

Curriculum Vitae

Personal Information

Family name: Velichkov First name: Bozhidar Web page: www.velichkov.it
Date of birth: 3 Feb 1985 e-mail: bozhidar.velichkov@unipi.it

Positions and cursus

Since 1 June 2020 I am Full Professor (Professore Ordinario) at Università di 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. PhD at Scuola Normale Superiore and, since 2012, also at Université de Savoie with advisors Giuseppe Buttazzo and Dorin Bucur; discussion: 8 Nov 2013 in Pisa, 70/70 cum Laude.

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).
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Honors and awards

2025. ERC Consolidator Grant

2024. Fubini Prize 2024.

2020. Book Prize UMI for my book “*Regularity of the one-phase free boundaries*” (Springer, 2023).

2019. ERC Starting Grant.

2013. My PhD Thesis “*Existence and Regularity Result for Some Shape Optimization Problems*” was selected for publication in Edizioni della Normale (Springer, 2015).

PhD students

Nuno Carneiro (since 2025; Università di Pisa);

Maria Antonietta Palladino (since 2024; Scuola Normale Superiore);

Federico Lai (since 2024; Università di Pisa);

Filippo Paiano (since 2023; Università di Pisa);

Matteo Carducci (since 2023; Scuola Normale Superiore);

Lorenzo Ferreri (2022-2026; Scuola Normale Superiore);

François Générault (2017-2020; Université Grenoble Alpes); co-supervised with Edouard Oudet;

Baptiste Trey (2016-2020; Université Grenoble Alpes); co-supervised with Emmanuel Russ.

Post-docs

Giulia Bevilacqua (1 Sept 2022 – 31 Jan 2026);

Carlo Gasparetto (1 April 2023 – 30 April 2025);

Luca Benatti (1 Feb 2023 – 31 Jan 2024; co-supervised with Alessandra Pluda);

Roberto Ognibene (1 Feb 2022 – 31 March 2025);

Joseph Feneuil (1 Sept 2021 – 9 July 2022);

Giorgio Tortone (1 March 2021 – 28 Feb 2025).

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 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.** 37 (11) (2024).

[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 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.** (27) (2025).

[FSV] L. Ferreri, L. Spolaor, B. Velichkov. *Fine structure of the two-phase Bernoulli free boundaries in 2D*. Preprint ArXiv (2026).

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 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.** (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.

[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

[OV2] R. Ognibene, B. Velichkov. *Structure of the free interfaces near triple junction singularities in harmonic maps and optimal partition problems*. **Arch. Rat. Mech. Anal.** 250 (2026).

[OV1] R. Ognibene, B. Velichkov. *Boundary regularity of the free interface in spectral optimal partition problems*. Preprint ArXiv 2024.

Free boundary minimal surfaces

[BSV] G. Bevilacqua, S. Stuvard, B. Velichkov. *Classical solutions to the soap film capillarity problem for plane boundaries*. **Math. Ann.** 392 (2025), 4607–4659.

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

- "Structure of the two-phase free boundaries in 2D"
Workshop Calculus of Variations (Oberwolfach, 2026).
- "Regularity up to the boundary for optimal partition problems"
Workshop Calculus of Variations (Oberwolfach, 2024).
- "On the fine structure of the two-phase free boundaries"
Workshop Partial Differential 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 Differential Equations (Oberwolfach, 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 isoperimetric inequality."
Partial Differential Equations (Oberwolfach, 2019).
- "On the logarithmic isoperimetric 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. Séminaire Parisien d'Optimisation, 6/10/2014.

Organization of workshops and conferences

Regularity Theory for Free Boundary and Geometric Variational Problems – one week conferences; 21 speakers per event; 5 editions: 2021 (Levico), 2022 (Pisa), 2023 (Levico), 2024 (Levico), 2025 (Cervia), 2026 (Cervia); organized with Giulia Bevilacqua, Roberto Ognibene, Luca Spolaor.

Calculus of Variations and Free Boundary Problems – one day workshops; two in 2025 (Pisa); three 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 Consolidator Grant project (2026-2031). PI of the project ERC CoG FiRM *Fine structure and regularity of moving and stationary free interfaces* (project number: 101230705; duration: 60 months; volume 1,714kE; starting date: 1 Feb 2026; host institution: Università di Pisa).

