

Bernat Espigulé

Self-similar sets, topology, and scientific computation

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I study the topology of self-similar sets and their parameter spaces, connecting the combinatorics of contacts with connectedness and other topological properties. My work combines symbolic dynamics, rigorous computation, and interactive visualization. A background in physics, experience at Wolfram Research, and project mentoring inform both my research and teaching.

Education

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| 2022-present | PhD candidate in mathematics · Universitat de Girona
Thesis deposited 9 September 2026; defence pending. Doctoral programme in Technology.
Doctoral thesis: Collinear Fractals and Connectedness Loci: Topology, Finite Capture, and Restricted Polynomial Roots.
Supervisors: David Juher and Joan Saldaña. |
| 2021 | MSc in Advanced Mathematics · Universitat de Barcelona
Master's thesis (2018): Complex trees and their families of connected self-similar sets .
Supervisors: Núria Fagella and Xavier Jarque. |
| 2012 | BSc in Physics · Universitat Autònoma de Barcelona
International study at UC Santa Barbara (2010-2011) and Heidelberg University (2011-2012). |

Research and professional experience

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| 2022-2025 | Predoctoral researcher · Universitat de Girona
Research and scientific software development for the doctoral thesis, supported by IFUG funding. December 2022-November 2025. |
| 2013-2017;
2020-2021 | Consultant · Wolfram Research
Mathematical content, symbolic and numerical prototypes, interactive demonstrations, and technical communication in an international environment.
Author of eight Wolfram Blog articles. |
| 2019-2020 | Content consultant · CosmoCaixa Barcelona
Mathematical and scientific content and participatory activities for museum visitors. |

Research affiliations

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| 2019 | Illustrating Mathematics · ICERM, Brown University.
Long-term participant. |
| 2017-2022 | HOLODYN · Universitat de Barcelona. Research member. |

RESEARCH

Connectedness, finite capture, and complex trees

I develop symbolic and computational methods for studying connectedness loci, the topology of self-similar sets, and roots of polynomials with restricted coefficients. Current directions include holes in parameter spaces, finite capture, and the contact geometry of planar binary self-similar sets.

Selected publications

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| 2024 | B. Espigule, D. Juher, and J. Saldaña. Collinear Fractals and Bandt's Conjecture . Fractal and Fractional 8 (12), article 725. doi:10.3390/fractalfract8120725 |
| 2019 | B. Espigulé. A Family of Fern-like Ternary Complex Trees . Proceedings of Bridges 2019, pp. 147-154. |

Selected preprints

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| 2026 | B. Espigule. Explicit interpolations among the Sierpiński, Rauzy, and Apollonian gaskets . arXiv:2606.23278. Preprint. |
| 2026 | B. Espigule. Infinitely many holes in connectedness loci for collinear affine iterated function systems . arXiv:2606.01467. Preprint. |
| 2026 | B. Espigule and D. Juher. Finite capture and the closure of roots of restricted polynomials . arXiv:2603.07397. Preprint. |
| 2019 | B. Espigule. Families of connected self-similar sets generated by complex trees . arXiv:1902.11282. Preprint. |

Scientific software and interactive projects

Collinear Fractals. Browser tools for numerical exploration of collinear self-similar sets, parameter spaces, and finite capture layers. The current Canvas/CPU alpha supports research exploration.

4D Connectedness Explorer. Finite numerical exploration of planar binary self-similar sets across four real parameters, with attractor views and contact signatures.

Sierpiński, Rauzy, and Apollonian gaskets. Interactive companion to the 2026 preprint on explicit interpolations among these classical gaskets.

TEACHING AND MATHEMATICAL COMMUNICATION

Teaching and mentoring

- 2025 and 2026** **Bojos per les Matemàtiques** · Universitat de Barcelona
Designed and taught four-hour workshops for advanced secondary-school students on fractals, polynomial roots, computational exploration, conjectures, and proofs.
- 10 Jan 2022** **Arbres complexos i fractals** · FANJAC
Online workshop.
- 2019** **Invited session on fractal geometry and design** · UIC Barcelona
- 2018** **Barcelona Tech Math Summer Camp** · Universitat Politècnica de Catalunya
Computational mathematics outreach.
- 2014-2017** **Wolfram Educational Summer Programs** · Massachusetts
Teaching and project mentoring across four editions, covering computational mathematics, Wolfram Language, visualization, and the development of research questions.

Teaching interests. Topology, numerical methods, and geometry; problem classes and computational laboratories in calculus, linear algebra, differential equations, and scientific programming for mathematics, engineering, and AI students. Project supervision in dynamical systems, complex analysis, and mathematical communication.

Selected research presentations

- Jun 2026** **One World Numeration Seminar.** Research talk.
- 27 Mar 2026** **Institut Henri Poincaré** · Paris.
[Finite capture and the closure of roots of restricted polynomials.](#) [Recording.](#)
- 2025** **ICERM Illustrating Mathematics Reunion/Expansion.** Online research talk.

Communication, collaboration, and mathematical art

History of Mathematics Project. Author of eight interactive learning journeys with Wolfram Research and the National Museum of Mathematics (MoMath), New York.

Erdős Problems (2025). Three merged pull requests contributing OEIS references for five problems.

Mathematical visualization and sculpture. Visual and physical work connecting research, geometry, and design.

Methods, tools, and languages

Methods and tools. Wolfram Language/Mathematica; Python; JavaScript/TypeScript; GLSL/WebGL; Git/GitHub; LaTeX. Exact algebraic computation and interval arithmetic.

Languages. Catalan: native. Spanish and English: fluent in academic and professional contexts.