Gianluca Giacchi

Curriculum Vitae

Education

02-25-2021 Laurea cum laude in Mathematics, Università degli Studi di Milano

Thesis: *Time-Frequency Analysis of Pseudodifferential Operators on Modulation Spaces, with applications to the Global Well-Posedness of the Heat Problem Related to the Fractional Hermite Semigroup on Modulation Spaces*

Supervisor: Professor Maura Salvatori

Academic positions

Current

11-01-2021–Present **PhD Student in Mathematics**, *Dipartimento di Matematica*, University of Bologna, Bologna, Italy
Supervisor: Prof. Nicola Arcozzi

09-01-2022–Present **PhD Student in Neuroscience**, *Faculty of Biology and Medicine*, University of Lausanne, Lausanne, Switzerland
Supervisors: Prof. Benedetta Franceschiello and Prof. Micah Murray

Visiting Positions

From September 2022 to June 2024 **University of Lausanne - Centre Hospitalier Universitaire Vadoise, Lausanne (Switzerland)**, *Research activities with Prof. Benedetta Franceschiello*

October 2023 **HES-SO Valais-Wallis, School of Engineering, Sion (Switzerland)**, *Research activities with Dr. Bastien Milani*

November 2023 **HES-SO Valais-Wallis, School of Engineering, Sion (Switzerland)**, *Research activities with Professor Benedetta Franceschiello*

November 2023 **Università degli Studi di Torino, Dipartimento di Matematica G. Peano, Turin (Italy)**, *Research activities with Professors Elena Cordero and Luigi Rodino*

Professional experience

2021 Professor in Mathematics on research leave, class of competition A047, Liceo Scientifico Gandini and Liceo Classico Verri, Lodi, Italy

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2021-2022 Teaching Tutor of Mathematical Analysis T-B (cod. 28616), University of Bologna, Department of Mechanical Engineering, Bologna, Italy

2021-2022 Teaching Tutor of Mathematical Analysis T-2 (cod. 27993), University of Bologna, Department of Mechanical Engineering, Bologna, Italy

Bibliometric Indicators (January 11, 2024)

Scopus source: Publications: 4, Citations: 3 total citations by 4 documents, h-index: 1
MathSciNet source: Publications: 3, Citations: 2
Google Scholar source: Citations: 23, h-index: 3
ResearchGate: Research Interest Score: 29.1, Citations: 7, h-index: 2.

Organization of Conferences

- Co-organizer of the Workshop: "Symposium in Harmonic & Complex Analysis, Microlocal & Geometrical Analysis and Applications", University of Bologna, Italy, January 24-26, 2024. https://sites.google.com/view/shacamiga2024/
- Co-organizer of "Seminari per Borsisti, Assegnisti e Dottorandi" (BAD Seminars), University of Bologna, Italy, from November 2021

Invited Talks

- Invited speaker at *III Young Researchers Workshop in Harmonic Analysis*, University of Genova, January 10-12, 2024, Genova, Italy. Talk: "Wigner Analysis of Fourier Integral Operators" https://sites.google.com/view/3yrwha24-genova/home
- Invited Speaker at *NUMTA 2023 "Numerical Computations: Theory and Algorithms"*, Pizzo Calabro, Italy, 14-20 June 2023. Talk: "An innovative method to detect the optimal tuning parameter for LASSO problem" https://www.numta.org
- Invited Speaker at *Friday Radiology Research Interdisciplinary Meeting*, Lausanne, Switzerland, 27 January 2023. Talk: "From Signal Analysis to Compressed Sensing MRI". Session Organizer: by Prof. Micah Murray.

Main Talks and Poster Sessions

- *LNDS retreat 2023*, September 1-September 2, 2023, Villars-sur-Ollon, Switzerland. Talk: "A mathematics-driven approach to detect the optimal tuning parameter for LASSO problem". https://wp.unil.ch/lemanicneuroscience/annual-retreat/
- *Organization of Human Brain Mapping*, July 22-July 26, 2023, Montreal, Canada. Poster: "Analytic optimal tuning parameters of a space-variant lasso denoising problem in MRI". https://event.fourwaves.com/ohbm2023/pages
- *Advanced Courses in Operator Theory and Complex Analysis*, June 26-June 30, 2023, Thessaloniki, Greece. Talk: "Metaplectic Gabor Frames and Symplectic Analysis of Time-Frequency Spaces". https://acotca2023.web.auth.gr
- *XLII Convegno Nazionale di Analisi Armonica (XLII National Conference of Harmonic Analysis)*, May 29-May 31, Milan, Italy. Talk: "Symplectic Analysis of Modulation Spaces, part II: Metaplectic Gabor Frames". https://www.matapp.unimib.it/it/eventi/xlii-convegno-nazionale-analisi-armonica
- *BAD Seminars*, 2022, University of Bologna, Italy. Talk: "Eardrums writing scores, the handbook

of absolute pitches"
- *Complex Analysis LAB*, 2022, University of Bologna, Italy. Talk: "The inverse problem in compressed sensing"
- *Complex Analysis LAB*, 2021, University of Bologna, Italy. Talk: "From the time-frequency analysis of Gabor frames to the complex analysis of Fock spaces".
- *The Sense Retreat*, September 23-September 24, 2022, Nendaz, Switzerland. Poster: "Analytic Estimates of Optimal Tuning Parameters for an enhanced formulation of LASSO and its applications in imaging inverse problems with motion".
  https://www.the-sense.ch/first-edition-of-the-senses-retreat/

