

Mattia Sensi

Caritro postdoctoral fellow at Università degli Studi di Trento

Università degli Studi di Trento
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RESEARCH INTERESTS

Mathematical modelling, mathematical biology, mathematical epidemiology, dynamical systems, billiards, multiple time scales dynamics, Geometric Singular Perturbation Theory (GSPT), qualitative theory of ordinary differential equations, partial differential equations, integro-differential equations, delay differential equations.

EDUCATION

- Ph.D. in Mathematics**, *cum laude*, Università degli Studi di Trento. November 2017 – January 2021
Thesis: “A Geometric Singular Perturbation approach to epidemic compartmental models”
Supervisor: [Prof. Andrea Pugliese](#)
- M.Sc. in Mathematics**, Universiteit van Amsterdam. September 2015 – June 2017
Thesis: “Homoclinic vegetation stripes in a Klausmeier-Gray-Scott model”
Supervisor: [Prof. Dr. Arjen Doelman](#)
- B.Sc. in Mathematics**, Università degli Studi di Padova. September 2011 – September 2014
Thesis: “Portfolio optimization for quadratic utility function with partial information”
Supervisor: [Prof. Wolfgang J. Runggaldier](#)

RESEARCH EXPERIENCE

- Postdoctoral researcher in Mathematics**, Università degli Studi di Trento. March 2025 – present
[Caritro postdoctoral fellow](#) in the group of [Prof. Andrea Pugliese](#), researching the project “*Modelli matematici di malattie infettive più ospiti e popolazioni eterogenee: applicazioni all’influenza aviaria*” (Mathematical models of infectious disease spreading in multi-host and heterogeneous populations: applications avian flu).
- Postdoctoral researcher in Mathematics**, Politecnico di Torino. March 2023 – February 2025
Postdoctoral researcher in the group of [Prof. Andrea Tosin](#), as part of PRIN 2020 project “*Integrated Mathematical Approaches to Socio-Epidemiological Dynamics*” (No. 2020JLWP23, CUP: E15F21005420006).
- Postdoctoral researcher in Mathematics**, Inria at Université Côte d’Azur. December 2021 – February 2023
Postdoctoral researcher in the group [MathNeuro](#), led by [Prof. Mathieu Desroches](#).
- Postdoctoral researcher in Mathematics**, TU Delft. March – November 2021
Postdoctoral researcher in the group [NAS](#), led by [Prof. Piet Van Mieghem](#).

