Curriculum vitæ of Giovanni Alberti

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Personal data

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Summary

Positions

2002–present	Full professor of Mathematical Analysis at the University of Pisa, Department of Mathematics.
1998–2002	Associate professor of Mathematical Analysis at the University of Pisa, Department of Mathematics.
1992–1998	Ricercatore (lecturer) of Mathematical Analysis at the University of Pisa, Department of Applied Mathematics.

Education

1996–1997 Postdoctoral position at the Max Planck Institute for Mathematics in the Sciences, Leipzig (from October 1996, to September 1997; on leave from the University of Pisa).

1992 Postdoctoral position at the Scuola Normale Superiore (from January to October 1992, supported by a senior fellowship of the Istituto Nazionale di Alta Matematica).

1989–1991 Graduate student in Mathematics at the Scuola Normale Superiore, Pisa. Title of dissertation (not completed): *Rectifiable measures in Euclidean spaces*; advisors: E. De Giorgi and G. Buttazzo.

1984–1988 Undergraduate student at the Scuola Normale Superiore, Pisa.

1984–1988 Undergraduate student in Mathematics at the University of Pisa. Title of dissertation: *Proprietà fini delle funzioni a variazione limitata* [Fine properties of functions with bounded variation]; advisors: L. Modica and S. Mortola; defended (cum laude) on November 24, 1988.

Honours

Luigi and Wanda Amerio Prize, awarded in 2019 by the Istituto Lombardo Accademia di Scienze e Lettere.

Plenary speaker at the *XVIII Congresso nazionale dell'Unione Matematica Italiana* [XVIII Congress of the Italian Mathematical Union], Bari, September 24–29, 2007.

Invited speaker at the *IV European Congress of Mathematics*, Stockholm, June 27 - July 2, 2004.

Caccioppoli Prize, awarded in 2002 by the Unione Matematica Italiana.

Invited speaker at the *XVI Congresso nazionale dell'Unione Matematica Italiana* [XVI Congress of the Italian Mathematical Union], Naples, September 13–18, 1999.

Service and teaching

Service

Besides regularly taking part in hiring and evaluation committees, I held the following administrative positions at the University of Pisa:

2017–2022: director of the graduate program in Mathematics;

2011–2017: deputy director of the graduate program in Mathematics;

2008–2010: deputy director of the undergraduate program in Mathematics;

2005–2008: director of the undergraduate program in Mathematics;

2003–2005: deputy director of the undergraduate program in Mathematics.

Scientific organization (recent)

Head of the research unit at Pisa University of the 2022 PRIN project *Geometric Measure Theory: structure of singular measures, regularity theory, and applications in the Calculus of Variations* (2023-25, principal investigator: A. Marchese, Trento).

Member of the Scientific Board of INdAM (Istituto Nazionale di Alta Matematica "Francesco Severi", Roma) since 2020, renewed in 2023.

Member of the editorial board of *Nonlinear Analysis* since 2020.

Member of the editorial board of *Zeitschrift für Analysis und ihre Anwendungen* [Journal of Analysis and its Applications] since 2016.

Head of the research unit at Pisa University of the 2017 PRIN project *Variational methods for stationary and evolution problems with singularities and interfaces* (2019-22, principal investigator: G. Dal Maso, SISSA, Trieste).

Organizer of the conference *Transport, fluids and mixing*, Centro di Ricerca Matematica E. De Giorgi, Pisa, January 24–28, 2022 (together with G. Crippa, A. Mazzucato, L. Spinolo, S. Spirito).

Organizer of the conference *Ricordando Luciano Modica* [Remembering Luciano Modica], Dipartimento di Matematica, Università di Pisa, November 8–9, 2021 (together with G. Buttazzo, M.S. Gelli, M. Novaga).

Organizer of the conference *Some topics of geometric analysis and geometric measure theory*, Centro di Ricerca Matematica E. De Giorgi, Pisa, April 16–17, 2019 (together with V. Magnani, D. Trevisan, D. Vittone).

