

TOMÁS SANZ-PERELA

CONTACT INFORMATION AND PERSONAL DATA

Departament de Matemàtiques i Informàtica
Universitat de Barcelona

<https://www.ub.edu/pde/tomas.sanz.perela/>
tomas.sanz.perela@ub.edu

BIRTH: Barcelona — May 1993

RESEARCHERID: J-9900-2017

CITIZENSHIP: Spanish

ORCID ID: [0000-0002-1210-1111](https://orcid.org/0000-0002-1210-1111)

RESEARCH INTERESTS

- Elliptic partial differential equations
- Variational problems and stable solutions
- Reaction-diffusion equations
- Relativistic quantum physics
- Integro-differential equations
- Free boundary problems
- Phase transitions and minimal surfaces
- Music and mathematical modeling

POSITIONS

09/2023 - PRESENT	Assistant professor (Professor Lector) Universitat de Barcelona
09/2021 - 08/2023	Assistant professor (Profesor Ayudante Doctor) Universidad Autónoma de Madrid
03/2020 - 08/2021	Postdoctoral Research Associate University of Edinburgh EP/S03157X/1 project. PI: A. KARAKHANYAN
09/2019 - 02/2020	Postdoctoral Fellow BCAM - Basque Center for Applied Mathematics 669689 – HADE ERC-2014-AdG project. PI: L. VEGA
09/2016 - 07/2019	Predocctoral researcher Universitat Politècnica de Catalunya Advisor: X. CABRÉ

EDUCATION

06/2019	Ph.D. in Applied Mathematics Universitat Politècnica de Catalunya, Barcelona (Spain) Thesis: “Stable solutions of nonlinear fractional elliptic problems” (link) GRADE: Excellent Cum Laude
07/2016	Master in Advanced Mathematics and Mathematical Engineering Universitat Politècnica de Catalunya, Barcelona (Spain) Thesis: “Stable solutions to nonlinear equations with fractional diffusion” (link) GRADE (AVERAGE): 9.63/10
07/2015	Bachelor’s degree in Mathematics Universitat Politècnica de Catalunya, Barcelona (Spain) Thesis: “De l’equació d’ones a l’afinació del piano: un model basat en la teoria de la dissonància” (link) GRADE (AVERAGE): 8.36/10 2014: Erasmus semester at Universidade de Lisboa (Portugal)

GRANTS AND COMPETITIVE RESEARCH CONTRACTS

- 10/2021 | **Juan de la Cierva Formación (declined)**
Ranked #3 in Mathematics (FJC2020-042937-I)
Ministry of Science and Innovation, Government of Spain
- 09/2016 | **PhD 3-years position by the BGSMath through the María de Maeztu programme**
MDM-2014-0445, Ministry of Economy, Industry, and Competitiveness, Government of Spain
- 04/2016 | **Teaching's support studentship (Beca per a les activitats acadèmiques dirigides de suport al professorat)**
2016AAD00167-UPCA01, Ministry of Business and Knowledge, Government of Catalonia

PRIZES AND AWARDS

- 04/2018 | **Accessit at Évariste Galois Prize 2018 (Best Master's Thesis award)**
Catalan Society of Mathematics
- 10/2016 | **Best academic records of the 2015-2016 year**
Master in Advanced Mathematics and Mathematical Engineering
- 06/2012 | **Award to the students with higher grades in the access exam to the university (Reconeixement a l'esforç i a l'excel·lència acadèmica)**
CatalunyaCaixa foundation