PI of an ERC Starting Grant project (2020-2025). PI of the project ERC StG 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).

Local Coordinator of a national PRIN project (2023-2025). Local Coordinator (for Università di Pisa) of the project PRIN 2022 "NO³ - Nodal Optimization, NOnlinear elliptic equations, NOnlocal geometric problems, with a focus on regularity" (200kE; 24 months; PI: Nicola Soave).

PI of a project at University of Pisa (2022-2024). 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). Local Coordinator (for Laboratoire Jean Kuntzmann – Université Grenoble Alpes) of the project ANR "ShapO - Shape Optimization" financed by the French National Research Agency - ANR (300kE; 48 months; PI: Jimmy Lamboley).

PI of a project at Université Grenoble Alpes (2015-2016). PI of "VariForm - Méthodes Variationnelles en Optimisation de Formes" (Université Grenoble Alpes, 24 months, 15 kE).

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 2025 I was member (with Cecilia Pagliantini and Michele D'Adderio) of the selection committee for the entrance exam of the PhD school in Mathematics for the academic year 2025/2026.

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.

- 2026.** Gabriele Fioravanti (Università di Torino; advisors: Alessandro Audrito and Stefano Vita);
- 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);

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.

List of publications

Preprints (for the complete list check my ArXiv page)

- [P9] F. Paiano, B. Velichkov. An elliptic regularization approach to the Stefan problem. arXiv:2606.00885
- [P8] G. Siclari, B. Velichkov. On a multiphase vectorial Bernoulli free boundary problem. arXiv:2605.19757
- [P7] L. Ferreri, L. Spolaor, B. Velichkov. Fine structure of the two-phase Bernoulli free boundaries in 2D. arXiv:2604.23843.
- [P6] G. Siclari, B. Velichkov. On the blow-up of the vectorial Bernoulli free boundary problem. arXiv:2602.00741
- [P5] L. Ferreri, L. Spolaor, B. Velichkov. Unique continuation for nonlinear variational problems. arXiv:2408.00405.
- [P4] L. Ferreri, L. Spolaor, B. Velichkov. On the boundary branching set of the one-phase problem. arXiv:2407.15230.
- [P3] L. Ferreri, L. Spolaor, B. Velichkov. On the fine structure of the solutions to nonlinear thin two-membrane problems in 2D. arXiv:2405.05799.
- [P2] R. Ognibene, B. Velichkov. Boundary regularity of the free interface in spectral optimal partition problems. arXiv:2404.05698.
- [P1] L. Ferreri, G. Tortone, B. Velichkov. A capillarity one-phase Bernoulli free boundary problem. arXiv:2310.14309.

Journal articles

- [A58] A. Pacati, G. Tortone, B. Velichkov. *Some remarks on singular capillary cones with free boundary.* accepted **J. Geom. Anal.** (2026); arXiv:2502.07697.
- [A57] R. Ognibene, B. Velichkov. Structure of the free interfaces near triple junction singularities in harmonic maps and optimal partition problems. **Arch. Rat. Mech. Anal.** 250, article number 77 (2026); arXiv:2412.00781.
- [A56] M. Carducci, B. Velichkov. *Existence and regularity in the fully nonlinear one-phase free boundary problem.* **SIAM Math. Anal.** 58 (5) (2026); arXiv:2501.12101.
- [A55] C. Gasparetto, F. Paiano, B. Velichkov. *Regularity for free boundary surfaces minimizing degenerate area functionals.* **Calc. Var. PDE** Volume 65, article number 208 (2026); arXiv:2503.02535.
- [A54] G. Tortone, B. Velichkov. *Vectorial Bernoulli problems and free boundary systems.* **La Matematica** Volume 5, article number 16, (2026); special issue for Sandro Salsa.
- [A53] R. Ognibene, B. Velichkov. *A survey on the optimal partition problem.* **La Matematica** Volume 5, article number 6, (2026); special issue for Sandro Salsa.
- [A52] M. Carducci, B. Velichkov. *An isoperimetric inequality for odd frequencies in the thin obstacle problem.* **J. Funct. Anal.** 289, No. 10, Article ID 111115, 31 p. (2025).
- [A51] G. Bevilacqua, S. Stuvard, B. Velichkov. Classical solutions to the soap film capillarity problem for plane boundaries. **Math. Ann.** 392, No. 4, 4607–4659 (2025).
- [A50] L. Ferreri, B. Velichkov. *A one-sided two phase Bernoulli free boundary problem.* **J. Math. Pures Appl.** 195, Article ID 103659, 42 p. (2025).
- [A49] S. Guarino Lo Bianco, D. A. La Manna, B. Velichkov. *Free boundary cluster with Robin condition on the transmission Interface.* **Calc. Var. PDE** 64 (2024), art. 4.

