

# Curriculum Vitae

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## Personal information

Date of birth July 29, 1992, Genoa (Italy)

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## Current research area

Geometric analysis, namely questions of geometric flavor studied with analytic methods, using techniques from elliptic PDEs and geometric measure theory.

Specifically, I have been working on the variational construction and regularity theory of unstable minimal submanifolds in codimension higher than one, exploring different energies approximating the area. Less recently, I also worked in sub-Riemannian geometry.

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## Academic appointments

2023 – present **Assistant Professor** at the Department of Decision Sciences of Bocconi University

2020 – 2022 **Courant Instructor/Assistant Professor** at the Courant Institute of Mathematical Sciences (New York University) and **Morawetz Postdoctoral Fellow**

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## Education

2016 – 2020 **PhD**

Zürich Graduate School in Mathematics, ETH Zürich

Dissertation topic: *New min-max frameworks for minimal submanifolds in dimension two or codimension two*

Advisor: Prof. Tristan Rivière (ETH Zürich)

2014 – 2016 **Master Degree in Mathematics**

University of Pisa, 110/110 cum laude

Dissertation topic: *New regularity results for sub-Riemannian geodesics*

Advisors: Prof. Luigi Ambrosio (SNS), Prof. Davide Vittone (University of Padua)

2011 – 2014 **Bachelor Degree in Mathematics**

University of Pisa, 110/110 cum laude

Dissertation topic: *The kissing number of spheres in Euclidean spaces*

Advisor: Prof. Giovanni Alberti (University of Pisa)

2011 – 2016 **Diploma**

Scuola Normale Superiore (SNS)

## Publications, preprints and surveys

Sorted according to date of completion:

- with G. De Philippis: **Michael–Simon inequality for anisotropic energies close to the area**. In preparation.
- with D. Parise and D. Stern: **Convergence of the self-dual  $U(1)$ -Yang–Mills–Higgs gradient flow to Brakke’s  $(n - 2)$ -dimensional motion by mean curvature**. In preparation.
- with G. De Philippis: **Non-degenerate minimal submanifolds as energy concentration sets: a variational approach**. *arXiv preprint* 2205.12389, 2022.
- with D. Stern: **Quantization and non-quantization of energy for higher-dimensional Ginzburg–Landau vortices**. *arXiv preprint* 2204.06491, 2022.
- **Surviving without monotonicity: anisotropic Michael–Simon inequality** (survey). *Oberwolfach Reports: Partial Differential Equations (workshop 2130)*, 2021.
- with D. Parise and D. Stern: **Convergence of the self-dual  $U(1)$ -Yang–Mills–Higgs energies to the  $(n - 2)$ -area functional**. *arXiv preprint* 2103.14615, 2021.
- **The viscosity method for min-max free boundary minimal surfaces**. Accepted in *Archive for Rational Mechanics and Analysis*.
- **Codimension two min-max minimal submanifolds from PDEs** (survey). *Oberwolfach Reports: Partial Differential Equations (workshop 1930)*, 2019.
- with D. Stern: **Minimal submanifolds from the abelian Higgs model**. *Invent. Math.* 223 (2021), 1027–1095. This paper was chosen as the topic of the London Geometric Analysis Reading Seminar for an entire term.
- **Parametrized stationary varifolds and the multiplicity one conjecture** (survey). *Oberwolfach Reports: Calculus of Variations (workshop 1831)*, 2018.
- with T. Rivière: **A proof of the multiplicity one conjecture for min-max minimal surfaces in arbitrary codimension**. *Duke Math J.* 169 (2020), no. 11, 2005–2044.
- with T. Rivière: **The regularity of parametrized integer stationary varifolds in two dimensions**. *Comm. Pure Appl. Math.* 73 (2020), no. 9, 1981–2042.
- with F. Da Lio: **Free boundary minimal surfaces: a nonlocal approach**. *Ann. Sc. Norm. Super. Pisa Cl. Sci. (5) XX* (2020), no. 2, 437–489.
- with R. Monti and D. Vittone: **On tangent cones to length minimizers in Carnot–Carathéodory spaces**. *SIAM J. Control Optim.* 56 (2018), no. 5, 3351–3369.
- with R. Monti and D. Vittone: **Existence of tangent lines to Carnot–Carathéodory geodesics**. *Calc. Var. PDE* 57 (2018), art. 75.

