

# Carlo Marcati

## Curriculum Vitæ

Dipartimento di Matematica  
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## Employment & Education

- 2022 – ongoing **Ricercatore (RTDa)**, *Department of Mathematics – Università di Pavia, Italy*
- 2019 – 2021 **Lecturer**, *Department of Mathematics – ETH Zürich, Switzerland*
- 2018 – 2021 **Postdoctoral researcher**, *Seminar for Applied Mathematics – ETH Zürich, Switzerland*
- 2020 **Qualification aux fonctions de Maître de Conférences**, France
- 2013 – 2018 **PhD in Mathematics**, *Laboratoire Jacques-Louis Lions – Sorbonne Université, Paris, France*
- 2016 – 2017 **Attaché temporaire d'enseignement et de recherche (ATER)**, *Laboratoire Jacques-Louis Lions – Université Pierre et Marie Curie, Paris, France*
- 2011 – 2013 **MSc in Mathematical Engineering**, *Politecnico di Milano, Milano, Italy*  
Final mark obtained: 110/110 cum Laude.
- 2007 – 2011 **BSc in Mathematical Engineering**, *Politecnico di Milano, Milano, Italy*  
Final mark obtained: 110/110 cum Laude.

## Research activity

### Preprints

- [1] M. FAUSTMANN, C. MARCATI, J. M. MELENK, CH. SCHWAB. *Weighted analytic regularity for the integral fractional Laplacian in polyhedra*. arXiv:2307.11679, 2023
- [2] Y. MADAY, C. MARCATI. *Weighted analyticity of Hartree-Fock eigenfunctions*. Tech. Rep. 2020-59, Seminar for Applied Mathematics, ETH Zürich, Switzerland, 2020

### Journal articles

- [3] Y. HE, C. MARCATI, CH. SCHWAB. *Analytic regularity for the incompressible Navier-Stokes equations in polygons with mixed boundary conditions*. SIAM Journal on Mathematical Analysis 56(2), 2024
- [4] Y. MADAY, C. MARCATI. *Analyticity and hp discontinuous Galerkin approximation of nonlinear Schrödinger eigenproblems*. Mathematical Models and Methods in Applied Sciences 33(13), 2023
- [5] M. FAUSTMANN, C. MARCATI, J. M. MELENK, CH. SCHWAB. *Exponential Convergence of hp FEM for the Integral Fractional Laplacian in Polygons*. SIAM Journal on Numerical Analysis 61(6), 2023
- [6] C. MARCATI, CH. SCHWAB. *Exponential Convergence of Deep Operator Networks for Elliptic Partial Differential Equations*. SIAM Journal on Numerical Analysis 61(3), 2023
- [7] M. FAUSTMANN, C. MARCATI, J. M. MELENK, CH. SCHWAB. *Weighted analytic regularity for the integral fractional Laplacian in polygons*. SIAM Journal on Mathematical Analysis 54(6), 2022
- [8] C. MARCATI, J. A. A. OPSCHOOR, P. C. PETERSEN, CH. SCHWAB. *Exponential ReLU neural network approximation rates for point and edge singularities*. Foundations of Computational Mathematics 23(3), 2023.
- [9] C. MARCATI, CH. SCHWAB, M. RAKHUBA. *Tensor rank bounds for point singularities in  $\mathbb{R}^3$* . Advances in Computational Mathematics 48(3), 2022.
- [10] C. MARCATI, M. RAKHUBA, J. E. M. ULANDER. *Low rank tensor approximation of singularly perturbed partial differential equations in one dimension*. Calcolo, 59(1), 2022.

- [11] A. CHERNOV, C. MARCATI, L. MASCOTTO. *p- and hp- virtual elements for the Stokes problem*. Advances in Computational Mathematics 47(2), 2022.
- [12] D. SCHÖTZAU, C. MARCATI, CH. SCHWAB. *Exponential convergence of mixed hp-DGFEM for the incompressible Navier-Stokes equations in  $\mathbb{R}^2$* . IMA Journal on Numerical Analysis 41(3), 2021
- [13] C. MARCATI, CH. SCHWAB. *Analytic Regularity for the incompressible Navier-Stokes Equations in Polygons*. SIAM Journal on Mathematical Analysis 52(3), 2020.
- [14] Y. MADAY, C. MARCATI. *Regularity and hp discontinuous Galerkin finite element approximation of linear elliptic eigenvalue problems with singular potentials*. Mathematical Models and Methods in Applied Sciences 29(8):1585–1617, 2019.
- [15] P. F. ANTONIETTI, C. MARCATI, I. MAZZIERI, A. QUARTERONI. *High order discontinuous Galerkin methods on simplicial elements for the elastodynamics equation*. Numerical Algorithms 71(1):181–206, 2015.

