

Mauro Bonafini

Curriculum Vitae

General informations

email	mauro.bonafini@univr.it
Nationality	Italian
Languages	Italian (native), English (full professional knowledge, C1)

* Current position

Ricercatore a tempo determinato (RTDA) (04/2022 – now)

University of Verona, Italy

Fixed-term researcher of mathematical analysis (MAT/05), Department of Computer Science, University of Verona

* Education

PhD in Mathematics (11/2015 – 04/2019)

University of Trento, Italy

Final Mark: awarded cum laude

Thesis: *Variational and convex approximations of 1-dimensional optimal networks and hyperbolic obstacle problems*

Advisor: Prof. Giandomenico Orlandi

Keywords: calculus of variations, scientific computing, optimal transportation, irrigation-type problems, convex relaxation, hyperbolic obstacle problems

Master's Degree in Mathematics (10/2012 – 07/2015)

University of Verona, Italy

Final Mark: 110/110 cum laude

Thesis: *A BMO-type Scheme for the Relativistic Hyperbolic Mean Curvature Flow*

Advisor: Prof. Giandomenico Orlandi

Keywords: mean curvature flow, interfacial dynamics, level set method, thresholding method

Bachelor's Degree in Applied Mathematics (10/2009 – 10/2012)

University of Verona, Italy

Final Mark: 110/110 cum laude

Thesis: *Efficient Numerical Methods for Soliton Dynamics of Nonlinear Schroedinger Equations*

Advisor: Prof. Marco Caliari

Keywords: spectral methods, splitting methods, exponential Runge–Kutta methods

* Previous positions

Post-Doctoral Researcher in Mathematics (06/2020 – 03/2022)

Georg-August-Universität Göttingen, Germany

Supervisor: Prof. Bernhard Schmitzer

Postdoc within the *Optimal transport group*

Post-Doctoral Researcher in Mathematics (05/2019 – 05/2020)

Technical University of Munich (TUM), Germany

Supervisors: Prof. Massimo Fornasier and Prof. Bernhard Schmitzer

Postdoc within the DFG Emmy Noether programme *Numerical analysis and extensions for optimal transport*

* Teaching experience

Summary: PhD 30h, master 36h, bachelor 212h, tutoring 48h

2023-24

Lecturer for the PhD course *Multi-agent interaction models, from control to learning across scales* (12h)
Doctoral Programme in Mathematics, University of Trento

Lecturer and course holder, *Mathematical Analysis II* (32h)

Bachelor Degree in Human Centered Medical System Engineering, University of Verona

Lecturer and course holder, *Mathematical Analysis I* (24h)

Bachelor Degree in Human Centered Medical System Engineering, University of Verona

Invited lecture on *Mathematical methods for neutron scattering* (2h)

Giornate Didattiche della Società Italiana di Spettroscopia Neutronica, SISN

2022-23

Lecturer for the PhD course *Multi-agent interaction models, from control to learning across scales* (12h)
Doctoral Programme in Mathematics, University of Trento

Lecturer and course holder, *Mathematical Analysis II* (32h)

Bachelor Degree in Human Centered Medical System Engineering, University of Verona

Lecturer and course holder, *Mathematical Analysis I* (24h)

Bachelor Degree in Human Centered Medical System Engineering, University of Verona

Invited lecture on *Mathematical methods for neutron scattering* (2h)

Giornate Didattiche della Società Italiana di Spettroscopia Neutronica, SISN

2021-22

Lecturer and course holder, *Mathematical Analysis I* (56h)

Bachelor Degree in Human Centered Medical System Engineering, University of Verona

Teaching assistant for *Computational Optimal Transport* (12h)

Institut für Informatik, Georg-August-Universität Göttingen

Invited lecture on *Mathematical methods for neutron scattering* (2h)

Giornate Didattiche della Società Italiana di Spettroscopia Neutronica, SISN

2013-17

Teaching assistant and tutoring at the University of Verona:

Functional Analysis (36h), Master's Degree in Mathematics, 2016-17

Mathematical Analysis II (32h), Bachelor Degree in Computer Science, 2015-16

Numerical Methods for Differential Equations (48h), Bachelor Degree in Applied Mathematics, 2013-15

* Organization of events

2024

Workshop *GAMMA24 - General Advances in Mathematics and Models for Applications*

University of Verona, Italy, 24/06/2024

Organizers: G. Albi, M. Bonafini, F. Cassini, N. Sansonetto

Budget: 2000€

2022-23

Organizer of three seminar courses (12h each) within the master degree in Mathematics at the University of Verona, invited lecturers Prof. Elena Gaburro (numerical methods for hyperbolic equations), Dr. Clément Sarrazin (optimal transport, a guided tour) and Dr. Michele Giuliano Carlino (Galerkin methods for Navier-Stokes equations)