RESEARCH ARTICLES AND PREPRINTS

- [1] Karakhanyan, A. & Sanz-Perela, T. (2024) *Stable cones in the Alt-Phillips free boundary problem*. Submitted. Preprint at [arXiv](#).
- [2] Audrito, A. & Sanz-Perela, T. (2024) *Elliptic regularization of some semilinear parabolic free boundary problems*. **Interfaces Free Bound.** 26, 135-159. doi:10.4171/IFB/511
- [3] Sanz-Perela, T. (2022) *Stable solutions to fractional semilinear equations: uniqueness, classification, and approximation results*. Submitted. Preprint at [arXiv](#).
- [4] Arrizabalaga, N., Mas, A., Sanz-Perela, T., & Vega, L. (2023) *Eigenvalue curves for generalized MIT bag models*. **Commun. Math. Phys.** 397, 337–392. doi: 10.1007/s00220-022-04526-3
- [5] Cabré, X. & Sanz-Perela, T. (2022) *A universal Hölder estimate up to dimension 4 for stable solutions to half-Laplacian semilinear equations*. **J. Differential Equations**, 317, 153–195. doi: 10.1016/j.jde.2022.02.001
- [6] Felipe-Navarro, J.C. & Sanz-Perela, T. (2021) *Semilinear integro-differential equations II: one-dimensional and saddle-shaped solutions to the Allen-Cahn equation*. **Math. Eng.**, 3, 1–36. doi: 10.3934/mine.2021037
- [7] Felipe-Navarro, J.C. & Sanz-Perela, T. (2020) *Semilinear integro-differential equations I: odd solutions with respect to the Simons cone*. **J. Funct. Anal.**, 278, 108309 doi: 10.1016/j.jfa.2019.108309

- [8] Felipe-Navarro, J.C. & Sanz-Perela, T. (2020). *Uniqueness and stability of the saddle-shaped solution to the fractional Allen-Cahn equation*. **Rev. Mat. Iberoam.**, 36, 1887–1916 doi: [10.1016/10.4171/rmi/1185](https://doi.org/10.1016/10.4171/rmi/1185)
- [9] Sanz-Perela, T. (2018). *Regularity of radial stable solutions to semilinear elliptic equations for the fractional Laplacian*. **Commun. Pure Appl. Anal.**, 17, 2547–2575. doi: [10.3934/cpaa.2018121](https://doi.org/10.3934/cpaa.2018121)
- [10] Gràcia, X. & Sanz-Perela, T. (2017). *The wave equation for stiff strings and piano tuning*. **Rep. @SCM**, 3, 1–16. doi: [10.2436/20.2002.02.11](https://doi.org/10.2436/20.2002.02.11).

EXPOSITORY PAPERS

- [A] Sanz-Perela, T. (2022) *Per què ens agrada la música? Una explicació matemàtica*. **Butl. Soc. Catalana Mat.**, 37, 173–204. doi: [10.2436/20.2002.01.106](https://doi.org/10.2436/20.2002.01.106)

TALKS

- Barcelona Mathematical Days (November 2-3, 2023. Institut d’Estudis Catalans, Barcelona, Spain)
Title: “A shape optimization problem in relativistic quantum mechanics”.
- Young Researchers in PDEs (September 25 - October 6, 2023. Universidad Autónoma de Madrid, Madrid, Spain)
Title: “A shape optimization problem in relativistic quantum mechanics”.
- Analytic and algebraic methods in physics (August 28-31, 2023. Czech Technical University in Prague, Prague, Czech Republic)
Title: “A shape optimization problem in relativistic quantum mechanics”.
- Young Researcher’s Workshop on Nonlocal PDEs and Applications (October 26-28, 2022. Universidad de Granada, Granada, Spain)
Title: “A shape optimization problem in relativistic quantum mechanics”.
- Aspect’22 “Asymptotic Analysis & Spectral Theory” (September 26-30, 2022. University of Oldenburg, Oldenburg, Germany)
Title: “Confinement models in relativistic quantum mechanics: spectral study and shape optimization”.
- Seminario de Análisis y Aplicaciones (April 29, 2022. Universidad Autónoma de Madrid, Madrid, Spain)
Title: “Confinement models in relativistic quantum mechanics: spectral study and shape optimization”.
- Analysis Seminar (November 16, 2021. ETH Zürich, Zürich, Switzerland)
Title: “A universal Hölder estimate up to dimension 4 for stable solutions to half-Laplacian semilinear equations”.
- Seminario de Ecuaciones en Derivadas Parciales (October 22, 2021. Universidad Autónoma de Madrid, Madrid, Spain)
Title: “Boundedness of stable solutions to fractional semilinear elliptic equations”.
- Barcelona Analysis seminar (February 22, 2021. Universitat de Barcelona, Barcelona, Spain)
Title: “Confinement models in relativistic quantum mechanics: spectral study and shape optimization”.
- PDE’s: Italia vs España seminar (November 19, 2020. Online)
Title: “Regularity of stable solutions to fractional semilinear equations”.

