Summary CV

Silvano Pitassi

Personal Details

- *Name*: Silvano Pitassi
- *Date of birth*: 27/11/1994
- *Place of birth*: Udine, Italy
- *Nationality*: Italian
- *Current position*: Marie Skłodowska–Curie Postdoctoral Researcher, University of Montpellier
- *Email*: silvano.pitassi@umontpellier.fr

My research activity focuses on the development and application of advanced numerical methods for **electromagnetic field problems**, with particular emphasis on the **rigorous mathematical analysis** of numerical simulation algorithms. More specifically, I develop **polyhedral methods** on general meshes, combining **computational electromagnetics**, **functional analysis**, **computational topology**, and **scientific software**. These methods are designed for reliable simulation on complex geometries and for applications ranging from industrial electromagnetics to emerging multiphysics problems.

Work Experience

- 09/2024 – present: **Marie Skłodowska–Curie Postdoctoral Researcher**
  Institution: University of Montpellier
  Advisor: Daniele A. Di Pietro
  Description: I am the Principal Investigator of the **EffECT** project, funded by the European Union through the Marie Skłodowska–Curie Actions. The project develops advanced Discrete de Rham numerical methods on polyhedral meshes, with applications to electromagnetic simulations and eddy current testing.

- 10/2022 – 08/2024: **Postdoctoral Researcher**
  Institution: INRIA Lille and EDF
  Advisor: Simon Lemaire (INRIA), Jean-Pierre Ducreux and Jérémy Dalphin (EDF)
  Description: My project focused on the design and analysis of non-conforming Hybrid High-Order methods for magnetostatics on domains with general topology, and on their applicability to industrial electromagnetic problems at EDF.

- 02/2022 – 09/2022: **Postdoctoral Researcher**
  Institution: University of Udine
  Advisor: Ruben Specogna
  Description: I contributed to the development of an eddy current numerical solver aimed at minimizing power losses in industrial wireless-charging devices.

Research Funding and Awards

- 2024 – 2026: **Marie Skłodowska–Curie Postdoctoral Fellowship 2023**
  Starting date: 09/2024
  Duration: 2 years
  Project acronym and title: EffECT, "Breaking frontiers of Eddy Current Testing simulations through Discrete de Rham methods"
  Total funding: 195,914 €

- 2023: **Best PhD Thesis Award in Engineering**
  Institution: University of Udine

Research Activity

My research activity focuses on the development of numerical methods for electromagnetic field computation on complex geometries, with particular emphasis on the mathematical analysis of simulation algorithms and on their reliable software implementation. Across different methods and applications, my work has developed along three closely connected research directions. Overall, my profile combines computational electromagnetics, computational topology, and the mathematical analysis of numerical methods, with continuous attention to software development and to applications motivated by real-world engineering problems.

1. Computational electromagnetics and numerical modelling on complex geometries. This research direction started during my PhD and still constitutes the backbone of my scientific activity. It focuses on the development of numerical methods for computational electromagnetics, with particular emphasis on electromagnetic field problems arising in complex industrial geometries. A common feature of this work is the use of polyhedral numerical methods, which provide great geometric flexibility but require dedicated mathematical and algorithmic tools. Within this line, I worked in particular on Mimetic Finite Difference methods and related compatible discretizations, extending them to curved geometries and developing efficient formulations for eddy current problems, including volume integral methods and matrix compression techniques (see Publications [6, 8, 9, 12–15]). These developments led to major computational improvements with respect to standard finite element approaches, making it possible to solve problems with up to one million unknowns on a standard computer. This computational advantage also provided part of the scientific basis for the spin-off company EMC Gems, which I co-founded in 2021 during my PhD.

2. Computational topology for electromagnetic field computation. A second research direction, also initiated during my doctoral work and continued up to the present, concerns the use of computational topology for electromagnetic simulations. This includes the computation of cohomology generators, the construction of vector potentials, and, more generally, the development of efficient topological algorithms required in electromagnetic formulations on domains with non-trivial topology. These questions are fundamental, for instance, in the treatment of loop-star decompositions and in the rigorous handling of topological obstructions in electromagnetic scattering. This line of work is represented by Publications [2, 5, 7, 10, 11, 16]. A constant objective of this activity has been to combine rigorous topological foundations with efficient graph-based or combinatorial algorithms suitable for large-scale simulations.

3. Functional analysis and stability of advanced numerical methods. A more recent direction of my research was developed after moving abroad for my first postdoctoral experience at INRIA Lille, in collaboration with Électricité de France (EDF), and is now continuing within my current Marie Curie project as Principal Investigator. In this phase, I progressively moved toward the theoretical study of advanced high-order polyhedral methods, with particular emphasis on their stability properties and on the functional analysis underlying modern polyhedral discretizations. This includes discrete Poincaré- and Weber-type inequalities, compactness properties, adjoint consistency, and stabilization-free formulations. The corresponding works are represented by Publications [5, 7, 10], together with the most recent publications, preprints, and ongoing works. Throughout this phase, theoretical developments have always been accompanied

by software activity: during my first postdoctoral experience I developed the entire electromagnetics branch of the ParaSkel library, and I am currently contributing to the HArDCore library while maintaining strong links with application-oriented and industrial contexts.

