

GABRIELE LOLI

PhD in Mathematics

SUMMARY

I am a researcher specialized in numerical analysis and scientific computing. My research focuses on the development of efficient numerical methods for partial differential equations, with particular interests in isogeometric analysis, space-time discretizations, preconditioning techniques, and shape optimization. I apply these methods to challenging problems including heat and wave propagation, flows in porous media, Maxwell's equations, and structural dynamics.

CURRENT POSITION

07/2023 – 06/2026 **Non-tenure track Assistant Professor (RTDa)** Università degli Studi di Pavia
Department of Mathematics

WORK EXPERIENCES

09/2024 **Member of the Admission Committee** Scuola Universitaria Superiore IUSS Pavia
Ordinary Courses at IUSS for the 2024-2025 academic year

07/2023 – 06/2026 **Non-tenure track Assistant Professor (RTDa)** Università degli Studi di Pavia
Department of Mathematics

12/2020 – 06/2023 **Research Assistant** Università degli Studi di Pavia
Department of Mathematics

EDUCATION

2017–2020 **Ph.D. in Mathematics** Università degli Studi di Pavia
Thesis: Efficient solvers for Isogeometric Analysis. Supervisors: Giancarlo Sangalli (Università degli Studi di Pavia) and Annalisa Buffa (EPFL).

2015–2018 **Diploma IUSS di licenza (Eccellente)** Scuola Universitaria Superiore IUSS Pavia
Thesis: Round-off error analysis of the isogeometric method. Supervisor: Giancarlo Sangalli (Università degli Studi di Pavia).

2015–2017 **Master in Mathematics (110/110 cum laude)** Università degli studi di Pavia
Thesis: A Sylvester equation based preconditioner for the isogeometric advection-diffusion problem. Supervisor: Giancarlo Sangalli and Mattia Tani (Università degli Studi di Pavia).

2012–2016 **Diploma IUSS di primo livello (Eccellente)** Scuola Universitaria Superiore IUSS Pavia
Thesis: The isoperimetric inequality for the entropy and its consequences. Supervisor: Giuseppe Toscani (Università degli Studi di Pavia).

2012–2015 **Bachelor Mathematics (110/110)** Università degli studi di Pavia
Thesis: Classical interpolation inequalities. Supervisor: Pierluigi Colli (Università degli Studi di Pavia).

Since 2012 **Fellow of Collegio Ghislieri**
Pavia

VISITING POSITIONS

01/2020–03/2020 **École Polytechnique Fédérale de Lausanne, Institute of Mathematics (EDMA)**
Invited as a visiting PhD Student by Annalisa Buffa.

PROJECTS

Software **XTIgA-Waves** github.com/XTIgA-Waves/XTIgA-Waves.git
Matlab add-on to GeopDEs for Stable Space-Time Isogeometric Wave Equation

PUBLICATIONS

On the computation of the infinity Wasserstein distance and the Wasserstein Projection Problem
G. Auricchio, G. Loli, M. Veneroni. Journal of Computational and Applied Mathematics. 117025 (2025).

Unconditionally stable space-time isogeometric discretization for the wave equation in Hamiltonian formulation
M. Ferrari, S. Fraschini, G. Loli, I. Perugia. Accepted for publication in ESAIM: Mathematical Modelling and Numerical Analysis.

Space-Time Isogeometric Analysis: A Review with Application to Wave Propagation

G. Loli, G. Sangalli. SeMA (2025).

Space-time Isogeometric Analysis of cardiac electrophysiology

P. F. Antonietti, L. Dedè, G. Loli, M. Montardini, G. Sangalli, P. Tesini. Computer Methods in Applied Mechanics and Engineering. Volume 441, 117957 (2025).

An unconditionally stable space-time isogeometric method for the acoustic wave equation

S. Frascini, G. Loli, A. Moiola, G. Sangalli. Computer & Mathematics with Applications. Volume 169, Pages 205-222 (2024).

An Isogeometric Shape Optimization method for groundwater flow in porous media

A. Bressan, G. Loli, S. Manenti, A. Reali, G. Sangalli. Computer & Mathematics with Applications. Volume 162, Pages 104-119 (2024).

