Curriculum Vitae

Personal Information

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Positions and cursus

Since 1 June 2020. I am Full Professor (Professore Ordinario) at
Università di Pisa (Pisa, Italy)

2019 – 2020. I was Associate Professor (Professore Associato) at
Università degli Studi di Napoli Federico II (Naples, Italy).

2014 – 2019. I was Assistant Professor (Maître de Conférences) at
Laboratoire Jean Kuntzmann - Université Grenoble Alpes (Grenoble, France).

2014 – 2014. I spent six months as Post-doc in Shape Optimization at Università di Pisa .

2010 – 2013. I was PhD student (Perfezionando) at *Scuola Normale Superiore SNS*, and, since 2012, also at *Laboratoire de Mathématiques LAMA - Université de Savoie*; I discussed on 8 Nov 2013 in Pisa; mention: 70/70 cum Laude; advisors: Giuseppe Buttazzo and Dorin Bucur.

2005 – 2010. I was *Student in Mathematics* at SNS and I graduated with 70/70 cum Laude in 2010; as every SNS student, I was also a student at the University of Pisa:

- 2008 – 2010. Master in Mathematics - Università di Pisa (110/110 cum Laude);
- 2005 – 2008. Bachelor in Mathematics - Università di Pisa (110/110 cum Laude).

Honors and awards

2020. *Book Prize UMI* for the lecture notes *Regularity of the one-phase free boundaries.*
2019. P.I. of the project *ERC Starting Grant VAREG*
2015. PEDR - *Prime d'Encadrement Doctoral et de Recherche*
2013. My PhD Thesis *"Existence and Regularity Result for Some Shape Optimization Problems"* was selected for publication in *Edizioni della Normale* (n.19, Springer 2015, ISBN 978-88-7642-526-4).

PhD students

Filippo Paiano (since 2023; Università di Pisa);
Matteo Carducci (since 2023; Scuola Normale Superiore);
Lorenzo Ferreri (since 2022; Scuola Normale Superiore);
François Générau (2017-2020; Université Grenoble Alpes); co-supervised with Edouard Oudet;
Baptiste Trey (2016-2020; Université Grenoble Alpes); co-supervised with Emmanuel Russ.

Post-docs

Carlo Gasparetto (1 April 2023 -);
Luca Benatti (1 Feb 2023 – 31 Jan 2024; co-supervised with Alessandra Pluda);
Giulia Bevilacqua (1 Sept 2022 -);
Roberto Ognibene (1 Feb 2022 -);
Joseph Feneuil (1 Sept 2021 – 9 July 2022);
Giorgio Tortone (1 March 2021 -).

Selected results

Logarithmic epiperimetric inequalities for the obstacle and the thin-obstacle problems.

[CSV1] M. Colombo, L. Spolaor, B. Velichkov. *A logarithmic epiperimetric inequality for the obstacle problem.* **Geom. Funct. Anal.** 28 (4) (2018), 1029–1061.

[CSV2] M. Colombo, L. Spolaor, B. Velichkov. *Direct epiperimetric inequalities for the thin obstacle problem and applications.* **Comm. Pure. Appl. Math.** 73 (2) (2020), 384–420.

Regularity theory for two-phase free boundary problems.

[SV] L. Spolaor, B. Velichkov. *An epiperimetric inequality for the regularity of some free boundary problems: the* 2*-dimensional case.* **Comm. Pure. Appl. Math.** 72 (2) (2018), 375–421.

[DSV1] G. De Philippis, L. Spolaor, B. Velichkov. *Regularity of the free boundary for the two-phase Bernoulli problem.* **Invent. Math.** 225 (2021), 347–394.

[DSV2] G. De Philippis, L. Spolaor, B. Velichkov. *(Quasi-)conformal methods in two-dimensional free boundary problems.* **J. Eur. Math. Soc.** (2024), doi: 10.4171/JEMS/1435

Regularity theory for vectorial Bernoulli problems and free boundary systems.

[MTV1] D. Mazzoleni, S. Terracini, B. Velichkov. *Regularity of the optimal sets for some spectral functionals.* **Geom. Funct. Anal.** 27 (2017), 373–426.