Education

- 2018 – 2021: **Ph.D. in Industrial and Information Engineering**
  Institution: University of Udine
  Thesis: "Topological and geometrical aspects of mimetic numerical schemes"
  Advisor: Ruben Specogna
  Graduation date: 08/06/2022
  Final grade: cum laude

- 2016 – 2018: **M.Sc. in Electronic Engineering**
  Institution: University of Udine
  Thesis: "Novel effective strategies for computing minimal discrete surfaces"
  Advisor: Ruben Specogna
  Graduation date: 22/10/2018
  Final grade: 110/110 cum laude

- 2013 – 2016: **B.Sc. in Electronic Engineering**
  Institution: University of Udine
  Thesis: "Compressed sensing techniques for ECG denoising"
  Advisor: Roberto Rinaldo
  Graduation date: 11/10/2016
  Final grade: 110/110 cum laude

Publications

Submitted articles and preprints

[1] E. Nilsson and S. Pitassi. "Uniformly bounded cochain extensions and uniform Poincaré inequalities". *arXiv preprint* arXiv:2604.04927 (2026).

[2] S. Pitassi. "Generators of $H^1(\Gamma, \partial\Gamma^c)$ with $\partial\Gamma^c \subset \partial\Gamma$ for triangulated surfaces Γ: construction and classification of global loops". *arXiv preprint* arXiv:2504.05124 (2025).

[3] D. A. Di Pietro, J. Droniou, and S. Pitassi. "Conforming lifting and adjoint consistency for the discrete de Rham complex of differential forms". *arXiv preprint* arXiv:2509.21449 (2025).

[4] D. A. Di Pietro, J. Droniou, M. Hanot, and S. Pitassi. "Uniform Poincaré inequalities for the discrete de Rham complex of differential forms". *arXiv preprint* arXiv:2501.16116 (2025).

Journal articles

[5] J. Dalphin, J.P. Ducreux, S. Lemaire, and S. Pitassi. "Hybrid high-order approximations of div-curl systems on domains with general topology". *SIAM Journal on Scientific Computing* 47.5 (2025).

[6] S. Pitassi, F. Trevisan, and R. Specogna. "Treatment of curved faces with the generalized dual complex". *IEEE Transactions on Magnetics* 61 (Early Access) (2025).

[7] S. Lemaire and S. Pitassi. "Discrete Weber inequalities and related Maxwell compactness for hybrid spaces over polyhedral partitions of domains with general topology". *Foundations of Computational Mathematics* 25.9, 1–39 (2024).

[8] S. Pitassi, R. Ghiloni, I. Petretti, F. Trevisan, and R. Specogna. "The curved Mimetic Finite Difference Method: allowing grids with curved faces". *Journal of Computational Physics* 490.112294 (2023).

[9] A. Vacalebre, S. Pitassi, and R. Specogna. "Low-rank compression techniques in integral methods for eddy currents problems". *Computer Physics Communications* 289.108756 (2023).

[10] D. A. Di Pietro, J. Droniou, and S. Pitassi. "Cohomology of the discrete de Rham complex on domains of general topology". *Calcolo* 60.2 (2023).

[11] S. Pitassi, R. Ghiloni, and R. Specogna. "Inverting the discrete curl operator: a novel graph algorithm to find a vector potential of a given vector field". *Journal of Computational Physics* 466.111404 (2022).

[12] M. Passarotto, S. Pitassi, and R. Specogna. "Foundations of volume integral methods for eddy current problems". *Computer Methods in Applied Mechanics and Engineering* 392.114626 (2022).

[13] S. Pitassi, F. Trevisan, and R. Specogna. "Explicit geometric construction of sparse inverse mass matrices for arbitrary tetrahedral grids". *Computer Methods in Applied Mechanics and Engineering* 377.113699 (2021).

[14] S. Pitassi, R. Ghiloni, F. Trevisan, and R. Specogna. "The role of the dual grid in low-order compatible numerical schemes on general meshes". *Journal of Computational Physics* 436.110285 (2021).

[15] S. Pitassi, R. Ghiloni, F. Trevisan, and R. Specogna. "New Magic Formula Demonstration Shows Unexpected Features of Geometrically Defined Matrices for Polyhedral Grids". *IEEE Transactions on Magnetics* 57.6 (2021).

[16] P. Dłotko, B. Kapidani, S. Pitassi, and R. Specogna. "Fake Conductivity or Cohomology: Which to Use When Solving Eddy Current Problems With h-Formulations?". *IEEE Transactions on Magnetics* 55.6 (2019).

Works in preparation

[17] R. Kumar, A. E. Spadotto, and S. Pitassi. "High-order volume integral eddy current formulation on general polyhedral meshes". *In preparation* (2026).

[18] S. Pitassi, A. A. Rodriguez, and F. Rapetti. "A small-simplices framework for explicit potentials and discrete Poincaré–Friedrichs estimates". *In preparation* (2026).

Patents, Technology Transfer, and Industrial Activities

Patents

- M. Passarotto, S. Pitassi, and R. Specogna. "Process for calculating physical quantities of a conductive body, corresponding processing system and computer product". Italian patent IT202100015602A1 (published 15/12/2022), extended PCT WO2022263973A1 (published 22/12/2022), European and US patent pending.

- A. Hoxha, S. Pitassi, and R. Specogna. "Biosensor for tracking of insulating particles". Italian patent (2021).

Technology Transfer and Industrial Activities

- 03/2021 – 03/2025: **Co-founder of EMC Gems S.r.l.**
  Context: University spin-off of the University of Udine, founded on the basis of the results of my PhD research in collaboration with Prof. Ruben Specogna.
  Activity: Development of electromagnetic simulation software for high-tech industrial applications.
  Impact: Technology and knowledge transfer through the development of innovative numerical algorithms, their application to real industrial problems, the commercialization of software solutions, and the creation of training and employment opportunities for students from the University of Udine.

Supervision Activities

- Co-supervision of the M.Sc. research internship of Tom Wozniak in Applied Mathematics, University of Montpellier, on the development of stabilization-free DDR methods.
- Co-supervision of the M.Sc. theses of Antonino Vacalebre and Francesco Campagna in Electronic Engineering, University of Udine.

Languages

- Italian: native language.
- English: full professional proficiency.
- French: full professional proficiency.