Organizer of the conference *Geometric measure theory*, Mathematics Institute, University of Warwick, July 10–14, 2017 (together with D. Preiss).

Organizer of the workshop *Irregular transport: analysis and applications*, Department of Mathematics and Computer Science, University of Basel, June 26–30, 2017 (together with G. Crippa, A. Mazzucato).

Key member of the ERC project *Local structure of sets, measures and currents* (2011–2017, principal investigator: D. Preiss, Warwick University).

Organizer of the workshop *Variational and PDE problems in applied mathematics*, Mathematics Department, University of Pisa, February 10–12, 2016 (together with M.S. Gelli, M. Novaga).

Editor of the volumes *HCDTE lecture notes. Nonlinear hyperbolic PDEs, dispersive and transport equations. Part I and II.* Applied Mathematics, 6–7. American Institute of Mathematical Sciences (AIMS), 2013–2014 (together with F. Ancona, S. Bianchini, G. Crippa, C. De Lellis, A. Marson, C. Mascia).

Key member of the ERC project *Hyperbolic systems of conservation laws: singular limits, properties of solutions and control problems* (2010–2014, principal investigator: S. Bianchini, SISSA, Trieste).

Organizer of the workshop *Two days on hyperbolic PDEs, geometric measure theory and optimal transport*, SISSA, Trieste, October 28–29, 2013 (together with F. Ancona, S. Bianchini, G. Crippa, C. De Lellis, A. Marson, C. Mascia).

Organizer of the workshop *Geometric measure theory, analysis in metric spaces and real analysis*, Centro di Ricerca Matematica E. De Giorgi, Pisa, October 7–11, 2013 (together with L. Ambrosio, C. De Lellis).

Organizer of the school *Geometric measure theory and real analysis*, Centro di Ricerca Matematica E. De Giorgi, Pisa, September 30–October 4, 2013 (together with L. Ambrosio, C. De Lellis).

Teaching

Most of my undergraduate teaching took place at the University of Pisa. From 1990 to 1998 I taught calculus exercise classes for students in computer science and engineering; from 1998 I taught basic math courses (that is, elementary calculus, statistics and probability) for students in biology and geology, calculus courses for students in computer science and engineering, and analysis courses (basic and advanced) for students in mathematics [detailed list, in italian].

Since 1998 I also acted as advisor for several undergraduate theses in mathematics [detailed list, in italian] and for some graduate theses [detailed list].
Finally, I taught several courses at graduate level in Pisa and elsewhere; a few recent ones are:

Rectifiable decompositions of measures, minicourse (3 lectures) in the "Westlake Winter School in Geometric Measure Theory", Institute for Theoretical Sciences, Westlake University, Hangzhou (Zhejiang, China), January 13–17, 2025.

Teoria della Misura [Measure Theory], advanced undergraduate course held at the University of Pisa in 2006, 2024.

Geometric Measure Theory and Plateau's problem, minicourse (3 lectures) in the workshop "XVII ENAMA (Encontro Nacional de Análise Matemática e Aplicações)", Colégio Brasileiro de Altos Estudos (CBAE-UFRJ), Rio de Janeiro (Brazil), November 6–8, 2024.

The transport equation with non-smooth velocity field: uniqueness, mixing and loss of regularity. , minicourse (3 lectures) in the summer school "Fluid dynamics and nonlinear PDEs", Department of Matemathics, University of Padua (Italy), September 9–13, 2024.

Theory of currents, graduate course (about 20 lectures), held at the University of Pisa in 2023/24 and 2014.

Calcolo delle variazioni A [Calculus of Variations A], advanced undergraduate/graduate course held at the University of Pisa in 2016, 2019, 2024.

Around the transport equation with non-smooth velocity: uniqueness, mixing and loss of regularity, minicourse (3 lectures) in the workshop "Three days between analysis and geometry in Trento", Department of Matemathics, University of Trento (Italy), August 29–31, 2022.

Teoria geometrica della misura [Geometric Measure Theory], advanced undergraduate/graduate course held at the University of Pisa in 2005, 2009, 2017, 2020.