- [A48] L. Ferreri, B. Velichkov. *Regularity for one-phase Bernoulli problems with discontinuous weights and applications*. **Trans. Amer. Math. Soc.** 377 (11) (2024), 7847–7876.
- [A47] D. Mazzoleni, G. Tortone, B. Velichkov. *On the dimension of the singular set in optimization problems with measure constraint*. **J. Conv. Anal.** 31, No. 2, 689–708 (2024) (special issue for Giuseppe Buttazzo).
- [A46] 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), article n. 44.
- [A45] G. De Philippis, L. Spolaor, B. Velichkov. *(Quasi-)conformal methods in two-dimensional free boundary problems*. **J. Eur. Math. Soc.** 27, No. 8, 3369–3406 (2025).
- [A44] N. Edelen, L. Spolaor, B. Velichkov. *The symmetric (log-)epiperimetric inequality and a decay-growth estimate*. **Calc. Var. PDE** 63, No. 1, Paper No. 2, 29 p. (2024).
- [A43] F. Maiale, G. Tortone, B. Velichkov : *Epsilon-regularity for the solutions of a free boundary system*. **Rev. Mat. Iberoam.** 39 (2023), no. 5, 1947–1972.(2023).
- [A42] N. Edelen, L. Spolaor, B. Velichkov : *A strong maximum principle for minimizers of the one-phase Bernoulli problem*. **Indiana Univ. Math. J.** 73 (2024), 1061–1096 (2024) .
- [A41] F. Générault, E. Oudet, B. Velichkov : *Numerical computation of the cut locus via a variational approximation of the distance function*. **ESAIM:M2AN.** 56 (1) (2022), 105–120.
- [A40] F. Générault, E. Oudet, B. Velichkov : *Cut locus on compact manifolds and uniform semiconcavity estimates for a variational inequality*. **Arch. Rat. Mech. Anal.** 246 (2022), 561–602.
- [A39] F. Maiale, G. Tortone, B. Velichkov : *The boundary Harnack principle on optimal domains*. **Annali della Scuola Normale Superiore Cl. Sci** 25 (2024), 127–149.
- [A38] G. Buttazzo, F. Maiale, B. Velichkov : *Shape optimization problems in control form*. **Atti Accad. Naz. Lincei Cl. Sci. Fis. Mat. Natur.** 32 (2021), 413–435.
- [A37] 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.
- [A36] G. De Philippis, L. Spolaor, B. Velichkov : *Regularity of the free boundary for the two-phase Bernoulli problem*. **Invent. Math.** 225 (2021), 347–394.
- [A35] M. Colombo, L. Spolaor, B. Velichkov : *Almost everywhere uniqueness of blow-up limits for the lower dimensional obstacle problem*. **Interfaces and Free Bound.** 23 (2) (2021), 159–167.
- [A34] S. Guarino Lo Bianco, D. A. La Manna, B. Velichkov : *A two-phase problem with Robin conditions on the free boundary*. **Journal de l'École Polytechnique** 8 (2021), 1–25.
- [A33] L. Spolaor, B. Velichkov : *On the logarithmic epiperimetric inequality for the obstacle problem*. **Math. in Engineering** 3 (1) (2021), 1–42. Special issue dedicated to Sandro Salsa.
- [A32] 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.
- [A31] E. Russ, B. Trey, B. Velichkov : *Existence and regularity of optimal shapes for elliptic operators with drift*. **Calc. Var. PDE** 58 (2019).
- [A30] M. Colombo, L. Spolaor, B. Velichkov : *On the asymptotic behavior of the solutions to parabolic variational inequalities*. **J. reine angew. Math.** 768 (2020), 149–182.
- [A29] L. Spolaor, B. Trey, B. Velichkov : *Free boundary regularity for a multiphase shape optimization problem*. **Comm. PDE** 45 (2) (2020), 77–108.
- [A28] D. Mazzoleni, S. Terracini, B. Velichkov : *Regularity of the free boundary for the vectorial Bernoulli problem*. **Anal. PDE** 13 (3) (2020), 741–764.