[MTV2] D. Mazzoleni, S. Terracini, B. Velichkov. *Regularity of the free boundary for the vectorial Bernoulli problem.* **Anal. PDE** 13 (3) (2020), 741–764.

[MTV3] F. Maiale, G. Tortone, B. Velichkov. *Epsilon-regularity for the solutions of a free boundary system.* **Rev. Mat. Iberoam.** 39 (5) (2023), 1947–1972.

Regularity theory for one-phase free boundary problems.

[FTV] L. Ferreri, G. Tortone, B. Velichkov. *A capillarity one-phase Bernoulli free boundary problem.* **Preprint ArXiv** (2023).

[FV] L. Ferreri, B. Velichkov. *Regularity for one-phase Bernoulli problems with discontinuous weights and applications.* **Trans. Amer. Math. Soc.** (2024), to appear.

[book] B. Velichkov. *Regularity of the one-phase free boundaries.* Lecture notes of the Unione Matematica Italiana, Springer (2023).

[ESV] M. Engelstein, L. Spolaor, B. Velichkov. *Uniqueness of the blow-up at isolated singularities for the Alt-Caffarelli functional.* **Duke Math. J.** 169 (8) (2020), 1541–1601.

Regularity of optimal shapes.

[BMMTV] G.Buttazzo, F. Maiale, D. Mazzoleni, G. Tortone, B. Velichkov. *Regularity of the optimal sets for a class of integral shape functionals.* **Arch. Rat. Mech. Anal.** 248 (2024), to appear.

[MTV4] D. Mazzoleni, B. Trey, B. Velichkov. *Regularity of the optimal sets for the second Dirichlet eigenvalue.* **Ann. Inst. H. Poincaré Anal. Non Linéaire** 39 (3) (2022), 529–573.

[RTV] E. Russ, B. Trey, B. Velichkov. *Existence and regularity of optimal shapes for elliptic operators with drift.* **Calc. Var. PDE** 58, 199 (2019).

[BMPV] D. Bucur, D. Mazzoleni, A. Pratelli, B. Velichkov. *Lipschitz regularity of the eigenfunctions on optimal domains.* **Arch. Rat. Mech. Anal.** 216 (2015), 117–151.

Regularity theory for optimal partition problems.

[OV] R. Ognibene, B. Velichkov. *Boundary regularity of the free interface in spectral optimal partition problems.* **Preprint ArXiv** (2024).

Mini courses

- "Free boundary regularity for the one-phase Bernoulli problem" (6 hours).
  Summer school "Free boundary problems and related topics" (ETH Zürich, 2022).
- "Regularity of the one-phase free boundaries" (6 hours).
  Summer school "Shape optimization, control and inverse problems for PDEs" (Naples, 2019).

Selected talks

- "On the fine structure of the two-phase free boundaries".
  Workshop Partial Differentials Equations (Oberwolfach, 2023).
- "Free boundary clusters with two phases". MSRI Workshop "Regularity Theory for Minimal Surfaces and Mean Curvature Flow" - online (22/3/2022).
- "An epsilon-regularity theorem for the solutions of a vectorial free boundary system".
  Workshop Partial Differentials Equations (Oberwolfach, 2021).
- "Vectorial free boundary problems and regularity of the optimal sets for the eigenvalues of the Dirichlet Laplacian". One world PDE Seminar - online (2/3/2021).
- "Regularity of the two-phase free boundaries".
  Workshop Calculus of Variations (Oberwolfach, 2020).
- "Regularity of the two-phase free boundaries".
  XXX Convegno Nazionale di Calcolo delle Variazioni (Levico Terme, 2020).
- "On the logarithmic epiperimetric inequality".
  Partial Differentials Equations (Oberwolfach, 2019).
- "On the logarithmic epiperimetric inequality".
  XXIX Convegno Nazionale di Calcolo delle Variazioni (Levico Terme, 2019).
- "Approche variationnelle à la régularité des frontières libres singulières".
  Laboratoire Jacques-Louis Lions (05/02/2018).
- "Variational approach to the regularity of the singular free boundaries."
  Seminar at ETH Zürich, 13/03/2018.
- "Recent results on the regularity of the free boundary of the obstacle problem".
  Calculus of Variations at Paris-Diderot (Paris, 2018).
- "Regularity of the free boundaries around isolated singularities".
  Seminar at Université Paris Sud - Orsay, 26/01/2018.
- "Regularity of the optimal sets for spectral functionals".
  Seminar at Max Planck Institut Leipzig, 13/05/2016.
- "Regularity of the optimal sets for spectral functionals".
  Seminar at Universität Zürich, 13/04/2016.

