2012

Panagiotis Antonopoulos, in progress