### Conference proceedings

- [16] B. BAHR, M. FAUSTMANN, C. MARCATI, J. M. MELENK, CH. SCHWAB. *Exponential convergence of hp-FEM for the integral fractional Laplacian in 1D*. Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2020+1, 2023.

### Invited Conference Presentations & Seminar Talks

- March 2024 **94<sup>th</sup> GAMM Annual Meeting**, Session on Uncertainty Quantification (keynote talk), Magdeburg (Germany)
- August 2023 **CS@60**, ETH, Zürich (Switzerland)
- July 2023 **High-Order Finite Element and Isogeometric Methods (HOFEIM) 2023**, Larnaca (Cyprus)
- February 2023 **SIAM Computational Science and Engineering**, Minisymposium on Learning deep neural network and sparse approximations from limited data for high-dimensional problems in CSE, Amsterdam (Netherlands)
- September 2022 **GIMC-SIMAI Young**, Pavia (Italy)
- September 2022 **NuMeth seminar**, Politecnico di Milano, Milano (Italy)
- June 2022 **Synergies between Data Science and PDE Analysis**, Hausdorff Center for Mathematics, Bonn (Germany)
- May 2022 **Numerical methods for compression and learning**, GSSI, L'Aquila (Italy)
- March 2022 **Seminari di Matematica Applicata**, Università di Pavia, Pavia (Italy)
- December 2020 **Accelerated Discovery group meeting**, IBM Research, Zürich (Switzerland)
- April 2020 **CHCLS Machine Learning meeting**, IBM Research, Zürich (Switzerland)
- February 2020 **Mathematisches und Mathematikdidaktisches Kolloquium**, Carl von Ossietzky Universität Oldenburg, Oldenburg (Germany)
- February 2020 **Séminaire d'Analyse Numérique et Calcul Scientifique**, Université de Franche-Comté, Besançon (France)
- November 2019 **Seminar "Numerical Optimization"**, Universität Konstanz, Konstanz (Germany)
- October 2019 **Kick-off meeting of the EMC2 project**, Sorbonne Université, Paris (France)
- June 2019 **Workshop on Mathematical and Numerical Analysis of Electronic Structure Models**, Suzhou (China)
- May 2019 **High-Order Finite Element and Isogeometric Methods (HOFEIM) 2019**, Pavia (Italy)
- September 2018 **Franco-German workshop on mathematical aspects in computational chemistry**, RWTH Aachen (Germany)
- September 2016 **Séminaire d'Analyse numérique de l'IRMAR**, Rennes (France)
- July 2016 **Mathematical and numerical analysis of electronic structure models**, Roscoff (France)

August 2015 **International Conference on Industrial and Applied Mathematics (ICIAM), Minisymposium on Mathematical and Numerical Aspects of Electronic Structure Theory**, Beijing (China)

#### Contributed Conference Presentations

November 2022 **Matematica per l'Intelligenza Artificiale e il Machine Learning**, Torino (Italy)

September 2021 **Swiss Numerics Day 2021**, Lausanne (Switzerland)

May 2021 **SIAM Conference on Mathematical Aspects of Materials Science**, Bilbao (Spain)

September 2019 **9<sup>th</sup> Singular Days**, *Universität Kassel*, Kassel (Germany)

May 2019 **Swiss Numerics Day 2019**, Lugano (Switzerland)

July 2018 **ICOSAHOM 2018**, Imperial College, London (UK)

June 2017 **SMAI 2017**, La Tremblade (France)

June 2016 **Journées Singulières**, Nancy (France)

May 2016 **Congrès d'Analyse Numérique (CANUM)**, Obernai (France)

January 2016 **Adaptive algorithms for computational PDEs**, *Birmingham University*, Birmingham (UK)

#### Internal seminar talks

04/2017, 10/2014 **Journée Interne du Laboratoire Jacques Louis Lions**, UPMC, Paris (France)

May 2015 **PhD students seminar**, *Laboratoire Jacques-Louis Lions (LJLL)*, UPMC, Paris (France)

#### Posters

June 2023 **Mathematical and Scientific Machine Learning**, ICERM, Providence (USA)

January 2020 **Low rank models – Winter School**, Villars-sur-Ollon (Switzerland)

May 2017 **YM60**, Roscoff (France)

April 2015 **Lions-Magenes Days**, *University of Pavia*, Pavia (Italy)

July 2014 **Electronic Structure Theory for Materials and (Bio)molecules**, *UCLA*, Los Angeles (USA)