PUBLICATIONS

25. **E. Bernardi, T. Lorenzi, M. S. and A. Tosin.** *Heterogeneously structured compartmental models of epidemiological systems: from individual-level processes to population-scale dynamics.* Accepted, to appear in Studies in Applied Mathematics. [Preprint on arXiv](#)
24. **A. Chizhov, L. Pujo-Menjouet, T. Schwalger and M. S..** *A refractory density approach to a multi-scale SEIRS epidemic model.* Infectious Disease Modelling, 2025, 10(3), pp. 787–801
23. **M. A. Achterberg, M. S. and S. Sottile.** *A minimal model for multigroup adaptive SIS epidemics.* Chaos, 2025, 35(3), 033127
22. **L. Eigentler and M. S..** *Delayed loss of stability of periodic travelling waves: insights from the analysis of essential spectra.* Journal of Theoretical Biology, 2024, 595, 111945
21. **I. M. Bulai, M. S. and S. Sottile.** *A geometric analysis of the SIRS compartmental model with fast information and misinformation spreading.* Chaos, Solitons and Fractals, 2024, 185, 115104
20. **P. Kaklamanos, A. Pugliese, M. S. and S. Sottile.** *A geometric analysis of the SIRS model with secondary infections.* SIAM Journal on Applied Mathematics, 2024, 84(2), pp. 661–686
19. **R. Persoons, M. S., B. Prasse and P. Van Mieghem.** *Transition from time-variant to static networks: Timescale separation in N-intertwined mean-field approximation of susceptible-infectious-susceptible epidemics.* Physical Review E, 2024, 109(3), 034308
18. **M. Adimy, A. Chekroun, L. Pujo-Menjouet and M. S..** *A multigroup approach to delayed prion production.* Discrete and Continuous Dynamical Systems - Series B, 2024, 29(7), pp. 2972–2998
17. **M. S., M. Desroches and S. Rodrigues.** *Slow-fast dynamics in a neurotransmitter release model: delayed response to a time-dependent input signal.* Physica D: Nonlinear Phenomena, 2023, 455, 133887
16. **R. Della Marca, A. d’Onofrio, M. S. and S. Sottile.** *A geometric analysis of the impact of large but finite switching rates on vaccination evolutionary games.* Nonlinear Analysis: Real World Applications, 2024, 75, 103986
15. **N. Cangiotti, M. Capolli, M. S. and S. Sottile.** *A survey on Lyapunov functions for epidemic compartmental models.* Bollettino dell’Unione Matematica Italiana, 2024, 17(2), pp. 241–257
14. **P. Kaklamanos, C. Kuehn, N. Popovic and M. S..** *Entry-exit functions in fast-slow systems with intersecting eigenvalues.* Journal of Dynamics and Differential Equations, 2025, 37(1), pp. 559–576, 103220
13. **N. Cangiotti, M. Capolli and M. S..** *A generalization of unaimed fire Lanchester’s model in multi-battle warfare.* Operational Research, 2023, 23(2), 38
12. **M. A. Achterberg and M. S..** *A minimal model for adaptive SIS epidemics.* Nonlinear Dynamics, 2023, 111(13), pp. 12657–12670
11. **S. Ottaviano, M. S. and S. Sottile.** *Global stability of multi-group SAIRS epidemic models.* Mathematical Methods in the Applied Sciences, 2023, 46(13), pp. 14045–14071
10. **N. Cangiotti and M. S..** *Exact solutions for a Solow-Swan model with non-constant returns to scale.* IJPAM, 2023, 54(4), pp. 1278–1285

9. S. Ottaviano, M. S. and S. Sottile. *Global stability of SAIRS epidemic models*. Nonlinear Analysis: Real World Applications, 2022, 65, 103501
8. S. Sottile, O. Kahramanogullari and M. S.. *How network properties and epidemic parameters influence stochastic SIR dynamics on scale-free random networks*. Journal of Simulation, 2024, 18(2), pp. 206–219
7. B. Chang, L. Yang, M. S., M. A. Achterberg, F. Wang, M. Rinaldi and P. Van Mieghem. *Markov Modulated Process to model human mobility*. Complex Networks & Their Applications X. Studies in Computational Intelligence, 2022, 1015, pp. 607–618
6. N. Cangiotti and M. S.. *Benford's Law: a Number-Theoretical Perspective*. PJM, 2022, 11(3), pp. 379–385
5. N. Cangiotti and M. S.. *A geometric characterization of VES and Kadiyala-type production functions*. Filomat, 2021, 35(5), pp. 1661–1670
4. N. Cangiotti and M. S.. *Notes on a conformal characterization of 2-dimensional Lorentzian manifolds with constant Ricci scalar curvature*. U.P.B. Sci. Bull., 2021, 83(2), pp. 129–136
3. T. Lorenzi, A. Pugliese, M. S. and A. Zardini. *Evolutionary dynamics in an SI epidemic model with phenotype-structured susceptible compartment*. Journal of Mathematical Biology, 2021, 83(6-7), 72
2. H. Jardón-Kojakhmetov, C. Kuehn, A. Pugliese and M. S.. *A geometric analysis of the SIRS epidemiological model on a homogeneous network*. Journal of Mathematical Biology, 2021, 83(4), 37
1. H. Jardón-Kojakhmetov, C. Kuehn, A. Pugliese and M. S.. *A geometric analysis of the SIR, SIRS and SIRWS epidemiological models*. Nonlinear Analysis: Real World Applications, 2021, 58, 103220