Rectifiable decompositions of measures and applications, minicourse (4 lectures) in the "VII Spring School of Analysis in memory of Aleksander Pełczyński", Banach Center, Mathematical Institute of the Polish Academy of Science, Będlewo (Poznań, Poland), March 28–31, 2019.

Introduction to Geometric Measure Theory, course (12 lectures) for the graduate school in Mathematics, University of Padua, March–May, 2018.

Introduction to Geometric Measure Theory, minicourse (6 lectures) in the program "Geometric measure theory and optimal transport", Korea Institute for Advanced Study (KIAS), Seoul (South Korea), August 7–10, 2017.

Introduction to minimal surfaces and finite perimeter sets, minicourse (5 lectures) in the "Summer school on geometric measure theory and calculus of variations", Insitut Fourier, Grenoble (France), June 15–19, 2015.

Introduction to the theory of currents, minicourse (5 lectures) in the "Summer school on geometric measure theory and geometric analysis", University of Basel (Switzerland), June 23–27, 2014.

Differentiability of Lipschitz functions with respect to singular measures, and related questions, minicourse (3 lectures) in the "41st winter school in abstract analysis", Posázaví (Czech Republic), January 12–19, 2013.

Graduate students

Jeremy Mirmina (University of Pisa). Thesis discussion expected in 2026.

Tommaso Cortopassi (Scuola Normale Superiore, Pisa). Thesis discussion expected in 2026.

Kennedy Obinna Idu (University of Pisa): *Higher order rectifiability criteria and a model for soap films*; thesis defended on June 8, 2021.

Andrea Merlo (Scuola Normale Superiore, Pisa): *Geometry of 1-codimensional measures in Heisenberg groups*; thesis defended on June 17, 2020, co-advised with Roberto Monti.

Giacomo del Nin (University of Pisa): *Some asymptotic results on the global shape of planar clusters*; thesis defended on June 7, 2019.

Marco Caroccia (University of Pisa): *On the isoperimetric properties of planar N-clusters*; thesis defended on July 27, 2015, co-advised with Francesco Maggi.

Annalisa Massaccesi (Scuola Normale Superiore, Pisa): *Currents with coefficients in groups, applications, and other problems in Geometric Measure Theory*; thesis defended on March 5, 2014.

Andrea Marchese (University of Pisa): *Two applications of the theory of currents*; thesis defended on February 15, 2013.

Minh Nguyet Mach (University of Pisa): *Weak solutions to rate-independent systems: existence and regularity*; thesis defended on July 31, 2012.

Niccolò Desenzani (University of Milan): *Variational convergence of Ginzburg-Landau functionals with supercritical growth*; thesis defended on February 11, 2005, co-advised with Ilaria Fragalà.

Luigi De Pascale (University of Pisa): *The Morse-Sard Theorem in Sobolev Spaces. Optimal transport problems and applications*; thesis defended on April 28, 2001, co-advised with Giuseppe Buttazzo.

Research

Selected talks

Construction of pathological sets via Baire theorem. "Geometric Measure Theory in Trento", University of Trento (Italy), January 27–31, 2025

On the strong locality of linear differential operators. "Frontiers of the Calculus of Variations", Karlovasi, Samos (Greece), September 16–20, 2024

Frobenius theorem for nonsmooth surfaces. "Metric Geometry and Geometric Measure Theory", University of Fribourg (Switzerland) August 21–23, 2024.

The geometric Vanishing Mass Conjecture. "Geometric Measure Theory and applications", Cortona (Arezzo, Italy), June 17–21, 2024.

Frobenius theorem for nonsmooth surfaces. "Calculus of Variations and Geometric Measure Theory", University of Pisa, June 12–16, 2023.

The geometric Vanishing Mass Conjecture. "Meeting on nonlinear evolution PDEs, fluid dynamics and transport equations", Ettore Majorana Foundation and Centre for Scientific Culture, Erice (Trapani, Italy), May 25–31, 2023.