Organization of workshops and conferences

Regularity Theory for Free Boundary and Geometric Variational Problems – one week conferences; 21 speakers per event; 4 editions: 2021 (Levico), 2022 (Pisa), 2023 (Levico), 2024 (Levico); jointly organized with Luca Spolaor.

Calculus of Variations and Free Boundary Problems – one day warkshops; 4-5 speakers;
8 editions: two in 2024 (Pisa); two in 2023 (Pisa); one in 2022 (Pisa), 2019 (Napoli); 2018 (Grenoble); 2017 (Grenoble); a complete list can be found here: http://www.velichkov.it/events.html

Projects

PI of an ERC Starting Grant project (2020-2025). I am PI of the project ERC Starting Grant "VAREG - Variational approach to the regularity of the free boundaries" (project number: 853404; duration: 66 months; volume 1,330 kE; starting date: 1 June 2020; host institution: Università di Pisa; web page: http://www.velichkov.it/vareg.html).

Local Coordinator and Deputy PI of a national PRIN project (2023-2025). I am Deputy PI and Local Coordinator (for Università di Pisa) of the project PRIN 2022 "NO^3 - Nodal Optimization, NOnlinear elliptic equations, NOnlocal geometric problems, with a focus on regularity" financed by MIUR (volume 200kE; duration: 24 months; PI: Nicola Soave).

PI of a local project at University of Pisa (2022-2024). I am PI of the project PRA "GeoDom - Geometric evolution problems and PDEs on variable domains" financed by the University of Pisa (duration: 24 months; volume 50 kE; web page: http://www.velichkov.it/geodom.html).

Local Coordinator of a national ANR project (2018-2019). I was Local Coordinator (for Laboratoire Jean Kuntmann – Université Grenoble Alpes) of the project ANR "ShapO - Shape Optimization" financed by the French National Research Agency - ANR (duration: 48 months; starting date: 10/2018; volume 300 kE; PI: Jimmy Lamboley).

PI of a local project at Université Grenoble Alpes (2015-2016). I was PI of the project "VariForm - Méthodes Variationnelles en Optimisation de Formes" financed by Université Grenoble Alpes (duration: 24 months; volume 15 kE).

Participation to other national projects. I was member of the projects ANR "Geospec - Geometry and Spectral Optimization" (2016-2020) and ANR "CoMeDiC - Convergent Metrics for Digital Calculus" (2015-2020) financed by the French National Research Agency - ANR.

Selection committees and administration

PhD school in Mathematics (University of Pisa).

Since 11/2022 I am deputy coordinator of the PhD school in Mathematics at the Department of Mathematics, University of Pisa, appointed by the coordinator Roberto Frigerio.

In 2024 I was member (with Carlo Petronio and Cecilia Pagliantini) of the selection committee for the entrance exam of the PhD school in Mathematics for the academic year 2024/2025.

Selection committees at Scuola Normale Superiore.

In Sept 2020 and Sept 2022 I was member of the evaluation committees for the entrance exams (for the 1st and 4th years) at Scuola Normale Superiore respectively for the academic years 2020/2021 (chair: Franco Flandoli) and 2022/2023 (chair: Angelo Vistoli).

Referee of PhD thesis.

2024. Federico Franceschini (ETH Zürich; advisors: Alessio Figalli and Joaquim Serra);

2024. Clara Torres Latorre (Universitat de Barcelona; advisor: Xavier Ros-Oton);

2018. Harish Shrivastava (Università di Pisa; advisor: Giuseppe Buttazzo).

Participation to selection committees for permanent positions.

2022. Call for Associate Professor (Professore Associato) at Università di Torino.

2021. Call for Full Professor (Professore Ordinario) at Università di Pisa.

2021. Call for a Tenure-Track (RTDB) position at Università di Torino.