CURRICULUM VITAE

Fabien Lespagnol

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PhD thesis defended on 26 June 2024:
A new numerical method for fluid–structure interaction of slender bodies immersed in three-dimensional flows. PDF

Research area: Theoretical and numerical study of complex fluids.
Keywords: Fluid–structure interaction; Multiphase flows ; Multiscale asymptotic analysis.

Academic positions

2024 –	**Postdoctoral Researcher**, Université de Montpellier (IMAG) & INRIA (ANGUS). **Project**: *Mathematical analysis and numerical simulation of multiscale compressible bubbly flows.* **Advisors:** Matthieu Hillairet et Nicolas Seguin.

Education

2020 – 2024	**PhD thesis in applied mathematics**, joint supervision between INRIA Paris - Sorbonne Université (COMMEDIA) and Politecnico di Milano (MOX), defended 26 June 2024. **Title**: *A new numerical approach for fluid-structure interaction of slender bodies immersed in three-dimensional flows.* **Supervisors:** Miguel A. Fernández and Paolo Zunino. **Co-advisors**: Muriel Boulakia and Céline Grandmont. **Members of the committee:** - Xavier CLAEYS, Sorbonne Université - Astrid DECOENE, Université de Bordeaux (reviewer) - Lucia GASTALDI, Università degli studi di Brescia - Luca FORMAGGIA, Politecnico di Milano - Alexander POPP, Universität der Bundeswehr München (reviewer)
2019 – 2020	**Master MAS (Modélisation Analyse Simulation)**, Sorbonne Université & École Nationale des Ponts et Chaussées.
2016 – 2019	**Engineering school, Mathematical and Computer Engineering**, École Nationale des Ponts et Chaussées.
2014 – 2016	**Classes préparatoires aux Grandes Écoles (CPGE)**, *Lycée Charlemagne*, France (MPSI / MP)

Internships

2020	**INRIA Paris - Sorbonne Université**, COMMEDIA. **Project**: *Mathematical modelling and numerical analysis of a mixed-dimensional formulation for fluid-particle interaction.* **Advisors**: Muriel Boulakia, Miguel A. Fernández, Céline Grandmont and Paolo Zunino.
2019	**Università degli studi di Trento**, Italy. **Project**: *Study and implementation of discontinuous Galerkin (DG) finite element methods on adaptive Cartesian meshes (AMR) for advection–diffusion–reaction problems.* **Advisor**: Michael Dumbser.
2019	**CEA DAM**, Bruyères-le-Châtel. **Project**: *Study and implementation of high order staggered finite-difference schemes for the numerical approximation of the compressible Euler and Navier–Stokes equations.* **Advisor**: Gauthier Dakin.

Publications

International journals

[R1] Fabien Lespagnol, Céline Grandmont, Paolo Zunino, and Miguel A. Fernández. A mixed-dimensional formulation for the simulation of slender structures immersed in an incompressible flow. *Computer Methods in Applied Mechanics and Engineering*, 2024. Journal PDF, HAL PDF.

[R2] Muriel Boulakia, Céline Grandmont, Fabien Lespagnol, and Paolo Zunino. Mathematical and numerical analysis of reduced order interface conditions and augmented finite elements for mixed dimensional problems. *Computers & Mathematics with Applications*, 2024. Journal PDF, HAL PDF.

[R3] Fabien Lespagnol and Gautier Dakin. High order accurate schemes for Euler and Navier–Stokes equations on staggered Cartesian grids. *Journal of Computational Physics*, 2020. Journal PDF, HAL PDF.

Preprints

[P1] Anna Ranno, Francesco Ballarin, Fabien Lespagnol, Paolo Zunino, and Simona Perotto. A fictitious domain formulation based on hierarchical model reduction applied to drug-eluting stents. Research Report PDF, 2026.

[P2] Miguel Angel Fernández, Céline Grandmont, Fabien Lespagnol, and Paolo Zunino. A reduced Lagrange multiplier finite element method for fluid-particle interaction. HAL PDF, 2026.

[P3] Fabien Lespagnol and Matthieu Hillairet. Existence of solutions for an interaction problem between a bubble and a compressible viscous fluid. HAL PDF, 2026.

