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Jordi Manyer Fuertes

Interests

My research interests lie in the development of **numerical methods and scalable solvers** for the approximation of partial differential equations. I am also interested in the efficient implementation of these methods in **high-performance computing** (HPC) environments, with firm conviction in open-source software development.
My current research focuses on advancing numerical analysis for PDEs through two main avenues: the development of scalable solvers for non-conforming polytopal methods; and the design of robust solvers for multiphysics problems such as the magnetohydrodynamics equations.

Education

2022-2026 **PhD in Mathematics**, *Monash University*, Melbourne
Awarded June 2026. Under the supervision of Prof. Santiago Badia & Dr. Alberto F. Martín.

2019-2020 **Master in Advanced Mathematics and Mathematical Engineering (MAMME), with highest honors**, *UPC*, Barcelona

2014-2019 **Degree in Mathematics**, *CFIS program - UPC*, Barcelona

2014-2019 **Degree in Physics Engineering**, *CFIS program - UPC*, Barcelona

1998-2014 **French S Baccalauréat and Spanish Scientific Bachillerato diplomas with highest honors**, *Lycée Français de Barcelone*, Barcelona

Experience

2026-Now **Research assistant, within the group of Prof. Santiago Badia.**, *Monash University*, Melbourne (Australia)
Scalable solvers for polytopal non-conforming hybrid discretizations of PDEs.

2022-Now **Teaching assistant**, *Monash University*, Melbourne (Australia)

2019-2022 **Researcher at BSC's Nuclear Fusion group, led by Dr. Mervi Mantsinen**, *Barcelona Supercomputing Center (PRACE)*, Barcelona (Spain)
HPC and numerical methods for Nuclear Fusion, within an EUROfusion project.

2020-2022 **Teaching assistant**, *Universitat Politècnica de Catalunya*, Barcelona (Spain)

2019-2020 **Research internship at UPC's LaCàn (Mathematical and Computational Modeling) research group, led by Dr. Irene Arias, as part of my Master Thesis**, *Universitat Politècnica de Catalunya (UPC)*, Barcelona (Spain)
HPC and numerical methods for flexo-electric material optimisation.

2018-2019 **Research internship at Georgia Tech's Numerical Astrophysics group, led by Prof. Deirdre Shoemaker & Prof. Pablo Laguna, as part of my Bachelor Thesis**, *Center for Relativistic Astrophysics, School of Physics, Georgia Institute of Technology*, Atlanta (USA)

Numerical methods for numerical relativity, and simulation of gravitational waves for binary black hole mergers.

2017 **Research internship: Implementation of Game Theory strategies to Control Theory, for decentralized stochastic systems.**, *Institut de Robòtica Industrial (CSIC, UPC)*, Barcelona (Spain)

Publications and talks

Publications

[1] Santiago Badia, Jerome Droniou, Jordi Manyer, and Jai Tushar. "Analysis of BDDC preconditioners for nonconforming polytopal hybrid discretization methods". In: *SIAM Journal on Numerical Analysis* 64.2 (2026). DOI: 10.1137/25M1768801. arXiv: 2506.11956 [math.NA]. URL: https://arxiv.org/abs/2506.11956.

[2] Santiago Badia and Jordi Manyer. "Geometric Multigrid solvers for Hybrid High-Order methods on polytopal meshes". Preprint. 2026. arXiv: 2603.00860 [math.NA]. URL: https://arxiv.org/abs/2603.00860.

[3] Pierre Jolivet, Jordi Manyer, and Raphaël Zanella. "Overview of overlapping Schwarz methods in PETSc". In: *Proceedings of the 29th International Conference on Domain Decomposition Methods (DD29)*. To appear. Milan, Italy: Springer, 2026. URL: https://hal.science/hal-05501527.

[4] Jordi Manyer, Jai Tushar, and Santiago Badia. "A natural language framework for non-conforming hybrid polytopal methods in Gridap.jl". Preprint. 2026. arXiv: 2603.00880 [cs.MS]. URL: https://arxiv.org/abs/2603.00880.

[5] Zachary J. Wegert, Jordi Manyer, Connor Mallon, Santiago Badia, and Vivien J. Challis. "GridapTopOpt.jl: a scalable Julia toolbox for level set-based topology optimisation". In: *Struct Multidisc Optim 68, 22* (2025). DOI: 10.1007/s00158-024-03927-3. arXiv: 2405.10478 [cs.MS]. URL: https://arxiv.org/abs/2405.10478.

[6] Zachary J. Wegert, Jordi Manyer, Connor N. Mallon, Santiago Badia, and Vivien J. Challis. "Level-set topology optimisation with unfitted finite elements and automatic shape differentiation". In: *Computer Methods in Applied Mechanics and Engineering* 445 (2025), p. 118203. ISSN: 0045-7825. DOI: 10.1016/j.cma.2025.118203. arXiv: 2504.09748 [math.OC]. URL: https://www.arxiv.org/abs/2504.09748.

