María Martínez Barbeito

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Profile

Early-career physicist with experience in power grid dynamics and renewable energy systems. Skilled in programming and data analysis for scientific research and complex systems modelling. Adaptable, team-oriented, and motivated to contribute to the renewable energy transition.

Education

PhD in Physics Nov 2019 – Sep 2024

University of the Balearic Islands *Mallorca (Spain)*

- PhD thesis: Studied power grid dynamics and stability in scenarios with a high penetration of renewable energies.

MSc in Physics of Complex Systems Sep 2018 – Oct 2019

University of the Balearic Islands *Mallorca (Spain)*

- Relevant courses: Complex Networks, Dynamical Systems, Stochastic Simulation Methods.
- MSc thesis: Studied systemic risk and financial stability in banking systems through an agent-based model implemented in Fortran. In particular, analyzed vulnerability and resilience to external shocks.

BSc in Physics Sep 2013 – Jul 2018

University of Santiago de Compostela *Santiago de Compostela (Spain)*

- Relevant courses: Computational Physics, Experimental Techniques, Complex Systems.
- Completed a one-year academic exchange at the University of Granada.
- BSc thesis: Reviewed several complex network models and analyzed their effect on a social behaviour model implemented in Matlab.

Research Experience

PhD Researcher Nov 2019 – Sep 2024

Institute for Cross-Disciplinary Physics and Complex Systems (IFISC) *Mallorca (Spain)*

- Investigated power grid behavior under different energy transition scenarios, focusing on frequency dynamics and stability.
- Developed digital twins, analyzed diverse datasets, and published results in peer-reviewed journals.
- Presented at international conferences and workshops, and engaged in science dissemination.
- Collaborated with other researchers, including a 3-month stay at HES-SO (Switzerland).
- Worked on multiple research projects in parallel, including:
  - **Dynamical model for power grid frequency fluctuations** (2019 – 2023)
    - Developed a digital twin of the high-voltage power grid, reproducing real frequency statistics.
    - Conducted extensive studies on various energy transition scenarios running simulations in Fortran and analyzing the results with Python.
  - **Data analysis of frequency fluctuations** (2021)
    - Analyzed grid frequency and power data before and after the closure of a coal plant.
    - Used Python for data analysis and visualization.
  - **VPP4Islands – European project** (2021 – 2024)
    - Implemented the digital twin in Python, worked with diverse datasets, and conducted studies related to the transition to smart and green energy, including the use of batteries.
    - Collaborated with multiple teams and contributed to the production and writing of reports.

- **European transmission grid stability** (2023 – 2024)
  - Analyzed the stability of the Continental European grid using linear stability theory, identifying critical lines in power transmission from distant areas.
  - Used Fortran and Matlab for simulations, and Python for analysis and visualization.

Professional Experience

Junior Integrations Analyst Aug 2025 – Present
Axis Data *Mallorca (Spain)*

- Coordinate system integrations from design to deployment in Agile teams.
- Bridge technical teams and stakeholders in a hybrid project manager/product owner role.

Substitute Teacher (two short-term positions) Mar 2025 – Jun 2025
Balearic public education system *Mallorca (Spain)*

- Taught vocational and secondary-level courses, adapting quickly to new subjects and supporting diverse student learning needs.

Software and Mathematical Models Developer Nov 2024 – Feb 2025
ieco.io *Remote*

- Optimized mathematical models for partial shading in self-consumption photovoltaic systems, reducing computational cost with measurable impact on accuracy.
- Implemented algorithms using Python, improving coding skills.

Skills

- Programming: **Fortran** (advanced), **Python** (advanced), **Matlab** (intermediate), **Git** (basic)
- Software & Tools: **Microsoft Office** (advanced), **LaTeX** (advanced), **HTML** (basic)

Abilities

- Strong communication and organizational skills
- Quick learner, team-oriented, highly adaptable

Languages

- Spanish and Galician – Native
- English – Advanced
- Catalan – Intermediate (B1 certificate)

Additional Information

Publications – *full list on Google Scholar*

- M. Martínez-Barbeito, D. Gomila, P. Colet, J. Fritzsch, & P. Jacquod. (2025). Transmission grid stability with large interregional power flows. *Physical Review Research*, vol. 7, no 1, p. 013137.
- M. Martínez-Barbeito, D. Gomila, & P. Colet. (2023). Dynamical Model for Power Grid Frequency Fluctuations: Application to Islands with High Penetration of Wind Generation. *IEEE Transactions on Sustainable Energy*, p. 1-10.

Advisory Board Member (2022–2024) and **Chair** (2023–2024), *Young Researchers of the Complex Systems Society (CSS)* – Organized events and promoted collaboration among early-career researchers.