## Invited talks

- November 2023 *Recent advances in geometric analysis*, Marseille (France)
- August 2023 *Summer school in geometric analysis*, Brussels (Belgium)
- July 2023 *Partial Differential Equations*, Oberwolfach (Germany)
- June 2023 *Regularity theory for free boundary and geometric variational problems*, Levico Terme (Italy)
- October 2022 *Geometric analysis seminar at UCSD*, San Diego (United States)
- June 2022 *Geometric analysis and calibrated geometries*, Zürich (Switzerland)
- May 2022 *NCTS International Geometric Measure Theory Seminar (online)*

- May 2022 *Geometric analysis seminar at the University of Chicago*, Chicago (United States)
- April 2022 *PDE seminar at the University of Maryland*, College Park (United States)
- March 2022 *KIT Geometric analysis seminar (online)*, Karlsruhe (Germany)
- January 2022 *Analysis seminar at Johns Hopkins University*, Baltimore (United States)
- January 2022 *Variational aspects of minimal surfaces*, Paris (France)
- September 2021 *Geometry and analysis seminar at Columbia University (online)*, New York (United States)
- July 2021 *Partial Differential Equations (online)*, Oberwolfach (Germany)
- June 2021 *OLGA (Oxford–London Gauge Assembly) 2021 (online)*, London (United Kingdom)
- December 2020 *Analysis seminar at EPFL (online)*, Lausanne (Switzerland)
- December 2020 *Online workshop in Geometric Analysis (online)*, Pisa (Italy)
- December 2020 *Analysis seminar at CIMS – New York University (online)*, New York (United States)
- November 2020 *Geometry seminar at Stanford University (online)*, Stanford (United States)
- July 2020 *International Conference on PDEs and Geometric Analysis at SJTU (online)*, Shanghai (China)
- October 2019 *Analysis seminar at Queen Mary University*, London (United Kingdom)
- July 2019 *Partial Differential Equations*, Oberwolfach (Germany)
- June 2019 *Workshop on Geometric Measure Theory*, Alba di Canazei (Italy)
- March 2019 *Variational approaches to PDE's*, Rome (Italy)
- December 2018 *Workshop in Geometric Analysis*, Paris (France)
- July 2018 *Calculus of Variations*, Oberwolfach (Germany)
- June 2018 *Geometric Measure Theory in Verona*, Verona (Italy)
- April 2018 *Analysis seminar at University of Padua*, Padua (Italy)
- November 2017 *Analysis seminar at ETH Zürich*, Zürich (Switzerland)

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## Teaching

- Spring 2022 Algebra (instructor)
- Fall 2021 Partial Differential Equations (instructor)
- Spring 2021 Analysis (instructor)
- Fall 2020 Harmonic Analysis (instructor)
- Spring 2020 Analysis Aspects of Minimal Surfaces (co-organizer, speaker)
- Spring 2019 Differential Geometry II (teaching assistant)
- Fall 2018 Fourier Analysis in Function Space Theory (teaching assistant)
- Spring 2018 Functional Analysis II (teaching assistant)
- Fall 2017 Functional Analysis I (teaching assistant)
- Spring 2017 Products and Nonlinearities in Function Space Theory (co-organizer, speaker)
- Fall 2016 Functional Analysis I (teaching assistant)

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## Mentoring

- 2021 Shengwei Qiu (master thesis)
- 2021 Tianrui Sheng (summer research project)
- 2019 Michael Egretzberger (semester project)

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## Referee activity

I refereed papers for leading journals in pure mathematics (*Journal of the AMS*, *Calculus of Variations and Partial Differential Equations*, *Journal of the London Mathematical Society*, *Journal of Functional Analysis*, *Advances in Mathematics*)

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## Other informal seminars

- Fall 2021 The Yang–Mills–Higgs energy for  $U(1)$  bundles and codimension two area
- Spring 2020 Lectures on the regularity theory of area-minimizing hypersurfaces
- November 2019 Uhlenbeck compactness and applications to  $SU(2)$  instantons
- November 2019 Inverse mean curvature flow: uniqueness of weak solutions and short time existence
- April 2018 Gunther’s proof of the isometric embedding theorem
- Spring 2018 Lectures on minimal surfaces: existence of infinitely many minimal hypersurfaces in positive Ricci curvature, Gromov’s width, Weyl’s law for minimal hypersurfaces
- Spring 2017 Lectures on the real Hardy space
- November 2015 Immersions of  $S^2$  with prescribed mean curvature
- September 2015 The Cheeger–Gromoll soul theorem
- July 2015 Oseledec’s multiplicative ergodic theorem
- April 2015 Convex integration techniques and counterexamples to Korn’s inequality
- February 2015 Malgrange–Ehrenpreis theorem and Paley–Wiener theorems
- October 2014 The spectral theorem for bounded and unbounded self-adjoint operators
- September 2014 A polynomial version of Van der Waerden’s theorem
- May 2014 The central limit theorem and the monotonicity of entropy

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## Programming languages

C++, Python, LaTeX, HTML, CSS

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## Languages

- Native Italian
- Fluent English
- Basic French, German

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## Honors and awards

- October 2021 Morawetz Postdoctoral Fellowship, « awarded annually to an outstanding Courant Instructor »
- July 2011 Silver medal at the International Mathematical Olympiad, held in Amsterdam, Netherlands
- May 2011 Bronze medal at the Balkan Mathematical Olympiad, held in Iassy, Romania
- May 2011 Gold medal at the Italian Mathematical Olympiad, held in Cesenatico, Italy
- May 2010 Gold medal at the Italian Mathematical Olympiad, held in Cesenatico, Italy