Attended Conferences

- *Fourier Analysis and Partial Differential Equations*, University of Ferrara, January 29-January 30, 2024, Ferrara, Italy.
  http://dmi.unife.it/it/eventi/fourier-analysis-and-partial-differential-equations-ii
- *III Young Researchers Workshop in Harmonic Analysis*, University of Genova, January 10-12, 2024, Genova, Italy.
  https://sites.google.com/view/3yrwha24-genova/home
- *LNDS retreat 2023*, September 1-September 2, 2023, Villars-sur-Ollon, Switzerland.
  https://wp.unil.ch/lemanicneuroscience/annual-retreat/
- *Organization of Human Brain Mapping*, July 22-July 26, 2023, Montreal, Canada.
  https://event.fourwaves.com/ohbm2023/pages
- *Advanced Courses in Operator Theory and Complex Analysis*, June 26-June 30, 2023, Thessaloniki, Greece.
  https://acotca2023.web.auth.gr
- *NUMTA 2023 "Numerical Computations: Theory and Algorithms"*, Pizzo Calabro, Italy, 14-20 June 2023.
  https://www.numta.org
- *XLII Convegno Nazionale di Analisi Armonica (XLII National Conference of Harmonic Analysis)*, May 29-May 31, 2023, Milan, Italy.
  https://www.matapp.unimib.it/it/eventi/xlii-convegno-nazionale-analisi-armonica
- *Cardiac RNA-mediated (re)programming symposium*, March 9-March 10, 2023, University of Lausanne, Lausanne, Switzerland
- *CVM Mini Symposium, Communication between Peripheral Tissues and the brain: key to keep a normal bodyweight and glycemia*, December 9, 2022, University of Lausanne, Lausanne, Switzerland
- *(New trends in) Complex and Fourier Analysis and Operator Theory 2*, organized by Istituto Nazionale di Alta Matematica (INdAM), September 12-September 16, 2022, Rome, Italy.
  https://events.unibo.it/indam-cfaot-2022
- *XLI Convegno Nazionale di Analisi Armonica (XLI National Conference of Harmonic Analysis)*, May 30-June 1, 2022, University of Genova, Genoa, Italy.
  https://sites.google.com/view/xli-convegno-analisi-armonica/

Attended Courses and Schools

- PhD minicourse: *AI Pictures at a Mathematical Exhibition: How Applied Harmonic Analysis meets Machine Learning*, by Prof. Radu Balan, June 26-June 30 2023, University of Turin, Turin, Italy

- PhD Summer Course: *Function Spaces on the Disk and the Plane: Model and de Branges Spaces, recent results and applications*, by Prof. Marco Peloso and Prof. William Ross, May 7-May 19, Scuola Matematica Interuniversitaria, Cortona, Italy.
  https://www.smi-math.unipr.it/cortona/30/
- PhD Course: *Introduzione all'Analisi di Fourier so Gruppi Finiti (Introduction to Fourier Analysis on Finite Groups)*, by Prof. Marta Morigi, March 13-March 28, 2023, University of Bologna, Bologna, Italy
- PhD Course: *Interpolation and Sampling in Holomorphic Function Spaces*, by Prof. Nicola Arcozzi and Dr. Nikolaos Chalmoukis, March 1-April 19 2023, University of Bologna, Bologna, Italy
- PhD Course: *Beyond the Receptive Field: Neuroscientific and Computational Approaches*, by Prof. Micah Murray and Prof. Benedetta Franceschiello, a.y. 2022-2023, University of Lausanne, Lausanne, Switzerland
- PhD Course: *Clinical Neuroscience Course: Module 1, Modern Neuroimaging Methods*, by Prof. Bogdan Draganski, Ferath Kherif and Prof. Antoine Lutti, October 3-December 21 2022, University of Lausanne, Lausanne, Switzerland
- PhD Course: *Structural and Functional brain MRI: overview of image analysis methods*, by Prof. Mor Mishkovski, a.y. 2022-2023, EPFL, Lausanne, Switzerland
- PhD Course: *Lecture Series on Scientific Machine Learning*, by Prof. Lenka Zdeborova, a.y. 2022-2023, EPFL, Lausanne, Switzerland
- Summer School: *Applied Harmonic Analysis and Machine Learning*, September 5-September 9, 2022, University of Genova, Genoa, Italy
- Summer School: *Machine Learning Crash Course*, June 27-July 1, 2022, University of Genova, Genoa, Italy
- Master Course: *Computational Neuroimaging*, by Prof. Stefano Diciotti, February-June 2022, University of Bologna, Bologna, Italy.
  https://www.unibo.it/it/didattica/insegnamenti/insegnamento/2021/458778
- PhD Course: *Discrete potential theory and some applications to the continuum*, 2022, University of Bologna, Bologna, Italy.
  https://site.unibo.it/complex-analysis-lab/en/contents/discrete-potential-theory-and-some-applications-to-the-continuum.

