



# Elena Bachini

## Curriculum Vitae

### Personal Information

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### Research experience

#### Current and previous positions

from Apr 2023 **Assistant professor - RTDa**  
Dept. of Mathematics "Tullio Levi-Civita", University of Padua, Italy

Apr 2021 - Mar 2023 **Postdoctoral fellowship** at the Institute of Scientific Computing  
Dept. of Mathematics, TU Dresden, Germany

Jul 2020 - Mar 2021 **Postdoctoral fellowship** for the research project "Development of a numerical model for the solution of strongly anisotropic flow and transport equations in porous media"  
Dept. of Geosciences, University of Padua, Italy

Apr - Jun 2020 **Research grant** on the topic "Modelli 2D e 3D di flusso in mezzi porosi con anisotropia"  
Dept. of Geosciences, University of Padua, Italy

#### Education

2020 **Ph.D. in Computational Mathematics.** University of Padua, Italy

2016 **Master's Degree in Mathematics.** University of Padua, Italy  
Feb-Jul 2015. *ERASMUS+ Programme.* Instituto Superior Técnico, Lisbon, Portugal

2013 **Bachelor's Degree in Mathematics.** University of Pisa, Italy

### Awards and fellowships

2023-2026 Fixed-term assistant professorship (RTDa) within the "*RETURN - multi-Risk sciEnce for resilient commUnities undeR a changiNg climate*" project, MUR-PNRR Extended Partnership PE3, funded by EU

2021-2023 Postdoctoral fellowship within the "*Research Unit FOR 3013*", funded by DFG

- 2020-2021 Postdoctoral fellowship within the project *"Progetto di Eccellenza CARIPARO 2017"*, funded by Fondazione CARIPARO
- 2020 Research grant (2 months) at the Dept. of Geosciences, University of Padua, Italy
- 2020 Nomination from the Doctoral School of Mathematical Sciences (UniPD) to the national prize *"con.Science"*
- 2018 Grant for a (6 months) period abroad from *"Fondazione Ing. Aldo Gini"*
- 2016-2019 Doctoral scholarship (3 years), Department of Mathematics, University of Padua, Italy
- 2014 *ERASMUS+ Programme* scholarship for a (1 semester) period abroad

## Teaching, tutoring and supervision

### Teaching and tutoring

- from Mar 2024 *"Calcolo Numerico"*, first cycle degree in Chemical and Materials Engineering, University of Padua. Teaching.
- Nov 2023 *"Mixed and Stabilised Finite Element Method"*, doctoral course in Mathematical Sciences, University of Padua.  
Responsible of the course: Prof. R. Codina (UPC, Spain)
- Apr - Sep 2023 *"Calcolo Numerico"*, first cycle degree in Energy/Mechanical Engineering, University of Padua. Teaching (16h.)
- Oct 2022 - Feb 2023 Research assistance for the course *"Computational Mathematics Project"*, Computational Mathematics (master) curriculum, TU Dresden
- Sep 2020 - Jan 2021 *"Matematica"*, first cycle degree in Agricultural Sciences and Technology, University of Padua. Didattica integrativa (30h.)
- Mar - Sep 2020 *"Calcolo Numerico"*, first cycle degree in Chemical and Materials Engineering, University of Padua. Teaching (48h.)
- Mar- Jun 2020 *"Calcolo Numerico"*, first cycle degree in Computer Science, University of Padua. Didattica integrativa (16h.)
- Oct 2016 - Jan 2017 Tutor for the course *"Analisi Matematica 1"* held by Prof. O. Bernardi, University of Padua
- 17 Oct - 28 Nov 2014 Progetto C.A.M – Crittografia e Aritmetica Modulare.  
Tutor: assistance to the participants during lectures and laboratories, University of Padua