Budget: 1600€ each

* Coordination and participation in research projects

coordination

GNAMPA-INDAM project 2023 *Optimization of networks from the point of view of geometry and analysis*
Budget: 3500€

participation

Collaborator within the ERC-StG ALcHyMiA, project n. 101114995, PI Prof. Elena Gaburro

Former member (postdoc) of the DFG Emmy Noether programme *Numerical analysis and extensions for optimal transport*, PI Prof. Bernhard Schmitzer

Former member (postdoc) of the DFG Project “Shearlet approximation of brittle fracture evolutions” within the SFB Transregio 109 “Discretisation in Geometry and Dynamics”, PI Prof. Massimo Fornasier

Former member of the following GNAMPA-INDAM projects:

- *Applications of the theory of currents to real analysis and optimal transport*, coordinator Prof. Andrea Marchese
- *Geometric measure theoretical approaches to optimal networks*, coordinator Prof. Annalisa Massaccesi
- *Geometric evolution of curves, surfaces and networks*, coordinator Prof. Giandomenico Orlandi

* Research activities

Research visits at *Inria center at the University of Bordeaux*, France (2 weeks, 09/2023 and 01/2024)

Host: Prof. Elena Gaburro

Project: optimization schemes in numerical methods for hyperbolic equations

Visiting scholar at *Department of Mathematics, University of Toronto*, Canada (2+2 weeks, 05/2016 and 08/2018)

Host: Prof. Robert Jerrard

Project: motion of superconducting interfaces and strings

Visiting scholar at *Department of Mathematics, University of Pisa*, Italy (3 months, 10–12/2017)

Hosts: Prof. Édouard Oudet and Prof. Matteo Novaga

Project: optimal 1d structures on surfaces and obstacle problems for the wave equation

Visiting scholar at *Laboratoire Jean Kuntzmann, Université Grenoble Alpes*, France (3 months, 01–04/2017)

Host: Prof. Édouard Oudet

Project: identification of optimal 1d structures in the Euclidean space

* Talks and seminars

Invited talk, *11th Applied Inverse Problems Conference (AIP)*, 09/2023, Göttingen (Germany)

Title: A game-based approach to learn interaction rules for systems of rational agents

Invited talk, *10th International Congress on Industrial and Applied Mathematics (ICIAM)*, 08/2023, Tokyo (Japan)

Title: Game-based learning of interaction rules for rational agents

Invited talk, *Applications of Optimal Transportation in the Natural Sciences*, 02/2021, Oberwolfach (Germany)

Title: Entropic spatially inhomogeneous evolutionary games: fast reaction limit and learnability

Contributed talk, *Gradient Flows and Variational Methods in PDEs*, 11/2019, Ulm (Germany)

Title: A variational scheme for hyperbolic obstacle problems

Invited seminar, *Oberseminar: Optimization and Data Analysis*, 05/2019, Munich (Germany)

Title: A convex approach to the Steiner problem

Invited talk, *From interacting particle systems to kinetic equations*, 11/2018, Verona (Italy)

Title: A convex approach to the Steiner problem

Contributed talk, *Curves and Surfaces 2018*, 07/2018, Arcachon (France)

Title: A convex approach to the (Gilbert-) Steiner problem

Invited talk, *Curves and Networks in Geometric Analysis*, 06/2017, Centro De Giorgi, SNS Pisa (Italy)

Title: Convex relaxation and variational approximation of the (Gilbert-) Steiner problem: theory and numerics

Invited talk, *XXVII National Conference on Calculus of Variations*, 02/2017, Levico Terme (Italy)

Title: Convex relaxation and variational approximation of functionals defined on 1d connected sets

Contributed poster, *Calculus of Variations in Physics and Materials Science*, 02/2016, Würzburg (Germany)

Title: Numerical study of weighted TV functionals and vortex density in Bose-Einstein condensates

