

# Paolo Bonicatto – Curriculum Vitæ

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## Personal Information

DATE OF BIRTH	15/12/1990	PLACE OF BIRTH	Turin (Italy)
NATIONALITY	Italian	CIVIL STATUS	Married

## Current and previous positions

10/2020 - **Research Fellow (Post-Doc)**, University of Warwick (United Kingdom)  
Supervisor: Prof. F. Rindler  
*ERC-funded Project "SINGULARITY – Singularities and Compactness in Nonlinear PDEs"*

10/2017 - 09/2020 **Wissenschaftlicher Mitarbeiter (Post-Doc)**, University of Basel (Switzerland)  
Supervisor: Prof. G. Crippa  
*ERC-funded Project "FLIRT – Fluid Flows and Irregular Transport"*

## Education

10/2014-09/2017 **PhD in Mathematical Analysis, Modelling and Applications**, SISSA, Trieste (Italy)  
Thesis title: *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*  
Supervisor: Prof. S. Bianchini

10/2012-07/2014 **Master Degree in Mathematics**, (110/110 cum laude) SISSA - Università di Trieste (Italy)  
Thesis title: *Renormalization for nearly incompressible BV vector fields*  
Supervisor: Prof. S. Bianchini  
Co-advisor: Dr. N. A. Gusev

10/2009-07/2012 **Bachelor Degree in Mathematics**, (110/110 cum laude), Università di Torino (Italy)  
Thesis title: *Invarianti simplettici per problemi ai limiti lineari* (in italian)  
Supervisor: Prof. A. Capietto

## Awards, scholarships and grants

11/2022 *Oberwolfach Research Fellowship (OWRF)*

11/2021 *Kovalevskaya grant* (to attend ICM 2022 in St. Petersburg)

07/2020 *INdAM-SIMAI-UMI prize* for PhD thesis in Mathematics

12/2017 *Cuozzo prize* (Università di Roma Tor Vergata) for PhD thesis in Mathematics

05/2016 *Marco Reni prize* (Università di Trieste) for Master thesis in Mathematics

09/2014-09/2017 Scholarship for PhD in Mathematical Analysis, Modelling and Applications, SISSA, Trieste

09/2012-07/2014 Scholarship for joint master program SISSA - Università di Trieste

## Publications

### PREPRINTS

- P. BONICATTO, G. DEL NIN, AND F. RINDLER, *Transport of currents and geometric Rademacher-type theorems*. (2022)
- S. BIANCHINI, P. BONICATTO, AND E. MARCONI, *A Lagrangian approach for scalar multi-dimensional conservation laws*. (2017)
- P. BONICATTO, *Lagrangian representations of vector fields with special structure*. (2017)

### PUBLISHED

- A. ARROYO-RABASA AND P. BONICATTO, *A Bourgain–Brezis–Mironescu representation for functions with bounded deformation*, Calc. Var. Partial Differential Equations, 62 (2023)
- A. ARROYO-RABASA, P. BONICATTO, AND G. DEL NIN, *Representation of the total variation as a  $\Gamma$ -limit of BMO-type seminorms*, to appear in Indiana Univ. Math. J., (2022)
- P. BONICATTO, G. CIAMPA, AND G. CRIPPA, *On the advection-diffusion equation with rough coefficients: weak solutions and vanishing viscosity*, J. Math. Pures Appl., 167 (2022), pp. 204–224
- P. BONICATTO, G. DEL NIN, AND E. PASQUALETTO, *Decomposition of integral metric currents*, J. Funct. Anal., 282 (2022)
- P. BONICATTO AND N. A. GUSEV, *On the structure of divergence-free measures in  $\mathbb{R}^2$* , Adv. Calc. Var., 15 (2022), pp. 879–911
- P. BONICATTO AND E. MARCONI, *Regularity estimates for the flow of BV autonomous divergence free vector fields in  $\mathbb{R}^2$* , Comm. Partial Differential Equations, 46 (2021), pp. 2235–2267
- S. BIANCHINI AND P. BONICATTO, *Forward untangling and applications to the uniqueness problem for the continuity equation*, Discrete Contin. Dyn. Syst., 41 (2021), pp. 2739–2776
- S. BIANCHINI AND P. BONICATTO, *A uniqueness result for the decomposition of vector fields in  $\mathbb{R}^d$* , Invent. Math., 220 (2020), pp. 255–393
- P. BONICATTO, E. PASQUALETTO, AND T. RAJALA, *Indecomposable sets of finite perimeter in doubling metric measure spaces*, Calc. Var. Partial Differential Equations, 59 (2020), pp. 39, Paper No. 63
- P. BONICATTO AND N. A. GUSEV, *Non-uniqueness of signed measure-valued solutions to the continuity equation in presence of a unique flow*, Atti Accad. Naz. Lincei Rend. Lincei Mat. Appl., 30 (2019), pp. 511–531
- S. BIANCHINI AND P. BONICATTO, *Failure of the chain rule in the non steady two-dimensional setting*, in Current research in nonlinear analysis, vol. 135 of Springer Optim. Appl., Springer, Cham, (2018), pp. 33–60
- S. BIANCHINI, P. BONICATTO, AND N. A. GUSEV, *Renormalization for autonomous nearly incompressible BV vector fields in two dimensions*, SIAM J. Math. Anal., 48 (2016), pp. 1–33