- [A27] 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.
- [A26] M. Engelstein, L. Spolaor, B. Velichkov : *(Log-)epiperimetric inequality and regularity over smooth cones for almost area-minimizing currents*. **Geometry & Topology** 23 (2019), 513–540.
- [A25] I. Fragalà, B. Velichkov : *Serrin-type theorems for triangles*. **Proc. Amer. Math. Soc.** 147 (2019), 1615–1626.
- [A24] G. Buttazzo, F. Maestre, B. Velichkov : *Optimal potentials for problems with changing sign data*. **J. Optim. Theory Appl.** 178 (3) (2018), 742–762.
- [A23] M. Colombo, L. Spolaor, B. Velichkov : *A logarithmic epiperimetric inequality for the obstacle problem*. **Geom. Funct. Anal.** 28 (4) (2018), 1029–1061.
- [A22] G. Buttazzo, B. Velichkov : *A shape optimal control problem with changing sign data*. **SIAM J. Math. Anal.** 50 (3) (2018), 2608–2627.
- [A21] 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.
- [A20] G. De Philippis, J. Lamboley, M. Pierre, B. Velichkov : *Regularity of minimizers of shape optimization problems involving perimeter*. **J. Math. Pure. Appl.** 109 (2018), 147–181.
- [A19] D. Bucur, I. Fragalà, B. Velichkov, G. Verzini : *On the honeycomb conjecture for a class of minimal convex partitions*. **Trans. Amer. Math. Soc.** 370 (10) (2018), 7149–7179.
- [A18] D. Mazzoleni, S. Terracini, B. Velichkov : *Regularity of the optimal sets for some spectral functionals*. **Geom. Funct. Anal.** 27 (2017), 373–426.
- [A17] A. Massaccesi, E. Oudet, B. Velichkov : *Numerical Calibration of Steiner trees*. **Appl. Math. Optim.** 79 (2019), 69–86.
- [A16] J.C. Bellido, G. Buttazzo, B. Velichkov : *Worst-case shape optimization for the Dirichlet energy*. **Nonlinear Analysis** 153 (2017), 117–129.
- [A15] G. De Philippis, A. Meszaros, F. Santambrogio, B. Velichkov : *BV Estimates in Optimal Transportation and Applications*. **Arch. Rat. Mech. Anal.** 219 (2) (2016), 829–860.
- [A14] D. Bucur, D. Mazzoleni, A. Pratelli, B. Velichkov : *Lipschitz Regularity of the Eigenfunctions on Optimal Domains*. **Arch. Rat. Mech. Anal.** 216 (2015), 117–151.
- [A13] L. Brasco, G. De Philippis, B. Velichkov : *Faber-Krahn inequalities in sharp quantitative form*. **Duke Math. J.** 164 (9) (2015), 1777–1831.
- [A12] G. Buttazzo, E. Oudet, B. Velichkov : *A free boundary problem arising in PDE optimization*. **Calc. Var. PDE** 54 (4) (2015), 3829–3856.
- [A11] B. Bogosel, B. Velichkov : *Multiphase Optimization Problems for Eigenvalues: Qualitative Properties and Numerical Results*. **SIAM J. Numer. Anal.** 54 (1) (2015), 210–241.
- [A10] D. Bucur, B. Velichkov : *A free boundary approach to shape optimisation problems*. **Phil. Trans. R. Soc. A** 373 (2015).
- [A9] G. De Philippis, B. Velichkov : *Existence and regularity of minimizers for some spectral optimization problems with perimeter constraint*. **Appl. Math. Optim.** 69 (2) (2014), 199–231.
- [A8] G. Buttazzo, B. Ruffini, B. Velichkov : *Spectral optimization problems for metric graphs*. **ESAIM: COCV** 20 (1) (2014) 1–22.
- [A7] B. Velichkov : *A Note on the Monotonicity Formula of Caffarelli-Jerison-Kenig*. **Rend. Lincei Mat. Appl.** 25 (2014), 165–189.
- [A6] G. Buttazzo, A. Gerolin, B. Ruffini, B. Velichkov : *Optimal potentials for Schrödinger operators*. **Journal de l'École Polytechnique** 1 (2014), 71–100.