* Publications

1. *Hellinger–Kantorovich barycenter between Dirac measures*, with O. Minevich and B. Schmitzer.
ESAIM: Control, Optimisation and Calculus of Variations, vol. 29, p. 19-54 (2023)
DOI: [10.1051/cocv/2022088](https://doi.org/10.1051/cocv/2022088)
2. *Asymptotic analysis of domain decomposition for optimal transport*, with I. Medina and B. Schmitzer.
Numerische Mathematik, vol. 153, p. 451-492 (2023)
DOI: [10.1007/s00211-023-01347-x](https://doi.org/10.1007/s00211-023-01347-x)
3. *Data-driven entropic spatially inhomogeneous evolutionary games*, with M. Fornasier and B. Schmitzer.
European Journal of Applied Mathematics, vol. 34, p. 106-159 (2023)
DOI: [10.1017/S0956792522000043](https://doi.org/10.1017/S0956792522000043)
4. *Weak solutions for nonlinear waves in adhesive phenomena*, with V.P.C. Le.
Annali dell'Università di Ferrara, vol. 68, 223–233 (2022)
DOI: [10.1007/s11565-022-00398-6](https://doi.org/10.1007/s11565-022-00398-6)
5. *Domain decomposition for entropy regularized optimal transport*, with B. Schmitzer.
Numerische Mathematik, vol. 149, p. 819-870 (2022)
DOI: [10.1007/s00211-021-01245-0](https://doi.org/10.1007/s00211-021-01245-0)
6. *Entropic spatially inhomogeneous evolutionary games: fast reaction limit and learnability*, with M. Fornasier and B. Schmitzer.
In collection, Applications of Optimal Transportation in the Natural Sciences (online meeting). p. 515-517, Oberwolfach Reports, Oberwolfach (2021)
DOI: [10.14760/OWR-2021-10](https://doi.org/10.14760/OWR-2021-10)
7. *On the obstacle problem for fractional semilinear wave equations*, with V.P.C. Le, M. Novaga and G. Orlandi.
Nonlinear Analysis vol. 210, p. 112368-112384 (2021)
DOI: [10.1016/j.na.2021.112368](https://doi.org/10.1016/j.na.2021.112368)
8. *Variational approximation of functionals defined on 1-dimensional connected sets in \mathbb{R}^n* , with G. Orlandi and É. Oudet.
Advances in Calculus of Variations, vol. 14, p. 541-553 (2021)
DOI: [10.1515/acv-2019-0031](https://doi.org/10.1515/acv-2019-0031)
9. *A convex approach to the Gilbert–Steiner problem*, with É. Oudet.
Interfaces and Free Boundaries, vol. 22, p. 131-155 (2020)
DOI: [10.4171/IFB/436](https://doi.org/10.4171/IFB/436)
10. *A variational scheme for hyperbolic obstacle problems*, with M. Novaga and G. Orlandi.
Nonlinear Analysis, vol. 188, p. 389-404 (2019)
DOI: [10.1016/j.na.2019.06.008](https://doi.org/10.1016/j.na.2019.06.008)
11. *Variational approximation of functionals defined on 1-dimensional connected sets: the planar case*, with G. Orlandi and É. Oudet.
SIAM Journal on Mathematical Analysis, vol. 50, p. 6307-6332 (2018)
DOI: [10.1137/17M1159452](https://doi.org/10.1137/17M1159452)
12. *Convex relaxation and variational approximation of functionals defined on 1-dimensional connected sets*, with G. Orlandi and É. Oudet.
Rendiconti Lincei-Matematica e Applicazioni, vol. 29, p. 597-606 (2018)
DOI: [10.4171/RLM/823](https://doi.org/10.4171/RLM/823)
13. *Convex relaxation and variational approximation of the Steiner problem: theory and numerics*.
Geometric Flows, vol. 3, p. 19-27 (2018)
DOI: [10.1515/geofl-2018-0003](https://doi.org/10.1515/geofl-2018-0003)

* Book chapters

1. *Minimizing movements for hyperbolic obstacle-type problems and applications* with M. Novaga, V.P.C. Le and G. Orlandi.
In: Parés, C., Castro, M.J., Morales de Luna, T., Muñoz-Ruiz, M.L. (eds) Hyperbolic Problems: Theory, Numerics, Applications. Volume I. HYP 2022. SEMA SIMAI Springer Series, vol 34. Springer, Cham.
DOI: [10.1007/978-3-031-55260-1_10](https://doi.org/10.1007/978-3-031-55260-1_10)

* Other activities

Review activity for SIAM Journal on Optimization (SIOPT), Journal of Machine Learning Research (JMLR), Journal of Optimization Theory and Applications (JOTA), Communications in Contemporary Mathematics (CCM), Mediterranean Journal of Mathematics

Former member of the Selection Committee for the master in *Applied Data Science* at the Georg-August University of Göttingen (2020 – 2022)

* Programming skills

Fast prototyping and testing in various programming languages (Julia, Python, Matlab, Octave, FreeFem++)

Familiarity with the Julia optimization landscape (JuMP, Ipopt, Optim, Gurobi, Mosek, Convex)

General purpose operating systems and programs: Linux, Windows, Git, Latex, Visual Studio Code

Verona, September 23, 2024