### Supervision

- Co-supervision of 2 Master's degree thesis in Mathematics, University of Padua:
  - L. Favero (2022). "Intrinsic FEM for Vector Laplacian equations"
  - L. Donà (2020). "Bathymetry reconstruction via a time-dependent intrinsic shallow water model"
- Co-supervision of 1 Master's degree thesis in Civil Engineering, University of Padua:
  - M. Zurini (2024). "Modellazione geometricamente intrinseca delle equazioni delle onde lunghe in acque basse e della loro approssimazione diffusiva"

## Publications (\* = corresponding author)

### In preparation

- [pre3] E. Bachini, A. Larese, M. Putti, G. Scovazzi. Including low-dimensional features in 2D surface models. (in preparation)

- [pre2] E. Bachini, M. Camporese, A. Larese, M. Putti. Shallow water equations versus zero-inertia approximation within a geometrically intrinsic framework. (in preparation)
- [pre1] E. Bachini and M. Putti. Convergence analysis of the intrinsic surface finite element method. *arXiv*, 2022.

#### Publications with peer-review process.

- [pub9] E. Bachini, V. Krause, I. Nitschke, A. Voigt\*. Derivation and simulation of a two-phase fluid deformable surface model. *J. Fluid Mech.*, 977:A41, 2023.
- [pub8] E. Bachini, P. Bandner, T. Jankuhn, M. Nestler, S. Praetorius\*, A. Reusken, and A. Voigt. Diffusion of tangential tensor fields: numerical issues and influence of geometric properties. *J. Numer. Math.*, 0(0), 2023.
- [pub7] E. Bachini, V. Krause, A. Voigt\*. The interplay of geometry and coarsening in multicomponent lipid vesicles under the influence of hydrodynamics. *Phys. Fluids*, 35:042102, 2023.
- [pub6] E. Abreu, E. Bachini\*, J. Perez, and M. Putti. A geometrically intrinsic Lagrangian-Eulerian scheme for 2D shallow water equations with variable topography and discontinuous data. *Appl. Math. Comput.*, 443:127776, 2023.
- [pub5] E. Bachini\*, E. Bellizia, M. Putti, A. D’Alpaos, and M. Ghinassi. Two-dimensional model of flow and transport in porous media: linking heterogeneous anisotropy with stratal patterns in meandering tidal channel deposits of the Venice lagoon (Italy). *Environ. Modell. Softw.*, 157:105535, 2022.
- [pub4] E. Bachini\*, G. Manzini, and M. Putti. Arbitrary-order intrinsic virtual element method for elliptic equations on surfaces. *Calcolo*, 58(30), 2021.
- [pub3] E. Bachini\*, M. W. Farthing, and M. Putti. Intrinsic finite element method for advection-diffusion-reaction equations on surfaces. *J. Comp. Phys.*, 424, 2021.
- [pub2] E. Bachini and M. Putti\*. Geometrically intrinsic modeling of shallow water flows. *ESAIM Math. Model. Num. Anal.*, 54(6):2125–2157, 2020.
- [pub1] D. Gomes\* et al. Existence of positive solutions for an approximation of stationary mean-field games. *Involve, a Journal of Mathematics*, 10(3):473–493, 2017.

#### Doctoral thesis

- [phd] E. Bachini. *Numerical methods for Shallow Water Equations on regular surfaces*. PhD thesis, University of Padua, 2019.

## Workshops, schools, conferences, and seminars

### Invited presentations

- 15-19 Jul 2024 (forthcoming) **“SciCADE2024 - International Conference on Scientific Computation and Differential Equations”**, Singapore - invited to a minisymposium session
- 10-12 Jul 2024 (forthcoming) **“GIMC SIMAI YOUNG 2024”**, Napoli, Italy - invited to a minisymposium session
- 16 Jan 2024 **Elite Scientific Computing Program seminars**, University of Bayreuth, Germany - invited presentation
- 11 Jan 2024 **PhD seminar series**, TUM-IAS, Germany - invited presentation
- 10 Jan 2024 **Research seminar**, University of Duisburg-Essen, Germany - invited presentation
- 18-22 Sep 2023 **“YAMC 2023 - Third Conference of Young Applied Mathematicians”**, Siena, Italy - invited to a minisymposium session