- [A5] D. Bucur, G. Buttazzo, B. Velichkov : *Spectral Optimization Problems for Potentials and Measures*. **SIAM J. Math. Anal.** 46 (4) (2014), 2956–2986.
- [A4] D. Bucur, B. Velichkov : *Multiphase shape optimization problems*. **SIAM J. Control Optim.** 52 (6) (2014), 3556–3591.
- [A3] G. Buttazzo, B. Velichkov : *Some new problems in spectral optimization*. **Banach Center Publications** 101 (2014), 19–35.
- [A2] D. Bucur, G. Buttazzo, B. Velichkov : *Spectral optimization problems with internal constraint*. **Ann. Inst. H. Poincaré Anal. Non Linéaire** 30 (3) (2013), 477–495.
- [A1] G. Buttazzo, B. Velichkov : *Shape optimization problems on metric measure spaces*. **J. Funct. Anal.** 264 (1) (2013), 1–33.

Book chapters

- [B4] G. Buttazzo, B. Velichkov : *Spectral optimization problems for Schrödinger operators*. Shape Optimization and Spectral Theory, De Gruyter (2017), 325–352.
- [B3] G. Buttazzo, B. Velichkov : *The spectral drop problem*. Contemp. Math. **666** (2016), 111–135.
- [B2] G. Buttazzo, M. Van Den Berg, B. Velichkov : *Optimization problems involving the first Dirichlet eigenvalue and the torsional rigidity*. New Trends in Shape Optim., Springer (2015), 19–41.
- [B1] V. Georgiev, B. Velichkov : *Decay estimates for the supercritical 3-D Schrödinger equation with rapidly decreasing potential*. Progr. in Math. **301** (2012), 145–162.

Monographs

- [M2] B. Velichkov : *Regularity of the one-phase free boundaries*. Lecture Notes of the Unione Matematica Italiana - UMILN (volume 28), Springer 2023, ISBN 978-3-031-13237-7.
Open access: <https://link.springer.com/book/10.1007/978-3-031-13238-4>
- [M1] B. Velichkov : *Existence and regularity results for some shape optimization problems*. Edizioni della Normale, Tesi 19, Springer 2015, ISBN 978-88-7642-526-4.

List of seminars and talks at conferences

Mini courses

Bernoulli free boundary systems (6 hours mini-cours - [Link.](#))
School on "Selected topics in Calculus of Variations and PDEs" (Pisa, 2025).

Free boundary regularity for the one-phase Bernoulli problem (6 hours mini-cours - [Link.](#))
Free boundary problems and related topics (ETH - Zürich, 2022).

Regularity of the one-phase free boundaries. (6 hours mini-cours - [Link.](#))
Shape optimization, control and inverse problems for PDEs (Naples, 2019).

Talks at conferences and workshops

Structure of the two-phase free boundaries in 2D.
Workshop Calculus of Variations (Oberwolfach, 2026).

Structure of the two-phase free boundaries in 2D.
Shape Optimization & Spectral Minimal Partitions (Aveiro, Portugal, 2026).

Structure of the two-phase free boundaries in 2D.
(Ir)Regularity @Parma - workshop on the ERC StG project NEW (Parma, 2026).

On the boundary branching set of the one-phase problem.
XXXV Convegno Nazionale di Calcolo delle Variazioni (Riccione, 2025).

Regularity up to the boundary for optimal partition problems.
Workshop Calculus of Variations (Oberwolfach 2024).

Regular and singular one-phase free boundaries.
Geometric Measure Theory and applications 2024 (17–21 June 2024, Cortona).

Optimal partition problems.
50 anni di Calcolo delle Variazioni - workshop in honour of Giuseppe Buttazzo (Pisa 2024).