## Scientific Responsibilities, Fellowships & Grants

### Fellowships & Grants

2024 – 2025 **coPI, International Emerging Actions (CNRS)**, with *G. Dusson (CNRS, Université Bourgogne Franche-Comté)*

2023 – 2025 **Participant in the PRIN 2022 PNRR project P2022NC97R**

2023 – 2025 **Participant in the PRIN 2022 project 202292JW3F**

2013 – 2016 **Allocation doctorale DIM RDM-IdF**

2016 **Projet BOUM, SMAI**

### Seminar & conference organization

March 2024 **Organization of minisymposium on “Operator Surrogates for Uncertainty Quantification”**, *SIAM UQ 2024*, Trieste (Italy), with Ch. Schwab and J. Zech

July 2021 **Organization of minisymposium on “High order, tensor-structured methods and low rank approximation”**, *ICOSAHOM 2020*, Wien (Austria), with M. Rakhuba and Ch. Schwab

2019 – 2020 **Organization of the Graduate Colloquium in Applied Mathematics of ETH and UZH**, *Zurich, Switzerland*

2015 – 2016 **Organization of the PhD students seminar of LJLL**, *Paris, France*

### Refereeing activity

*Referee for* SIAM J. Num. An., Adv. Comp. Math., J. Sci. Comput., Commun. Comput. Phys., Int. J. Numer. Meth. Eng., ESAIM Math. Model. Numer. Anal., J. Comp. Phys., Math. in Eng., ...

Program committee, AAAI-23

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## Theses

- PhD thesis* **Discontinuous  $hp$  finite element methods for elliptic eigenvalue problems with singular potentials – with applications to quantum chemistry**
- Supervisor* Prof. Yvon Maday
- Master thesis* **High order discontinuous Galerkin methods on simplicial elements for the elastodynamics equation**
- Supervisors* Prof. Alfio Quarteroni – Prof. Paola Francesca Antonietti

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## Schools, Internships, Studies Abroad

- January 2020 **Low rank models – Winter School, Villars-sur-Ollon (Switzerland)**
- August 2015 **Hands-on Summer School on Electronic Structure Theory for Materials and (Bio)molecules, UCLA, Los Angeles (USA)**
- June 2013 **12<sup>th</sup> Summer School on Scientific Visualization, CINECA, Milano (Italy)**
- 2012 – 2013 **Research internship, IFOM–IEO campus, Milano (Italy)**  
Analysis of genetic and epigenetic data and models.
- 2009 – 2010 **Erasmus Exchange, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne (Switzerland)**

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## Teaching & Supervision

### PhD Students

- 2023 – ongoing **M. Ghiotto, PhD program in Mathematics, Università di Pavia, with G. Sangalli**

### Master Theses

- ongoing **V. Ridolfo, Master in Mathematics, Università di Pavia**
- 2023 **M. Ghiotto, Master in Mathematics, Università di Pavia, with G. Sangalli**
- 2021 **Y. He, Master in Mathematics, ETH Zürich, with Ch. Schwab**
- 2020 **J. Ulander, Master in Mathematics, ETH Zürich, with M. Rakhuba and Ch. Schwab**

### Teaching

- 2022 – 2024 **Advanced Numerical Methods for PDEs, Lecturer (Master, Università di Pavia)**
- 2021 – 2024 **Complementi di Matematica, Lecturer (Bachelor, Università di Pavia)**
- 2020 – 2021 **Computational methods for quantitative finance, Lecturer (Master/PhD, ETH Zürich)**
- 2019 – 2020 **Numerical Analysis Seminar on Model Order Reduction and Reduced Bases for PDEs, Lecturer (Master, ETH Zürich)**
- 2019 – 2020 **Programming Techniques for Scientific Simulations, Exercise class (Master, ETH Zürich)**
- 2018 – 2020 **Computational methods for quantitative finance, Exercise class & Organization (Master/PhD, ETH Zürich)**
- 2018 **ISCD Summer School 2018: Scientific Trends at the Interfaces Mathematics – Chemistry – High Performance Computing, Tutoring (Roscoff, France)**
- 2015 – 2017 **Approximation numérique des fonctions, Exercise class, computational sessions (Bachelor, UPMC, Paris)**
- 2014 – 2017 **Méthodes numériques pour les équations différentielles, Exercise class, computational sessions (Bachelor, UPMC, Paris)**
- 2014 – 2015 **Eléments de mathématiques, Exercise class (Bachelor, UPMC, Paris)**
- 2011 – 2012 **Tutor for the students of Ingegneria Matematica, Politecnico di Milano**