- 28 Aug - 1 Sep 2023 **"SIMAI congress"**, Matera, Italy - invited to a minisymposium session
- 19-22 Jun 2023 **"SIAM conference - Mathematical and Computational Issues in the Geosciences"**, Bergen, Norway - invited to a minisymposium session
- 9 Mar 2023 **Numerical Analysis seminar**, KTH, Sweden - invited presentation
- 12-14 Dec 2022 **"POEMS2022 - Polytopal Element Methods in Mathematics and Engineering"**, Milan, Italy - invited to the "Lighting Talks" session
- 25-29 Jul 2022 **"SciCADE2022 - International Conference on Scientific Computation and Differential Equations"**, Reykjavík, Iceland - invited to a minisymposium session
- 11-15 Jul 2022 **"EquaDiff15"**, Brno, Czech Republic - invited to a minisymposium session
- 21-24 Jun 2021 **"SIAM conference - Mathematical and Computational Issues in the Geosciences"**, Milan, Italy - invited to a minisymposium session (online event)
- 18 Jan 2021 **Research seminar**, TU Dresden, Germany - invited presentation (online event)
- 11 Dec 2020 **Seminar series: "Computational Science and Engineering Seminar"**, School of Computing at the University of Leeds, Leeds, UK - invited presentation (online event)
- 11-14 Mar 2019 **"SIAM conference - Mathematical and Computational Issues in the Geosciences"**, Houston (TX), USA - invited in a minisymposium session

#### Contributed talks and posters

- 3-7 Jun 2024 (forthcoming) **"ECCOMAS CONGRESS 2024 - 9<sup>th</sup> European Congress on Computational Methods in Applied Sciences and Engineering"**, Lisbon, Portugal - co-organizer of a minisymposium session
- 4-8 Sep 2023 **"ENUMATH 2023 - European Conference on Numerical Mathematics and Advanced Applications"**, Lisbon, Portugal - co-organizer of a minisymposium session
- 3-5 Jul 2023 **"INTRUSION 2023 - numerical aNalysis, porous media and waTer ResoUrceS: a fruitful cOntamiNation"**, Bari, Italy
- 5-7 Jun 2023 **"COUPLED 2023 - X International Conference on Coupled Problems in Science and Engineering"**, Crete, Greece - co-organizer of a minisymposium session
- 31 May - 1 Jun 2023 **"CATHY Days - International workshop on coupled surface and subsurface flow in hydrology"**, San Vito di Cadore (BL), Italy
- 15-17 Sep 2022 **"Chemnitz Finite Element Symposium 2022"**, Herrsching am Ammersee, Germany
- 23-26 May 2022 **"UMI100-800UniPD"**, Padova, Italy
- 7-9 Mar 2022 **"Workshop - PDEs for surfaces and Interfaces"**, Regensburg, Germany
- 30 Sep - 4 Oct 2019 **"ENUMATH 2019 - European Conference on Numerical Mathematics and Advanced Applications"**, Egmond aan Zee, The Netherlands - co-organizer of a minisymposium session
- 22 May 2019 **Graduate seminars series**, Department of Mathematics, University of Padua, Italy
- 15-17 May 2019 **"IperPA2019 - XVIII Italian Meeting on Hyperbolic Equations"**, Palermo, Italy
- 3-7 Jun 2018 **"Computational Methods in Water Resources XXII"**, Saint-Malo, France
- 3-4 May 2018 **"Seminari Padovani di Analisi Numerica"**, Padova, Italy
- 4-6 Apr 2018 **"International Conference on Terrestrial Systems Research"**, Bonn, Germany
- 11-14 Sep 2017 **"SIAM conference - Mathematical and Computational Issues in the Geosciences"**, Erlangen, Germany
- 6-8 Sep 2017 **"IperPV2017 - XVII Italian Meeting on Hyperbolic Equations"**, Pavia, Italy