- PROCEEDINGS
- P. BONICATTO AND N. A. GUSEV, *Weak superposition principle for signed measure-valued solutions of the continuity*. Preprint (2021)
  - S. BIANCHINI AND P. BONICATTO, *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*, in Proceedings of the 17-th Conference on Hyperbolic Problems, 2020
  - P. BONICATTO, *On uniqueness of weak solutions to transport equation with non-smooth velocity field*, in Theory, numerics and applications of hyperbolic problems. I, vol. 236 of Springer Proc. Math. Stat., Springer, Cham, (2018), pp. 191–203
  - S. BIANCHINI, P. BONICATTO, AND E. MARCONI, *Lagrangian representations between linear transport and scalar conservation laws*, in Nonlinear analysis in geometry and applied mathematics. Part 2, vol. 2 of Harv. Univ. Cent. Math. Sci. Appl. Ser. Math., Int. Press, Somerville, MA, (2018), pp. 1–22
  - P. BONICATTO AND N. A. GUSEV, *Superposition principle for the continuity equation in a bounded domain*, J. Phys. Conf. Ser., 990 (2018)

## Long term visits

- 10/2016                    **Steklov Mathematical Institute** (Moscow, Russian Federation)
- 04/2016-05/2016        **CMSA - Harvard University** (Cambridge, MA - United States of America)

## Invited and contributed talks

- 11/2022                    *Transport of currents and geometric Rademacher-type theorems*  
Seminar, **Universität Basel** (Switzerland), upon invitation by G. Crippa
- 09/2022                    *Transport of currents and geometric Rademacher-type theorems*  
Talk, **Another Pisan workshop in Geometric Analysis**, Pisa (Italy)
- 08/2022                    *Decomposition of integral metric currents*  
Talk, **Geometric measure theory and analysis on metric spaces** University of Warwick (United Kingdom)
- 06/2022                    *Representation of the total variation as a  $\Gamma$ -limit of BMO-type seminorms*  
Seminar, **EPFL, Lausanne** (Switzerland), upon invitation by M. Colombo
- 06/2022                    *Moving Currents: on the Lie transport equation and a Rademacher-type theorem*  
Talk, **Ypatia 2022** Rome (Italy)
- 03/2022                    *Representation of the total variation as a  $\Gamma$ -limit of BMO-type seminorms*  
Seminar, **Imperial College London** (United Kingdom), upon invitation by M. Coti Zelati
- 02/2022                    *Moving Currents: on the Lie transport equation and a Rademacher-type theorem*  
Online talk, **Workshop on Harmonic analysis, Singular Integrals and PDEs** HIM Bonn (Germany)
- 01/2022                    *Moving Currents: on the Lie transport equation and a Rademacher-type theorem*  
Online talk, **Transport, Fluids and Mixing** SNS, Pisa (Italy)
- 11/2021                    *Advection-diffusion equations with rough coefficients: weak solutions and vanishing viscosity*  
Online talk, **Convex Integration and Nonlinear PDEs** ICMS Edinburgh (United Kingdom)
- 11/2021                    *An invitation to Regular Lagrangian Flows (Part I & II)*  
Internal seminars, **University of Warwick** (United Kingdom)