- Virtual Maxwell Analysis seminar (October 9, 2020. University of Edinburgh, Edinburgh, United Kingdom)
Title: “Regularity of stable solutions to fractional semilinear equations”.
- V Congreso de Jóvenes Investigadores de la RSME (January 27-31, 2020. Universitat Jaume I, Castelló, Spain)
Title: “Maximum principles for integro-differential operators acting on odd functions”.
- Analysis and PDE seminar (October 10, 2019. Basque Center for Applied Mathematics, Bilbao, Spain)
Title: “Maximum principles for integro-differential operators acting on odd functions”.
- INDAM Intensive Period 2019 “Shape optimization, control and inverse problems for PDEs” (May-July, 2019. Università degli Studi di Napoli Federico II, Naples, Italy)
Title: “Stable solutions to fractional semilinear equations”.
- Barcelona Analysis Conference 2019 (June 25-28, 2019. Universitat de Barcelona, Barcelona, Spain)
Title: “Stable solutions to fractional semilinear equations”.
- Second BYMAT Conference (May 20-24, 2019. Instituto de Ciencias Matemáticas, Madrid, Spain)
Title: “Stable solutions to fractional semilinear equations”.
- First BYMAT Conference (May 7-9, 2018. Instituto de Ciencias Matemáticas, Madrid, Spain)
Title: “Integro-differential Allen-Cahn equations: the saddle-shaped solution”.

SHORT VISITS AND STAYS

- 11/04/2023 - 14/04/2023 (1 week): BCAM (Bilbao) Host: Luis Vega
- 28/06/2022 - 01/07/2022 (1 week): ETH Zürich (Switzerland) Host: Joaquim Serra
- 15/11/2021 - 26/11/2021 (2 weeks): ETH Zürich (Switzerland) Host: Joaquim Serra

TEACHING

Universitat de Barcelona, Barcelona (Spain)

FALL 2023	Matemàtica Aplicada i Bioestadística Grau en Farmàcia (Facultat de Farmàcia) Undergraduate course, 3 groups: 3 x 60 h. = 180 h. (3 x 6 ECTS = 18 ECTS)
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Universidad Autónoma de Madrid, Madrid (Spain)

SPRING 2023	Ecuaciones diferenciales (Differential equations) Grado en Matemáticas (Facultad de Ciencias) Undergraduate course, 60 h. (9 ECTS)
	Estadística (Statistics) Grado en Ciencia y Tecnología de los alimentos (Facultad de Ciencias) Undergraduate course, 45 h. (6 ECTS)

SPRING 2022	Ecuaciones diferenciales (Differential equations) Grado en Matemáticas (Facultad de Ciencias) Undergraduate course, 60 h. (9 ECTS)
	Estadística (Statistics) Grado en Ciencia y Tecnología de los alimentos (Facultad de Ciencias) Undergraduate course, 45 h. (6 ECTS)

University of Edinburgh, Edinburgh (United Kingdom)

FALL 2020 | **Introduction to fractional diffusion and nonlocal operators**
Maxwell Institute Graduate School in Analysis and its Applications
PhD course, 20 h. (7.5 ECTS)

Universitat Politècnica de Catalunya, Barcelona (Spain)

SPRING 2019 | **Equacions en derivades parcials (Partial differential equations)**
Grau en Matemàtiques (Facultat de Matemàtiques i Estadística)
Undergraduate course, 30 h. (7.5 ECTS)

SPRING 2018 | **Anàlisi funcional (Functional Analysis)**
Grau en Matemàtiques (Facultat de Matemàtiques i Estadística)
Undergraduate course, 30 h. (6 ECTS)

SPRING 2016 | **Linear algebra and computer programming**
Grau en Estadística
Undergraduate problem sessions, 45 h.