- 12-14 Jun 2017 **"Coupled Problems 2017 - VII International Conference on Coupled Problems in Science and Engineering"**, Rhodes Island, Greece
- 28 May - 02 Jun 2017 **"NUMHYP17: Numerical Methods for Hyperbolic Problems"**, Monte Verità, Switzerland
- 26-27 Jan 2017 **"CATHY Days - International workshop on coupled surface and subsurface flow in hydrology"** San Vito di Cadore (BL), Italy
- [Attendance only](#)
- 7-11 Oct 2023 **"PARTICLES 2023 - VIII International Conference on Particle-Based Methods"** (Particle courses and conference), Milan, Italy
- 11-13 Sep 2016 **"4<sup>th</sup> Dolomites Workshop on Constructive Approximation and Applications"**, Alba di Canazei (TN), Italy
- 23 Aug - 10 Sep 2015 **"VSRP - Applied Differential Equations Workshop"**  
King Abdullah University of Science and Technology - Thuwal, Saudi Arabia
- 19-26 Jul 2015 **"European Consortium for Mathematics in Industry (ECMI) Modelling Week 2015"**, Instituto Superior Técnico - Lisbon, Portugal

## Organizing activities

- Co-organizer of a mini-symposium session at **ECCOMAS 2024** (Lisbon, Portugal, 3-7 Jun 2024 - forthcoming)
- Co-organizer of a mini-symposium session at **ENUMATH 2023** (Lisbon, Portugal, 4-8 Sep 2023)
- Co-organizer of a mini-symposium session at **COUPLED 2023** (Crete, Greece, 5-7 Jun 2023)
- Co-organizer of a mini-symposium session at **ENUMATH 2019** (Egmond aan Zee, The Netherlands, 30 Sep - 04 Oct 2019)

## Mobility and collaborations

### International mobility

- Sep 2018 - Mar 2019 *Visiting PhD student* at "Oden Institute for Computational Engineering and Sciences". University of Texas at Austin, Austin (TX), USA  
Working under the supervision of Prof. C. Dawson in the Computational Hydraulics Group
- 23 Aug - 10 Sep 2015 *VSRP - Applied Differential Equations Workshop*. KAUST, Saudi Arabia  
The workshop included: lectures by KAUST faculty and research scientists, visit to the laboratory facilities, a group research project under the supervision of Prof. D. Gomes and collaborators. The work has been published in a research paper [pub1].
- Feb-Jul 2015 *ERASMUS+ Programme*. IST, Lisbon, Portugal.  
Courses from Master degree in Mathematics and Applications

## International collaborations

- Development of numerical methods adapted to the geometry for PDEs on surfaces: intrinsic surface finite elements methods, high-order virtual elements method, unfitted methods for embedded low-dimensional features.  
COLLABORATORS: Dr. M. W. Farthing (U.S.Army-ERDC), Dr. G. Manzini (IMATI-CNR), Prof. A. Mazzia (UniPD), Prof. M. Putti (UniPD), Prof. G. Scovazzi (Duke Univ.), Prof. A. Voigt (TU Dresden)
- Modeling of Intrinsic Shallow Water Equations (ISWE) on fixed and moving surfaces and development of numerical methods to solve ISWE (finite volumes with Eulerian and Lagrangian-Eulerian approach, discontinuous Galerkin scheme, continuous Galerkin with entropy-viscosity stabilization).  
COLLABORATORS: Prof. E. Abreu (UniCamp), Prof. C. Dawson (UT Austin), Dr. M. W. Farthing (U.S.Army-ERDC), Dr. J. Pérez (ITM), Prof. M. Putti (UniPD)
- Numerical modeling of flow and transport equations in porous media (two and three dimensional cases): study of strong anisotropic cases, coupling of surface and sub-surface processes.  
COLLABORATORS: Dr. E. Bellizia (UniPD), Prof. M. Camporese (UniPD), Dr. M. W. Farthing (U.S.Army-ERDC), Prof. M. Ghinassi (UniPD), Prof. A. Larese (UniPD), Prof. M. Putti (UniPD)
- Vector- and Tensor-valued surface PDEs: numerical methods for surface fluids. Numerical modeling of two-phase flow including curvature effects on stationary and evolving surfaces.  
COLLABORATORS: V. Krause (TU Dresden), Dr. M. Nestler (TU Dresden), Dr. S. Praetorius (TU Dresden), Prof. A. Reusken (RWTH Aachen), P. Schwering (RWTH Aachen), Prof. A. Voigt (TU Dresden)