- 05/2021 *Decomposition of integral metric currents*  
Online talk, **University of Padova** (Italy), upon invitation by F. Ancona
- 05/2021 *Decomposition of integral metric currents*  
Online talk, **University of Trento** (Italy), upon invitation by A. Marchese
- 10/2020 *Lagrangian representations in linear transport theory*  
Online talk, **University of Warwick** (United Kingdom), upon invitation by D. Bate
- 02/2020 *Uniqueness and non-uniqueness phenomena for the transport equation in  $\mathbb{R}^d$*   
Seminar, **Sapienza Università di Roma** (Italy), upon invitation by A. Malusa
- 09/2019 *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*  
Seminar, **University of Jyväskylä** (Finland), upon invitation by T. Rajala and V. Julin
- 07/2019 *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*  
Talk, **ICIAM 2019** Valencia (Spain)
- 06/2019 *On the Superposition Principle for signed measure-valued solutions to the continuity equation*  
Talk, **MPDSIDA 2019** Moscow (Russian Federation)
- 06/2019 *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*  
Seminar, **Università di Torino** (Italy), upon invitation by A. Capietto
- 05/2019 *On the Superposition Principle for signed measure-valued solutions to the continuity equation*  
Talk, **IperPA2019 XVIII Italian Meeting on Hyperbolic Equations** Palermo (Italy)
- 07/2018 *Untangling of trajectories for non-smooth vector fields and Bressan's Conjecture - Part 3*  
Invited talk, **International Workshop on Hyperbolic and Kinetic Problems** Academia Sinica, Taipei (Taiwan)
- 07/2018 *Untangling of trajectories for non-smooth vector fields and Bressan's Conjecture - Part 2*  
Talk, **12th AIMS Conference on Dynamical Systems, Differential Equations and Applications** Taipei (Taiwan)
- 06/2018 *Untangling of trajectories for non-smooth vector fields and Bressan's Conjecture - Part 1*  
Talk, **XVII International Conference on Hyperbolic Problems** Penn State University (USA)
- 06/2018 *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*  
Seminar, **Universität Aachen** (Germany), upon invitation by M. Westdickenberg
- 06/2018 *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*  
Seminar, **Universität Leipzig** (Germany), upon invitation by L. Székelyhidi Jr.
- 05/2018 *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*  
Seminar, **University of Oxford - Mathematical Center** (United Kingdom), upon invitation by G.-Q. G. Chen and A. Bressan
- 03/2018 *Untangling of trajectories for non-smooth vector fields and Bressan's Compactness Conjecture*  
Seminar, **Universität Zürich** (Switzerland), upon invitation by C. De Lellis
- 09/2017 *A uniqueness result for the decomposition of vector fields in  $\mathbb{R}^d$*   
Talk, **IPERP2017 XVII Italian Meeting on Hyperbolic Equations** Pavia (Italy)
- 10/2016 *Flows of weakly differentiable vector fields*  
Seminar, **Moscow State University (MGU)** (Russian Federation), upon invitation by Oleg G. Smolyanov

- 10/2016     *On uniqueness of weak solutions to transport equation with non-smooth velocity field*  
Talk, **New Trends in Theoretical and Mathematical Physics** Steklov Institute, Moscow (Russian Federation)
- 08/2016     *On uniqueness of weak solutions to transport equation with non-smooth velocity field*  
Talk, **XVI International Conference on Hyperbolic Problems** RWTH, Aachen (Germany)
- 06/2016     *Uniqueness of weak solutions to transport equation with 2D nearly incompressible BV vector field*  
Seminar, **Universität Basel** (Switzerland), upon invitation by G. Crippa

## Conferences and workshops

Organized conferences are marked with a ★

- 2022
- **Another Pisan workshop in Geometric Analysis**, Pisa (Italy)
  - **Geometric measure theory and analysis on metric spaces**, Warwick (United Kingdom)
  - **Ypatia 2022**, Rome (Italy)
  - **Transport, Fluids and Mixing**, Pisa (Italy)
  - **Workshop on Harmonic analysis, Singular Integrals and PDEs**, Bonn (Germany)
- 2021
- **Convex Integration and Nonlinear Partial Differential Equations**, Edinburgh (United Kingdom)
- 2020
- **Winter School: Turbulence in fluids and PDEs**, EPFL Lausanne (Switzerland)
- 2019
- **ICIAM 2019**, Valencia (Spain)
  - ★ **“GMT and PDEs in Basel – A young researchers meeting”**, local organizer
  - **MPDSIDA**, Moscow Institute of Physics and Technology (Russian Federation)
  - **IPERPA2019 XVIII Italian Meeting on Hyperbolic Equations**, Palermo (Italy)
- 2018
- **International Workshop on Hyperbolic and Kinetic Problems: Theory and Applications**, Institute of Mathematics Academia Sinica, Taipei (Taiwan)
  - **The 12th AIMS Conference on Dynamical Systems, Differential Equations and Applications**, Taipei (Taiwan)
  - **XVII International Conference on Hyperbolic Problems**, Penn State University, State College (USA)
- 2017
- **IPERP2017 XVII Italian Meeting on Hyperbolic Equations**, Pavia (Italy)
  - **Workshop “Irregular transport: analysis and applications”**, Basel (Switzerland)