Sets and currents tangent to non-involutive distributions of planes. Applied Mathematics Colloquium, Fields Institute, Toronto (Canada), April 11, 2023.

Partial results on the (geometric) vanishing mass conjecture. "Compensated compactness and applications to materials", Banff International Research Station (BIRS), Banff (Canada), April 2–7, 2023. [link to video]

Small sets in geometric measure theory and analysis. Warwick Mathematics Colloquium, University of Warwick (UK), November 4, 2022.

Sets and currents tangent to non-involutive distributions of planes. "Workshop on geometric measure theory and analysis on metric spaces", University of Warwick (UK), August 8–10, 2022.

The vanishing mass conjecture and its geometric interpretation. "Variational challenges in Materials Science and Imaging. Recent advances and new perspectives. To celebrate Irene Fonseca's 65th birthday", Technische Universität Wien (TUW), Vienna (Austria), June 20–24, 2022.

Grain boundaries in minimal planar N-partitions for large N. "20 years of summer schools on CalcVar in Rome", University of Roma Sapienza, Rome (Italy), June 13–17, 2022.

Dividing a set in half. "Calculus of Variations. Back to Carthage. A conference in honor of Andrea Braides on the occasion of his 60th birthday", IHEC de Carthage, Carthage (Tunisia), May 16–20, 2022.

Frobenius theorem for non-regular sets and currents. Workshop "Geometric Measure Theory and Harmonic Analysis" in the trimester "Interactions between Geometric Measure Theory, Singular Integrals, and PDE", Hausdorff Research Institute for Mathematics (HIM) Bonn (Germany), April 4–7, 2022. [link to video]

The vanishing mass conjecture and related geometric questions. "Variational methods and applications", Centro di Ricerca Matematica E. De Giorgi, Pisa (Italy), September 6-10, 2021. [link to video]

Frobenius theorem for non-smooth sets and currents. INdAM meeting "Geometric Measure Theory and applications", Cortona (Arezzo, Italy), August 30–September 3, 2021.

Grain boundaries in minimal planar N-partitions for large N. "PDEs and Continuum Mechanics", The Riemann International School of Mathematics, Varese (Italy), July 21–23, 2021. [link to video]

Frobenius theorem for non-smooth sets and currents. "Geometric and applied analysis", Hausdorff Center for Mathematics, Bonn (Germany), July 12–16, 2021. Held online.

Minimal planar N-partitions for large N. Minisymposium "Variational and evolutionary models involving local/nonlocal interactions" in "8th European Congress of Mathematics" Portorož (Slovenia), June 20–26, 2021. Held online.

Minimal planar N-partitions for large N. "Calculus of Variations and applications. An international conference to celebrate Gianni Dal Maso's 65th birthday", SISSA, Trieste (Italy), January 27–February 1, 2020.

Loss of regularity for transport equation with non-smooth velocity field. "Fluids and variational methods", Budapest (Hungary), June 10–14, 2019.

On the extension of Frobenius theorem to non-smooth sets and currents. "Alessio Figalli, Fields medallist 2018", Pisa (Italy), January 14–17, 2019. [link to video]

Minimizing N-clusters for large N. "Material theories", Matematisches Forschungsinstitut Oberwolfach (Germany), July 16–22, 2017.

Mixing properties of flows associated to divergence-free velocity fields. Invited lecture, "XVI international conference on hyperbolic problems theory, numerics, applications (HYP 2016)", Aachen (Germany), August 1–5, 2016.

Structure of the boundary of integral currents and Frobenius theorem. "Calculus of variations, optimal transportation, and geometric measure theory: from theory to applications", Lyon (France), July 4–8, 2016.

On the structure of minimizing N-partitions for large N. Plenary lecture, "PICOF 2016", Autrans (France), June 1–3, 2016.

On the structure of minimizing N-partitions for large N. "New challenges for the Calculus of Variations. In honour of the 60th birthday of Irene Fonseca", Montreal (Canada), May 16–20, 2016.

Mixing properties of flows associated to divergence-free velocity fields. "Oxbridge PDE conference 2016", Cambridge (UK), March 15–16, 2016.