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## Project participations

- *"RETURN - multi-Risk sciEnce for resilienT commUnities under a changiNg climate"* project, MUR-PNRR Extended Partnership PE5 on Natural Risks Next-Generation EU, 01/10/2021-31/03/2026 (Scientific head A. Larese)
- *"REACT - Digital Twins of Civil StRucturEs And Protection Systems in A ClimAte Change PerspecTive"* project, TUM-IAS (Germany), 01/10/2021-30/09/2024 (PI A. Larese)
- Research Unit *"Vector- and Tensor-Valued Surface PDEs"* (FOR 3013), German Research Foundation - DFG (PI A. Voigt)
- *"NEMESIS - NumErical MEthods for the SImulation of the impact of extreme hazards on Structures and landscape"* project, University of Padua (PI A. Larese)
- *"HYDROSEM: Fluvial and tidal meanders of the Venetian-Po plain: from hydrodynamics to stratigraphy"* project (Progetto di Eccellenza CARIPARO 2017, PI M. Ghinassi)
- UniPD-SID-2016 project *"Approximation and discretization of PDEs on Manifolds for Environmental Modeling"*, University of Padua (PI M. Putti)

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## Institutional responsibilities

Feb-Jul 2024 Member of "Commissione Incaricata di definire i bisogni relativi all'emissione di Bandi a Cascata per Start-up, Spin-Off, Piccole Imprese Innovative", within the Spoke Water VS1, MUR-PNRR RETURN project

- from Apr 2023 Member of the Department Board, Dept. of Mathematics "Tullio Levi-Civita", University of Padua
- from Sep 2023 Member of the Teaching Board for the first cycle degree in Chemical and Materials Engineering, Dept. of Industrial Engineering, University of Padua
- 2017-2018 Representative of the PhD students in the Department Board, Dept. of Mathematics "Tullio Levi-Civita", University of Padua

## Reviewer for

- AIMS Mathematics
- Applied Mathematics and Computation
- BUMI - Bollettino dell'Unione Matematica Italiana
- Communications in Computational Physics
- Computational Geosciences
- ESAIM: Mathematical Modelling and Numerical Analysis
- Journal of Computational Physics
- Mathematical and Computational Applications
- Mathematics and Computers in Simulation

## Scientific societies

- from 2024 Member of AIMETA, member of UMI-SIMAI
- from 2022 Member of "European Women in Mathematics"
- from 2017 Member of the "Gruppo Nazionale Calcolo Scientifico" (GNCS) of the Istituto di Alta Matematica (INdAM)
- 2019-2020 Member of "SIAM Geosciences" and "SIAM Computational Science and Engineering"

## Other activities

- 30 Sep 2023 Dissemination event "Science4All", University of Padua. Activity: "La matematica per comprendere il mondo"

## General skills

- Languages English (Fluent), Italian (Mother tongue)
- Software C++, Fortran (from Fortran 77 to object-oriented Fortran 2008), Matlab, Python, Git, CMake, LaTeX, Unix-based systems

Padova, May 2024

Elena Bachini