- 2016
  - **New Trends in Theoretical and Mathematical Physics**, Steklov Mathematical Institute of Russian Academy of Sciences, Moscow (Russian Federation)
  - **XVI International Conference on Hyperbolic Problems**, Aachen (Germany)
  - **Admitted to Nonlinear Waves 2016: Summer School**, Institut des Hautes Études Scientifiques, Paris (France)
  - **11th Meeting on Nonlinear Hyperbolic PDEs**, SISSA Trieste (Italy)
  
- 2015
  - **Winter School in Nonlinear function spaces in Mathematics and Physical Sciences**, École Normale Supérieure Lyon (France)
  - **Workshop Analysis in Lyon**, École Normale Supérieure Lyon (France)
  - **16th Italian Meeting on Hyperbolic Equations**, G.S.S.I. L'Aquila (Italy)
  - **XX Congresso dell'Unione Matematica Italiana (UMI)**, Siena (Italy)
  - **Summer school in Transport, Fluids and Mixing**, Levico Terme (Italy)
  - **Mathematical Thermodynamics of complex fluids, Convegno C.I.M.E.**, Cetraro (Italy)
  
- 2014
  - **Admitted (after international selection among 2000+ candidates) to the 2nd Heidelberg Laureate Forum**, Heidelberg (Germany)
  - **Transport microscales and fluids**, G.S.S.I. L'Aquila (Italy)
  - **First Joint ENS-Lyon - SNS School of Mathematics**, Centro De Giorgi - Scuola Normale Superiore Pisa (Italy)
  
- 2013
  - **Two days on Hyperbolic PDEs, Geometric Measure Theory and Optimal Transport**, SISSA Trieste (Italy)
  
- 2010
  - **Admitted to  $\alpha$ -Class project**, Summer school organised by Università di Torino and Politecnico di Torino, (Italy)
  
- 2008
  - **Admitted to (after national selection) 56° Corso di Orientamento**, Scuola Normale Superiore di Pisa (Italy)

## Teaching activity

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|------------------|--|
| Autumn 2022      | <b>Teaching Assistant</b><br>Course MA4M5 “Geometric Measure Theory” (Warwick)                                       |
| Spring 2022      | <b>Teaching Assistant</b><br>Course MA4J0 “Advanced Real Analysis” (Warwick)   |
| Autumn 2018-2019 | <b>Lecturer &amp; Teaching Assistant</b><br>Undergraduate course “Reelle Analysis” (Basel), with E. Marconi          |
| Spring 2018      | <b>Teaching Assistant</b> (in German)<br>Undergraduate course “Proseminar: (Gegen)Beispiele in der Analysis” (Basel) |
| Autumn 2017      | <b>Teaching Assistant</b> (in German)<br>Undergraduate course “Reelle Analysis” (Basel)                              |

## Other activities and skills

- **Referee for several journals, including:**

*Differential Integral Equations*  
*Calc. Var. Partial Differential Equations*  
*Comm. Partial Differential Equations*  
*J. Differential Equations*  
*Arch. Ration. Mech. Anal.*  
*Interfaces Free Bound.*

- **Organization of the Analysis Junior Seminars at SISSA, Trieste**

*Organized 20+ seminars within the SISSA SIAM Chapter, 2017*

- **Communication and linguistic skills**

*Italian* - Native speaker  
*English* - Fluent (FCE, Grade A - 2008)  
*German* - Intermediate (Goethe Zertifikat B1, Ergebnis: 93/100 - 2015)  
*French* - Intermediate (DELF B1, Note Finale: 94,50/100 - 2007)  
*Russian* - Basics

- **IT skills**

$\LaTeX$ ,  $\TeX$  - Proficient  
*Python, JavaScript* - Basics  
*Linux Kernel* - Basics  
*Git* - Basics