Regular and singular one-phase free boundaries.
New Trends in Nonlinear PDE's, Physics and Geometry (Granada 2024) [Link.](#)

Regular and singular one-phase free boundaries.
Shape Optimization and Isoperimetric and Functional Inequalities (Levico 2023) [Link.](#)

On the fine structure of the two-phase free boundaries.
Workshop Partial Differential Equations (Oberwolfach 2023) [Link.](#)

On the fine structure of the two-phase free boundaries.
Highlights in Nonlinear Analysis - workshop in honour of Susanna Terracini (Cetraro 2023) [Link.](#)

On the regularity of the optimal shapes for a class of integral functionals.
New Trends in Geometric & Variational PDEs (Trento 2023) [Link](#).

On the regularity of the optimal shapes for a class of integral functionals.
Shape Optimisation and Geometric Spectral Theory (Edinburgh 2022) [Link](#).

On the regularity of the optimal shapes for a class of integral functionals.
IX Partial differential equations, optimal design and numerics (Benasque 2022) [Link](#).

Free boundary clusters with two phases.
Geometric Analysis and PDE on Garda Lake (Gargnano, 2022) [Link](#).

Free boundary clusters with two phases.
MSRI Workshop - Hot Topics:
Regularity Theory for Minimal Surfaces and Mean Curvature Flow (online, 2022). [Link](#).

An epsilon-regularity theorem for a free boundary system.
Geometric Measure Theory and applications (Cortona, 2021). [Link](#).

An epsilon-regularity theorem for a free boundary system.
Workshop Partial Differential Equations (Oberwolfach, 2021). [Link](#).

Regularity of the two-phase free boundaries.
Workshop Calculus of Variations (Oberwolfach, 2020). [Link](#).

Regularity of the two-phase free boundaries.
XXX Convegno Nazionale di Calcolo delle Variazioni (Levico Terme, 2020). [Link](#).

Regularity of the two-phase free boundaries.
Workshop Geometric Measure Theory in Padova (Padova, 2020). [Link](#).

Regularity of the two-phase free boundaries.
Shape optimization, Isoperimetric and Functional Inequalities (Levico Terme, 2019) [Link](#).

On the logarithmic isoperimetric inequality.
Partial Differential Equations (Oberwolfach, 2019) [Link](#).

On the logarithmic isoperimetric inequality.
Brescia - Trento Nonlinear Day III (Trento, 2019). [Link](#).

On the logarithmic isoperimetric inequality.
Analytic and Geometric Aspects of PDEs (Milano, 2019). [Link](#).

On the logarithmic isoperimetric inequality.
XXIX Convegno Nazionale di Calcolo delle Variazioni (Levico Terme, 2019). [Link](#).

Recent results on the regularity of the free boundary of the obstacle problem.
Calculus of Variations at Paris-Diderot (Paris, 2018). [Link](#).

Shape optimization problems for elliptic operators with drift.
Journées Optimisation de Formes et Applications 2 (Pau, 2018). [Link](#).

On the honeycomb conjecture for a class of minimal convex partitions.
Transport problems in Zürich (Zürich, 2017). [Link](#).

An epiperimetric inequality approach to the regularity of the free boundaries.
GMT Shape Optimization and Free Boundaries (SISSA, Trieste, 2016). [Link](#).

Lipschitz regularity for quasi-minimizers and applications to some shape optimization problems.
Calculus of Variations, Geometric Measure Theory, Optimal Transportation: from Theory to Applications (Lyon, 2016). [Link](#).

Regularity of optimal sets for spectral functionals.
Advances in Nonlinear Problems from Material Science and Shape Optimization (Pisa, 2016). [Link](#).

Regularity of optimal sets for spectral functionals.
Bru-To: Bruxelles-Torino PDE's Conference (Torino, 2016). [Link](#).

Reinforcement of an elastic membrane, infinity laplacian and obstacle problems.
Spectral Theory and Shape Optimization Problems for Elliptic PDEs (Milano, 2015). [Link](#).

Tre problemi di ottimizzazione legati al problema dell'ostacolo
Proprietà Analitico-Geometriche di Soluzioni di EDP (Napoli, 2016). [Link](#).