High-Order Spline Upwind for Space-Time Isogeometric Analysis

G. Loli, G. Sangalli, P. Tesini. Computer Methods in Applied Mechanics and Engineering. Volume 417, 116408 (2023).

Easy and Efficient preconditioning of the Isogeometric Mass Matrix

G. Loli, G. Sangalli, M. Tani. Computer & Mathematics with Applications. Volume 116, Pages 245-264 (2022).

Explicit high-order generalized- α methods for isogeometric analysis of structural dynamics

P. Behnoudfar, G. Loli, A. Reali, G. Sangalli, V. M. Calo. Computer Methods in Applied Mechanics and Engineering. Volume 389, 114344 (2022).

A projected super-penalty method for the C^1 -coupling of multi-patch isogeometric Kirchhoff plates

L. Coradello, G. Loli, A. Buffa. Computational Mechanics. Volume 67, 4, Pages 1133-1153 (2021).

An efficient solver for space-time isogeometric Galerkin methods for parabolic problems

G. Loli, M. Montardini, G. Sangalli, M. Tani. Computer & Mathematics with Applications. Volume 80, Issue 11, Pages 2586-2603 (2020).

Quadrature Rules in the Isogeometric Galerkin Method: State of the Art and an Introduction to Weighted Quadrature

F. Calabrò, G. Loli, G. Sangalli, M. Tani. Giannelli C. and Speleers H. (eds.) Advanced Methods for Geometric Modeling and Numerical Simulation. Springer International Publishing, pp. 43-55 (2019).

PREPRINTS

Parallelization in time by diagonalization

A. Bressan, A. Kushova, G. Loli, M. Montardini, G. Sangalli, M. Tani. arXiv Preprint. arXiv:2403.07875 (2023).

Isogeometric multi-patch C^1 -mortar coupling for the biharmonic equation

A. Benvenuti, G. Loli, G. Sangalli, T. Takacs. arXiv Preprint. arXiv:2303.07255 (2023).

SCIENTIFIC PRESENTATIONS AT CONFERENCES

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| 25/06/2024 | An isogeometric shape optimization method for the dam problem
"XXVIII Congress of Differential Equations and Applications / XVIII Congress of Applied Mathematics (CEDYA/CMA)", University of the Basque Country, Bilbao, Spain. |
| 23/02/2024 | Isogeometric Shape Optimization method for groundwater flow
"Workshop Spoke 6 - Multiscale modelling & Engineering Applications - Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing", Sapienza Università di Roma, Rome, Italy. |
| 23/08/2023 | An efficient solver for space-time isogeometric Galerkin methods for parabolic problems
"10th International Congress on Industrial and Applied Mathematics – ICIAM 2023 Tokyo" in Tokyo, Japan. |
| 29/09/2022 | Isogeometric multi-patch C^1-mortar coupling for the bilaplace equation
"GIMC SIMAI YOUNG 2022" in Pavia, Italy. |
| 20/09/2019 | Isogeometric Mass Matrix preconditioner
"International Conference on Isogeometric Analysis (IGA 2019)" in Munich, Germany. |
| 10/05/2019 | Space-time isogeometric preconditioners for parabolic problems
"Third Young Numerical Analysts Meeting in Lombardy - TiciNUM 2019" in Pavia, Italy. |

SEMINAR TALKS

- 25/01/2024 **Efficient PDEs solver with Isogeometric Analysis**
Invited talk at "Incontro Annuale dei Ricercatori in Matematica UNIPV", Università degli Studi di Pavia, Pavia, Italy.
- 10/10/2020 **An efficient solver for space-time isogeometric Galerkin methods for parabolic problems**
Informal seminar at Institute of Mathematics (EDMA) of the École Polytechnique Fédérale de Lausanne (EPFL) in Lausanne, Switzerland.
- 20/01/2020 **Preconditioning of the isogeometric mass matrix**
Informal seminar at Institute of Mathematics (EDMA) of the École Polytechnique Fédérale de Lausanne (EPFL) in Lausanne, Switzerland.