Membership in scientific bodies/juries

- 2023, Member of the Committee for the assignment of a Senior Academic Associate / Post-doc or research assistant position at HES-SO Valais-Wallis (ref. 2235412)
- 2024, Member of the Committee for the assignment of a PhD Student Position at HES-SO Valais-Wallis (ref. 2294867)
- 2024, Member of the Committee for the assignment of a Senior Academic Associate / Post-doc or research assistant position at HES-SO Valais-Wallis (ref. 2294703)

Reviewer Activity

- *Reviewer for*: IEEE Transactions on Information Theory

Areas of research interest

- Harmonic analysis, time-frequency analysis and applications to Schrödinger equations
- Fourier integral operators (FIOs), generalized metaplectic operators, pseudodifferential operators

- Frame theory, wavelet frames, Gabor frames
- Complex analysis, Hardy spaces, Paley-Wiener spaces
- Holomorphic functions in several complex variables
- Sampling and interpolation
- (Vector Valued) Reproducing Kernel Hilbert Spaces and applications to Machine Learning
- Semigroup of operators, fractional Laplacian, fractional Hermite operators
- Compressed Sensing and generalized LASSO (Basis Pursuit) problem
- Magnetic Resonance Imaging (MRI), mathematical approach to MRI

Publications

Preprints

7. E. Cordero, G. Giacchi, L. Rodino and M. Valenzano. Wigner Analysis of Fourier Integral Operators with symbols in the Shubin classes. *Submitted*. arXiv:2402.02809

6. E. Cordero, G. Giacchi and L. Rodino. A Unified Approach to Time-Frequency Representations and Generalized Spectrogram. *Submitted*. arXiv:2401.03882

5. E. Cordero, G. Giacchi and L. Rodino. Wigner Representation of Schrödinger Propagators. *Submitted*. arXiv:2311.18383v2

4. E. Cordero and G. Giacchi. Excursus on modulation spaces via metaplectic operators and related time-frequency representations. *Submitted*. arXiv:2305.13166

3. E. Cordero and G. Giacchi. Metaplectic Gabor frames of Wigner-Decomposable Distributions. *Submitted*. arXiv:2304.14689

2. G. Giacchi. Metaplectic Wigner Distributions. *Submitted*. arXiv:2304.14689

1. E. Cordero, G. Giacchi and L. Rodino. Wigner Analysis of Operators. Part II: Schrödinger equations. *Submitted*. arXiv:2208.00505

Journal Articles

6. E. Cordero, G. Giacchi. Excursus on modulation spaces via metaplectic operators and related time-frequency representations. *Sampl. Theory Signal Process. Data Anal.* 22, 9 (2024). https://doi.org/10.1007/s43670-024-00085-x.

5. E. Cordero, G. Giacchi and L. Rodino. Wigner Analysis of Operators. Part II: Schrödinger equations. *Commun. Math. Phys. Accepted*.

4. G. Giacchi, B. Milani and B. Franceschiello. On the Determination of Lagrange Multipliers for a Weighted LASSO Problem Using Geometric and Convex Analysis Techniques. *Appl. Math. Optim.*89, 31 (2024). DOI: https://doi.org/10.1007/s00245-023-10096-0

3. E. Cordero and G. Giacchi. Metaplectic Gabor Frames and Symplectic Analysis of Time-Frequency Spaces. *Appl. Comput. Harmon. Anal.*, 68:101594, 2024. DOI:10.1016/j.acha.2023.101594

2. E. Cordero and G. Giacchi. Symplectic Analysis of Time-Frequency Spaces. J. Math. Pures Appl., 177: 154–177, 2023. DOI:10.1016/j.matpur.2023.06.011

1. E. Cordero and G. Giacchi. Quasi-Banach algebras and Wiener properties for pseudodifferential and generalized metaplectic operators. *J. Pseudo-Differ. Oper. Appl.* 14:9, 2023. DOI:10.1007/s11868-022-00503-5

Working Projects

(Book) E. Cordero, G. Giacchi and L. Rodino. *Time-Frequency Analysis of Operators*, 2nd Edition *De Gruyter Studies in Mathematics*. De Gruyter, Berlin.

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