Lipschitz continuity of the eigenfunctions on optimal sets.
Journées EDP Rhone-Alpes-Auvergne 2014 (Ecully, 2014). [Link](#).

Short talks (20-30 min) at conferences and workshops

On the logarithmic epiperimetric inequality.
Conference DEA - Dynamics, Equations and Applications, (Krakow, 2019). [Link](#).

On the logarithmic epiperimetric inequality.
12th ISAAC Congress, (Aveiro, 2019). [Link](#).

Variational approach to the regularity of optimal sets
VII PDE, Optimal Design and Numerics (Benasque, 2017). [Link](#).

An epiperimetric inequality approach to the regularity of the free boundaries.
Shape Optimization and Isoperimetric and Functional Inequalities (CIRM Luminy, 2016). [Link](#).

Regularity of the optimal sets for spectral functionals.
XIII Colloque Franco-Roumain de Mathématiques Appliquées (Iași, 2016). [Link](#).

A free boundary problem arising in PDE optimization.
XXVI Convegno Nazionale di Calcolo delle Variazioni (Levico Terme, 2016). [Link](#).

A free boundary problem arising in PDE optimization.
Shape Optimization and Spectral Geometry (ICMS Edinburgh, 2015). [Link](#).

Lipschitz continuity of the eigenfunctions on optimal sets.
Workshop Shape and topological optimization (RICAM, Linz, 2014). [Link](#).

Shape optimization problems for spectral functionals with perimeter and volume terms.
XXVI Convegno Nazionale di Calcolo delle Variazioni (Levico Terme, 2014). [Link](#).

Multiphase shape optimization problems.
New Trends in Shape Optimization (Erlangen, 2013). [Link](#).

The spectral drop problem.
Partial Differential Equations, Optimal Design and Numerics (Benasque, 2013). [Link](#).

Shape optimization problems with internal constraint.
Shape Optimization Problems and Spectral Theory (CIRM Luminy, 2012). [Link](#).

Shape optimization problems with internal constraint.
XXVI Convegno Nazionale di Calcolo delle Variazioni (Levico Terme, 2012). [Link](#).

Shape Optimization Problems on Metric Measure Spaces.
Geometric Analysis of Sub-Riemannian and Metric Spaces (Pisa, 2011). [Link](#).

Seminars

On the structure of the two-phase free boundaries in dimension two.
SISSA's Analysis seminars, 10/3/2026. [Link](#).

Regularity up to the boundary for optimal partition problems.
Università di Milano, 28/5/2024. [Link](#).

Free boundary clusters with two phases.
Università di Firenze, 29/4/2022. [Link](#).

Vectorial free boundary problems.
Lisbon WADE Seminar - online, 4/3/2021. [Link](#).

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. [Link](#).

Regularity of the two-phase free boundaries.
Sapienza Università di Roma, 28/11/2019.

Regularity of the two-phase free boundaries.
Università di Pisa, 06/11/2019.

Regularity of the free boundaries around isolated singularities.
Università degli studi di Napoli Federico II, 26/03/2018.

Variational approach to the regularity of the singular free boundaries.
ETH Zürich, 13/03/2018.

Regularity of the free boundaries around isolated singularities.
Calcolo delle Variazioni ed Analisi Geometrica, Università di Pisa, 07/02/2018.

Regularity of the free boundaries around isolated singularities.
Université Paris Diderot, 05/02/2018.

Regularity of the free boundaries around isolated singularities.
Université Paris Sud, 26/01/2018.

Variational approach to the regularity of the free boundaries.
Université Aix-Marseille, 26/10/2017.

Regularity of the optimal sets for spectral functionals.
Max Planck Institut Leipzig, 13/05/2016.

Regularity of the optimal sets for spectral functionals.
Universität Zürich, 13/04/2016.

Regularity of the optimal sets for spectral functionals.
Politecnico di Milano, 20/04/2016.

Lipschitz continuity of the eigenfunctions on optimal sets.
Università degli Studi di Torino, 29/10/2014.

Régularité Lipschitz pour les fonctions propres sur ensembles optimaux.
Séminaire Parisien d'Optimisation, 6/10/2014.

Optimal domains for spectral functionals with perimeter and volume penalizations.
Séminaires Analyse Appliquée LATP Marseille, 08/04/2014.