Mixing for fluxes associated to divergence-free velocity fields. Workshop "Analysis in Lyon", Lyon (France), October 25–30, 2015.

Rectifiable measures and applications. "NAFSA 10: nonlinear analysis, function spaces and applications", Třešt' (Czech Republic), June 9–15, 2014.

Differentiability of Lipschitz functions with respect to singular measures. "Geometric measure theory and optimal transport", International Centre for Theoretical Physics (ICTP), Trieste (Italy), July 29–August 2, 2013.

On the structure of null sets in Euclidean spaces. Perlen Colloquium, Basel University (Switzerland), June 6, 2013.

Differentiability of Lipschitz functions with respect to singular measures. "Interactions between analysis and geometry, workshop III: non-smooth geometry", Institute for Pure and Applied Mathematics (IPAM), UCLA, Los Angeles (USA), April 29–May 3, 2013. [link to video]

Contact angle hysteresis and friction in capillarity. "Fluids and variational methods", Leipzig (Germany), January 28–February 1, 2013.

Existence, regularity and symmetry in variational problems: some results and open questions. "Fluids and variational methods", Leipzig (Germany), January 28–February 1, 2013.

Sulla struttura degli insiemi di misura nulla: applicazioni e problemi aperti [On the structure of null sets: applications and open problems]. Plenary lecture at the "XVIII congresso dell'Unione Matematica Italiana" Bari (Italy), September 24–29, 2007.

Structure of null sets in the plane and applications. Invited lecture at the "European congress of mathematics", Stockholm (Sweden), June 27–July 2, 2004.

Un risultato di convergenza variazionale per funzionali di tipo Ginzburg-Landau in dimensione qualunque [A result on variational convergence for functionals of Ginzburg-Landau type in any dimension]. Invited lecture at the "XVI congresso nazionale dell'Unione Matematica Italiana", Naples (Italy), September 13–18, 1999.

Selected publications

[For a complete list of publications and related files follow this link.]

25. G. Alberti, S. Bianchini, L. Caravenna: Eulerian, Lagrangian and broad continuous solutions to a balance law with non convex flux. II. *J. Hyperbolic Differ. Equ.*, 21 (2024), no. 3, 621-657. [MR] [doi]