Thesis

[T1] Fabien Lespagnol. *A new numerical approach for the fluid-structure interaction of slender bodies immersed in three-dimensional flows*. Theses, Sorbonne Université ; Politecnico di Milano, 2024. HAL PDF.

Scientific programming experience

General experience: Scientific programming in Python and C++ applied to the numerical approximation of partial differential equations in fluid mechanics.

- **Finite element libraries:** FEniCS (Python), FreeFEM++ (C++).
- **Associated software and tools:** Gmsh (mesh generation), ParaView (visualization), Git (version control), Maple (symbolic computation).
- **Main contribution:** Development of modules within the C++ software `Felisce` (INRIA COMMEDIA team) for the simulation of 3D–1D fluid–structure interaction problems. These developments include in particular:
  - implementation of projection and interpolation operators between 3D fluid meshes and 1D structure meshes,
  - incorporation of coupling terms in a 3D–1D finite element formulation,
  - development of a contact algorithm for 1D structures.

Conferences

Invited talks

- 38ème séminaire de mécanique des fluides numérique CEA/GAMNI - Édition 2026, Paris, january 2026
- Modeling and mathematical analysis of micro-swimmers in biology – MicroSwim26, Brest, july 2026

Presentation in workshops and minisymposiums

- Final **Workshop** of the ARC Project 20-25 "PDEs in interaction", SPA, Belgique, december 2025
- 11th Coupled Problems, Villassimius (Italie), may 2025 - **Minisymposium**: *Mixed-Dimensional Modeling: Discretizations, Solvers and Multi-Physics Applications II*
- 9th ECCOMAS Congress, Porto (Portugal), juin 2024 - **Minisymposium**: *Mixed-dimensional Models for in-silico Biomechanics*
- ECCOMAS Young Investigators Conference, Porto (Portugal), june 2023
- **Simula's workshop on computational mechanics models on domains of heterogeneous dimensionality**, Split (Croatie), october 2022

- 8th ECCOMAS Congress, Oslo (Norvège), june 2022 - **Minisymposium**: *Mathematical Models and Numerical Methods for Interface-Coupled Multiphysics Problems I*

Talks at local seminars

- Laboratoire de Mathématiques Blaise Pascal, Université de Clermont Auvergne, Séminaire EDPAN, february 2026
- Laboratoire de Mathématiques Jean Leray, Université de Nantes, Séminaire de mathématiques appliquées, january 2026
- Institut Mathématiques de Bordeaux, Séminaire de Calcul Scientifique et Modélisation, january 2025
- Institut Montpellierain Alexander Grothendieck, Université de Montpellier, Séminaire MACS, april 2024

Responsibilities

- **Since November 2025, member of the organizing committee of the** IMAG PhD Seminar. This seminar is held approximately every two weeks and hosts both local and visiting PhD students, with talks of about 45 minutes.
- **Member of the organizing committee of the** Regional PhD Seminar, Université de Montpellier, 28 November 2025. This annual event aims to bring together PhD students and postdoctoral researchers from the Occitanie region. The 2025 edition was held at Université de Montpellier over half a day, gathering around forty participants, with nine talks and a poster session.

Dissemination

- Participation as a jury member for the regional competition (Occitanie) of the French Tournament of Young Mathematicians 2026 (TFJMM 2026), held on Saturday 11 and Sunday 12 April 2026.

Teaching

2025/2026 - S2	*Introduction to Mathematical Modeling in Biology* / Initiation à la modélisation mathématique en biologie (L1), Université de Montpellier, TD: 30H.
2025/2026 - S1	*Mathematics for the Polytech Program* / Mathématiques pour le parcours Polytech (2ème année), Université de Montpellier, TD: 33H.
2024/2025 - S2	*Analyse IV - Function sequences and series* / Analyse IV - suites et séries de fonctions (L2), Université de Montpellier, TD: 39H.
2023/2024 - S1	*Mathematics for Science Studies II* / Mathématiques pour les études scientifiques 2 (L1), Sorbonne Université, TD: 36H.

Langage

French (fluent), English (fluent), Italian (fluent), Spanish (intermediate)