Optimal domains for spectral functionals with perimeter and volume penalizations.
Séminaires LJK - Géométrie - Images - Calcul des Variations, Université de Grenoble, 02/04/2014.

Existence and regularity for some spectral optimization problems with perimeter constraint.
Université de Savoie, 09/11/2012.

Subsolutions of the Dirichlet energy functional. Density estimates and applications.
Università di Pavia, 08/05/2012.

<i>Concentration-compactness principle and shape optimization problems.</i> Calcolo delle Variazioni ed Analisi Geometrica, Università di Pisa, 25/05/2011.
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Teaching: list of courses

2025 - 2026 (108 ore, Università di Pisa).

- "Istituzioni di Analisi Matematica" - CdL Matematica (70 ore, S1);
- "Analisi Superiore A" - CdL Matematica (38 ore, S2).

2024 - 2025 (111 ore, Università di Pisa).

- "Analisi Matematica II" - Ingegneria dell'Energia (61 ore, S1);
- "Equazioni Ellittiche" - CdL Matematica (42 ore, S2);
- "Spazi di Sobolev" - PhD in Mathematics (8 ore, S2).

2023 - 2024 (150 ore, Università di Pisa).

- "Analisi Matematica II" - Ingegneria dell'Energia (60 ore, S1);
- "Spazi di Sobolev" - CdL Matematica (48 ore, S2);
- "Equazioni Ellittiche" - CdL Matematica (42 ore, S2).

2022 - 2023 (120 ore, Università di Pisa).

- "Analisi Matematica II" - Ingegneria dell'Energia (60 ore, S1);
- "Spazi di Sobolev" - CdL Matematica (48 ore, S2);
- "Monotonicity formulas in free boundary and geometric variational problems" - PhD in Mathematics (12 ore, S2).

2021 - 2022 (120 ore, Università di Pisa).

- "Complementi di Analisi Matematica" (Analisi 2) - CdL Fisica (54 ore);
- "Analisi Matematica II" - Ingegneria dell'Energia (30 ore);
- "Calcolo delle Variazioni A" - CdL Matematica (42 ore).

2020 - 2021 (102 ore, Università di Pisa).

- "Analisi Matematica II" - Ingegneria dell'Energia (60 ore);
- "Calcolo delle Variazioni A" - CdL Matematica (42 ore).

2019 - 2020 (120 ore, Università degli Studi di Napoli "Federico II").

- "Analisi Matematica I" - Ingegneria (60 ore, S1);
- "Analisi Matematica II" - Ingegneria (60 ore, S2).

2018 - 2019 (96 ore, Université Grenoble Alpes).

- MAT102 Mathématiques outils pour les sciences e l'ingénierie (96h).

2017 - 2018 (165 ore, Université Grenoble Alpes).

- MAT102 Mathématiques outils pour les sciences e l'ingénierie (165h).

2016 - 2017 (177 ore, Université Grenoble Alpes).

- MAT102 Mathématiques outils pour les sciences e l'ingénierie (132h);
- Introduction aux equations différentielles ordinaires et partielles (45h).

2015 - 2016 (144 ore, Université Grenoble Alpes).

- MAT102 Mathématiques outils pour les sciences e l'ingénierie (66h);
- MAT115 Algèbre, géométrie et calcul infinitésimal pour la physique (33h);
- Introduction aux equations différentielles ordinaires et partielles (45h).

2014 - 2015 (111 ore, Université Grenoble Alpes).

- MAT115 Algèbre, géométrie et calcul infinitésimal pour la physique (66h);
- Introduction aux equations différentielles ordinaires et partielles (45h).

Teaching: supervision of undergraduate and master thesis

- 2024.** Alberto Pacati (Università di Pisa) – Laurea Magistrale in Matematica (master thesis);
2024. Marco Lecci (Università di Pisa) – Laurea Magistrale in Matematica (master thesis);
2024. Andrea Rocca (Università di Pisa) – Laurea Triennale in Matematica (undergraduate thesis);
2023. Filippo Paiano (Università di Pisa) – Laurea Magistrale in Matematica (master thesis)
co-supervised with Joaquim Serra (ETH).