24. G. Alberti, D. Trevisan, E. Stepanov: Integration of nonsmooth 2-forms: from Young to Itô and Stratonovich. *J. Funct. Anal.*, 286 (2024), no. 2, art. 110212. [MR] [doi]
23. G. Alberti, A. Massaccesi, E. Stepanov: On the geometric structure of currents tangent to smooth distributions. *J. Differential Geom.*, 122 (2022), no. 1, 1-33. [MR] [doi]
22. G. Alberti, H. Bölcskei, C. De Lellis, G. Koliander, E. Riegler: Lossless analog compression. *IEEE Trans. Inform. Theory*, 65 (2019), no. 11, pp. 7480-7513. [MR] [doi]
21. G. Alberti, G. Crippa, A.L. Mazzucato: Loss of regularity for the continuity equation with non-Lipschitz velocity field. *Ann. PDE*, 5 (2019), no. 1, art. 9. [MR] [doi]
20. G. Alberti, G. Crippa, A.L. Mazzucato: Exponential self-similar mixing by incompressible flows. *J. Amer. Math. Soc. (JAMS)*, 32 (2019), no. 2, 445-490. [MR] [doi]
19. G. Alberti, S. Bianchini, L. Caravenna: Eulerian, Lagrangian and Broad continuous solutions to a balance law with non-convex flux. I. *J. Differential Equations*, 261 (2016), no. 8, 4298-4337. [MR] [doi]
18. G. Alberti, A. Marchese: On the differentiability of Lipschitz functions with respect to measures in the Euclidean space. *Geom. Funct. Anal. (GAFA)*, 26 (2016), no. 1, 1-66. [MR] [doi]
17. G. Alberti, G. Crippa, A.L. Mazzucato: Exponential self-similar mixing and loss of regularity for continuity equations. *C. R. Math. Acad. Sci. Paris*, 352 (2014), no. 11, 901-906. [MR] [doi]
16. G. Alberti, S. Bianchini, G. Crippa: A uniqueness result for the continuity equation in two dimensions. *J. Eur. Math. Soc. (JEMS)*, 16 (2014), no. 2, 201-234. [MR] [doi]
15. G. Alberti, S. Bianchini, G. Crippa: Structure of level sets and Sard-type properties of Lipschitz maps. *Ann. Scuola Norm. Sup. Pisa Cl. Sci. (5)*, 12 (2013), no. 4, 863-902. [MR] [doi]
14. G. Alberti, M. Csörnyei, D. Preiss: Differentiability of Lipschitz functions, structure of null sets, and other problems. *Proceedings of the international congress of mathematicians (ICM 2010, held in Hyderabad, India, August 19–27, 2010)*, Volume 3 (invited lectures), pp. 1379-1394. Edited by R. Bhatia et al. Hindustan Book Agency, New Delhi, 2010. [MR] [doi]
13. G. Alberti, R. Choksi, F. Otto: Uniform energy distribution for an isoperimetric problem with long-range interactions. *J. Amer. Math. Soc.*, 22 (2009), no. 2, 569-605. [MR] [doi]
12. G. Alberti, S. Baldo, G. Orlandi: Variational convergence for functionals of Ginzburg-Landau type. *Indiana Univ. Math. J.*, 54 (2005), no. 5, 1411-1472. [MR] [doi]
11. G. Alberti, M. Csörnyei, D. Preiss: Structure of null sets in the plane and applications. *European Congress of Mathematics. Proceedings of the 4th Congress (4ECM) held in Stockholm, June 27–July 2, 2004*, pp. 3-22. Edited by A. Laptev. European Mathematical Society (EMS), Zürich, 2005. [MR] [doi]
10. G. Alberti, S. Baldo, G. Orlandi: Functions with prescribed singularities. *J. Eur. Math. Soc. (JEMS)*, 5 (2003), no. 3, 275-311. [MR] [doi]
9. G. Alberti, G. Bouchitté, G. Dal Maso: The calibration method for the Mumford-Shah functional and free discontinuity problems. *Calc. Var. Partial Differential Equations*, 16 (2003), no. 3, 299-333. [MR] [doi]

8. G. Alberti, L. Ambrosio, X. Cabré: On a long standing conjecture of E. De Giorgi: symmetry in 3D for general nonlinearities and a local minimality property. *Acta Appl. Math.*, 65 (2001), no. 1-3, 9-33. [MR] [doi]
7. G. Alberti, S. Müller: A new approach to variational problems with multiple scales. *Comm. Pure Appl. Math.*, 54 (2001), no. 7, 761-825. [MR] [doi]
6. G. Alberti, G. Bouchitté, P. Seppecher: Phase transition with line-tension effect. *Arch. Rational Mech. Anal.*, 144 (1998), no. 1, 1-46. [MR] [doi]
5. G. Alberti, G. Bellettini: A nonlocal anisotropic model for phase transitions: asymptotic behaviour of rescaled energies. *European J. Appl. Math.*, 9 (1998), no. 3, 261-284. [MR] [doi]
4. G. Alberti, G. Bellettini: A nonlocal anisotropic model for phase transitions. The optimal profile problem. *Math. Ann.*, 310 (1998), no. 3, 527-560. [MR] [doi]
3. G. Alberti: On the structure of singular sets of convex functions. *Calc. Var. Partial Differential Equations*, 2 (1994), no. 1, 17-27. [MR] [doi]
2. G. Alberti: Rank one property for derivatives of functions with bounded variation. *Proc. Roy. Soc. Edinburgh Sect. A*, 123 (1993), no. 2, 239-274. [MR] [doi]
1. G. Alberti: A Lusin type theorem for gradients. *J. Funct. Anal.*, 100 (1991), no. 1, 110-119. [MR] [doi]