STUDENT SUPERVISION

Universidad Autónoma de Madrid, Madrid (Spain)

- Bachelor thesis: Eva Escudero Gutiérrez (2022-2023)
- Master thesis: Alejandro López Sanz (2022-2023)
- Bachelor thesis: Blanca Muñoz Torralba (2021-2022)
- Bachelor thesis: Diego Ekker Martino (2021-2022)

ORGANIZATION OF SCIENTIFIC EVENTS

- Organizer: “Math SOMMa Junior Meeting 2024” (October 2-4, 2024)
- Organizer: “Barcelona Analysis Seminar” (academic year 2023-2024)
- Organizer: Parallel session “Recent advances in local and nonlocal PDE’s” at “VI Congreso de Jóvenes Investigadores de la RSME” (February 6-10, 2023)
- Organizer: “Seminario de EDP UAM-ICMAT” (academic year 2022-2023)
- Organizer: “LMS network meeting”. (March 18, 2021. University of Edinburgh, UK)
- Scientific Committee member: “Third BYMAT Conference”. (December 1-3, 2020. Universitat Politècnica de València, Spain)

SCIENCE TRANSFER AND OUTREACH

- Campamento UAMMAT 2023. “Cómo repartir una pizza (sin que nadie se queje)”.
Workshop (2h) for high school students (Universidad Autónoma de Madrid)
- Semana de la Ciencia 2022. “Cómo repartir una pizza (sin que nadie se queje)”.
Workshop (2h) for high school students (Universidad Autónoma de Madrid)
- Campamento UAMMAT 2022. “Herramientas matemáticas para el tratamiento de música e imágenes”.
Workshop (9h) for high school students (Universidad Autónoma de Madrid)
- Semana de la Ciencia 2021. “Cómo repartir una pizza (sin que nadie se queje)”.
Workshop (2h) for high school students (Universidad Autónoma de Madrid)

- Cofounder of the project “Pedro y sus dilemas”, a divulgative performance of music and theater explaining the basic dilemmas of Game Theory through an adaptation of the musical composition of S. Prokofiev “Peter and the wolf”.

Presented in the ACTION! Festival 2016 Festival internacional de Performance, Poesía y Ciencia. (La Caldera, Barcelona) — [Link to a video](#)

ACREDITATIONS

- Profesor Contratado Doctor (ANECA, Spain), 05/2023.
- Profesor de Universidad Privada (ANECA, Spain), 03/2023.
- Lector (AQU, Generalitat de Catalunya), 07/2021.
- Profesor Ayudante Doctor (ANECA, Spain), 04/2021.

LANGUAGES

CATALAN: Native
SPANISH: Native
ENGLISH: B2 level
PORTUGUESE: B1.2 level
BASQUE: B1 level

COMPUTER SKILLS

Advanced knowledge: Matlab, C++, Java, LaTeX, Python.
Intermediate Knowledge: PL/SQL, R, Objective-C.

SCIENCE REVIEWING

- Referee for Discrete and Continuous Dynamical Systems (since 2022)
- Referee for Journal of Elliptic and Parabolic Equations (since 2021)
- Referee for Calculus of Variations and Partial Differential Equations (since 2021)
- Referee for Advances in Nonlinear Analysis (since 2020)
- Referee for TEMat (since 2017)
- Reviewer for MathSciNet Mathematical Reviews (since 2020)