

# 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. HE, C. MARCATI, CH. SCHWAB. *Analytic regularity for the incompressible Navier-Stokes equations in polygons with mixed boundary conditions*. Tech. Rep. 2021-29, Seminar for Applied Mathematics, ETH Zürich, Switzerland, 2021
- [3] Y. MADAY, C. MARCATI. *Weighted analyticity of Hartree-Fock eigenfunctions*. Tech. Rep. 2020-59, Seminar for Applied Mathematics, ETH Zürich, Switzerland, 2020

#### Journal articles

- [4] Y. MADAY, C. MARCATI. *Analyticity and  $hp$  discontinuous Galerkin approximation of nonlinear Schrödinger eigenproblems*. *Mathematical Models and Methods in Applied Sciences*, in press, 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*, in press, 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] 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

- 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 EMCz 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)

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## Scientific Responsibilities, Fellowships & Grants

### Seminar & conference organization

- 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*

### Fellowships & Grants

- 2013 – 2016 **Allocation doctorale DIM RDM-IdF**
- 2016 **Projet BOUM**, *SMAI*

### Refereeing activity

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

### Thesis Supervision

- 2023 **Master thesis of M. Ghiotto**, *Master in Mathematics, Università di Pavia*
- 2021 **Master thesis of Y. He**, *Master in Mathematics, ETH Zürich*
- 2020 **Master thesis of J. Ulander**, *Master in Mathematics, ETH Zürich*

### Teaching

- 2023 **Advanced Numerical Methods for PDEs**, *Lecturer (Università di Pavia)*
- 2022, 2023 **Complementi di Matematica**, *Lecturer (Università di Pavia)*
- 2021 **Computational methods for quantitative finance**, *Lecturer (ETH Zürich)*
- 2019 **Numerical Analysis Seminar on Model Order Reduction and Reduced Bases for PDEs**, *Lecturer (ETH Zürich)*
- 2019 **Programming Techniques for Scientific Simulations**, *Exercise class (ETH Zürich)*
- 2019, 2020 **Computational methods for quantitative finance**, *Exercise class & Organization (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 (UPMC, Paris)*
- 2014 – 2017 **Méthodes numériques pour les équations différentielles**, *Exercise class, computational sessions (UPMC, Paris)*
- 2014 – 2015 **Eléments de mathématiques**, *Exercise class (UPMC, Paris)*
- 2011 – 2012 **Tutor for the students of Ingegneria Matematica**, *Politecnico di Milano*