[7] Jordi Manyer, Alberto F. Martín, and Santiago Badia. "GridapSolvers.jl: Scalable multiphysics finite element solvers in Julia". In: *Journal of Open Source Software* (2024). DOI: 10.21105/joss.07162.

Presentations

[8] Santiago Badia, Jerome Droniou, Jordi Manyer, and Jai Tushar. "Analysis of BDDC preconditioners for non-conforming polytopal hybrid discretisation methods". In: *MATRIX 2025*. Regular presentation. Creswick, Australia, May 2025.

[9] Santiago Badia, Jerome Droniou, Jordi Manyer, and Jai Tushar. "Analysis of BDDC preconditioners for non-conforming polytopal hybrid discretisation methods". In: *DD29*. Regular presentation. Milan, Italy, June 2025.

[10] Jordi Manyer and Santiago Badia. "Towards scalable solvers for the inductionless MHD equations at high Hartmann numbers". In: *CTAC2024*. Regular presentation. Melbourne, Australia, Nov. 2024.

Workshops

[11] Santiago Badia and Jordi Manyer. *Gridap workshop at DD29*. Part of the postdoctoral courses offered at the DD29 conference. Material available at `https://github.com/gridap/GridapDD29Workshop`. 2025.

[12] Santiago Badia, Jordi Manyer, and Alberto F. Martín. *Gridap workshop at NCI*. Sponsored by NCI and held at ANU's campus in Canberra, Australia. Material available at `https://github.com/gridap/GridapWorkshopNCI2023`. 2023.

Open Source Contributions

→ **Browse my open source contributions on my GitHub profile.**

2022-Now **Gridap ecosystem**, *FEM in Julia*
Main contributor and maintainer of the Gridap ecosystem, a Julia framework for the numerical approximation of PDEs using finite element methods. Creator and maintainer of GridapSolvers.jl (scalable geometrical solvers) and GridapTopOpt.jl (topology optimization).

2026 **GeoGmsh.jl**, *Gmsh meshes from geospatial data*
Creator and maintainer of GeoGmsh.jl, a Julia package to create Gmsh meshes from geospatial data.

Further Merits

Grants and Awards

2026 **AustMS Lift-off Fellowship**
Awarded by the Australian Mathematical Society to support early-career post-doctoral researchers in Mathematics within Australia.

2022 **Monash Graduate Scholarship**
Awarded by Monash university.

2020 **Premi Càtedra Mir-Puig**
Awarded by Universitat Politècnica de Catalunya (UPC) for best academic record in the 2019-2020 class of the Master in Advanced Mathematics and Mathematical Engineering (MAMME).

2014-2019 **CFIS-UPC Scholarship**
Awarded to a maximum of 40 students in Spain per year. The scholarship covers the academic costs for coursing two bachelor degrees simultaneously at Universitat Politècnica de Catalunya.

2014 **Matrícula de Honor de Bachillerato**
Awarded to the top 5% of high-school students in Spain.

Outreach and voluntary work

2024 **Three Minute Thesis (3MT) competition**, *Monash University*, Melbourne (Australia)

Winner of the School of Mathematics heat, presenting my doctoral research to a non-specialist audience in under three minutes, and representative of the School at the Faculty of Science final.

2019-2022 **Volunteer at Casal dels Infants**, *Barcelona, Spain*

El Casal dels Infants is a Non-Profit Organisation acting on Barcelona and it's surroundings. It targets children, teens and young adults in danger of social exclusion (poverty, parental issues,...) and helps them get the life opportunities every child should have.

2020 **Volunteer supervisor at Bojos per la Supercomputació**, *Barcelona Supercomputing Center*, Barcelona (Spain)

Programme held by BSC-CNS, mentoring high-school students in research projects related to supercomputing and fusion science.

2019 **Speaker at the FuseNet Teacher Day**, *Barcelona Supercomputing Center*, Barcelona (Spain)

Outreach talk on nuclear fusion to high-school teachers, as part of an event organised by the European Fusion Education Network (FuseNet) to promote fusion science education.

2019 **Volunteer Instructor at Visions STEAM Anella**, *UPC*, Barcelona(Spain)

Visions STEAM Anella is an annual project organised by UPC and other institutions for students of ages 14-15 all around Catalonia (Spain), to give them an opportunity to discover physics in a completely different way: experiments are designed by UPC professors and carried out by the students at the Olympic Montjuïc Stadium (Barcelona), near Barcelona.

2018 **Instructor at 'Les matemàtiques de problemes reals de la fisica i l'enginyeria'**, *Facultat de Matemàtiques i Estadística (FME), UPC*

Summer course for high-school students (ages 17-18) centered around numerical mathematics and their application to solve physics problems.

2017 , 2018 **Volunteer Instructor at Fisidabo**, *UPC*, Barcelona(Spain)

Fisidabo is an annual project organised by UPC and other institutions for students of ages 14-18 all around Catalonia (Spain), to give them an opportunity to discover physics in a completely different way: experiments are designed by UPC professors and carried out by the students at Tibidabo theme park, near Barcelona.