TEACHING EXPERIENCE

- 10.2024–01.2025 **Numerical Methods in Engineering Sciences, 6 ECTS** Università degli Studi di Pavia
Professor for Master Degree course in Electrical Engineering, Environmental Engineering, Computer Engineering and Industrial Automation Engineering.
- 10.2023–01.2024 **Numerical Methods in Engineering Sciences, 6 ECTS** Università degli Studi di Pavia
Professor for Master Degree course in Environmental Engineering, Computer Engineering and Industrial Automation Engineering.
- 03.2020–06.2020 **Numerical Analysis, 6 ECTS.** Università degli Studi di Pavia
Teaching assistant for Bachelor Degree course in Mathematics.
- 10.2019–01.2020 **Mathematical Analysis 1, 6 ECTS** Università degli Studi di Pavia
Teaching assistant for Bachelor Degree course in Industrial Engineering.
- 03.2019–06.2019 **Numerical Methods with Computer Laboratory, 6 ECTS** Università degli Studi di Pavia
Teaching assistant for Bachelor Degree course in Chemistry.
- 10.2018–01.2019 **Finite Element Method and Applications, 6 ECTS** Università degli Studi di Pavia
Teaching assistant for Master Degree course in Bioengineering.
- 10.2018–01.2019 **Linear Algebra and Geometry, 6 ECTS** Università degli Studi di Pavia
Tutor for Bachelor Degree course in Civil Engineering.

STUDENT ADVISING

- 2025 **Giovanni Varetto** Master thesis Co-advisor
Title of the Thesis: Preconditioning the mass matrix for isogeometric immersed methods.
- 2021 **Silvia Preda** Master thesis Co-advisor
Title of the Thesis: Modelli di flussi idrici sotterranei.

GRANTS

- 2024 **Winner of the grant "Cassini Senior 2024" (1000,00€)**
Organization of "Fourth Conference of Young Applied Mathematicians in Rome (YAMC-2024)".
- 2024 **Principal investigator of the GNCS-INdAM Project 2024 (4700,00€)**
Sviluppo di metodi numerici innovativi ed efficienti per la risoluzione di PDE.
- 2021–2022 **Finanziamento Giovani Ricercatori GNCS 2021-2022 (1500.00€)**
Funding grant given by GNCS - Gruppo Nazionale per il Calcolo Scientifico (National Group for Scientific Computation) of INdAM - Istituto Nazionale di Alta Matematica (National Institute of High Mathematics) to young researchers.

AWARDS

- 2019 **HOFEIM - Best poster award**
Award for the best poster "An efficient solver for space-time isogeometric Galerkin methods for parabolic problems" given at international workshop "The 8th International Workshop on High-Order Finite Element and Isogeometric Methods (HOFEIM-2019)".

REVIEW ACTIVITY

Mathematical Models and Methods in Applied Sciences

Journal of Scientific Computing

ORGANIZATION OF WORKSHOPS OR CONFERENCES

16-20/09/2024	Fourth Conference of Young Applied Mathematicians in Rome (YAMC-2024) Rome (Ro), Italy	Organizer
18-22/09/2023	Third Conference of Young Applied Mathematicians in Siena (YAMC-2023) Siena (SI), Italy	Organizer
21-23/09/2022	Recent advances in numerical simulation of time-dependent problems Minisimposium 9th GACM Colloquium on Computational Mechanics for Young Scientists from Academia and Industry, Essen, Germany	Co-organizer
18-22/09/2022	Second Conference of Young Applied Mathematicians in Arenzano (YAMC-2022) Arenzano (GE), Italy	Organizer
28-31/05/2019	The 8th International Workshop on High-Order Finite Element and Isogeometric Methods (HOFEIM-2019) Pavia (PV), Italy	Local Organizer

COMPUTER SKILLS

Programming Languages

Python, Matlab, C.

Markup languages

LaTeX.

Operative systems

macOS, Unix, Windows.

Cad softwares

AutoCAD, Catia.

Database management systems

SQL.

Revision-tracking systems

Git.

Other software packages

MS Office Suite.

LANGUAGES

English - Advanced, **French** - Basic, **Italian** - Native