PREPRINTS

4. A. Andò, N. Cangiotti and M. S.. *Exploring Exponential Runge-Kutta Methods: A Survey*. [Preprint on arXiv](#)
3. J. Borsotti and M. S.. *A geometric analysis of the Bazykin-Berezovskaya predator-prey model with Allee effect in an economic framework*. [Preprint on arXiv](#)
2. C. Oelen, B. Rink and M. S.. *Non-Birkhoff periodic orbits in symmetric billiards*. [Preprint on arXiv](#), [GitHub repository](#) [BilliardOrbitFinder](#)
1. M. Aguiar, B. Kooi, A. Pugliese, M. S. and N. Stollenwerk. *Time scale separation in the vector borne disease model SIRUV via center manifold analysis*. [Preprint on medRxiv](#)

GRANTS & AWARDS

- [Caritro postdoctoral fellowship 2024](#) with the project “*Modelli matematici di malattie infettive più ospiti e popolazioni eterogenee: applicazioni all'influenza aviaria*” (Mathematical models of infectious disease spreading in multi-host and heterogeneous populations: applications to avian flu), from March 2025 to February 2027. Principal investigator, 85000 €
- [Progetti Giovani GNFM 2025](#) with the project “*Analisi geometrica della diffusione spaziale di epidemie su più scale temporali*” (Geometric analysis of the spatial diffusion of epidemics on multiple time scales), coordinated by Rossella Della Marca, from August 2025 to July 2026. Participant, 2000 €

ASN (ITALIAN NATIONAL SCIENTIFIC QUALIFICATION)

- ASN 2023/2025, Abilitazione Scientifica Nazionale alle funzioni di professore universitario di Seconda Fascia nel Settore Concorsuale 01/A3: Analisi Matematica, Probabilità e Statistica Matematica (Scientific Area 01/A3: Mathematical Analysis, Probability and Mathematical Statistics; qualification to become Associate Professor). From 28/02/2025 to 28/02/2037
- ASN 2023/2025, Abilitazione Scientifica Nazionale alle funzioni di professore universitario di Seconda Fascia nel Settore Concorsuale 01/A4: Fisica Matematica (Scientific Area 01/A4: Mathematical Physics; qualification to become Associate Professor). From 07/03/2025 to 07/03/2037

TEACHING EXPERIENCE

At Università degli Studi di Trento:

- Teacher for Ph.D. course “Advances in Mathematical Applications to Biology and Medicine: Stability analysis of dynamical systems in mathematical biology”, for first year Ph.D. students in Mathematics, June 2024
- Assistant teacher for [Prof. Alberto Valli](#)'s course *Analisi 1*, for first year students of Bachelor's Degree in Civil, Environmental and Mechanical Engineering, September 2018 – February 2019, September 2020 – February 2021, September – December 2022
- Tutor for [Prof. Andrea Pugliese](#)'s course *Probabilità e Statistica 2*, for second year students of Bachelor's Degree in Biotechnologies, February – May 2018

At Politecnico di Torino:

- Assistant teacher for [Prof. Luisa Mazzi](#)'s course *Analisi 1*, for first year students of Bachelor's Degree in Aerospace Engineering, October 2023 – February 2024, September 2024 – February 2025

At Inria – Université Côte d'Azur:

- Teacher of Mathematics for *Linear Algebra Bootcamp*, for first year students of Master's Degree in Computational Neuroscience, September – October 2022

At Università Popolare Trentina (CFP-UPT):

- Teacher of Mathematics, October 2019 – June 2020

At Universiteit van Amsterdam:

- Assistant teacher for [Prof. Dr. Rob Stevenson](#)'s course *Numerieke Analyse*, for third year students of Bachelor's Degree in Mathematics, February – June 2017
- Assistant teacher for [Dr. Han Peters](#)' course *Wiskunde 3*, for third year students of Bachelor's Degree in Physics, November – December 2015

Other:

- Private tutor for [Camplus](#), Torino, May – June 2023
- Private tutor for [WisMon / Bèta onderwijsinstituut](#), Amsterdam and Utrecht, April 2016 – June 2017
- Freelance private teacher of Mathematics and Physics, for high-school and university students, 2008 – present

MENTORING

Master thesis:

- Brian Chang, February – June 2021. [Modeling the Spread of Epidemics](#)
- Liufei Yang, February – June 2021. [Developing a Markov-Modulated Process Model for Mobility Processes](#)

VISITING PERIODS

Visiting postdoc:

- Lyon, France, 4 – 8 June 2023. At Inria Lyon, working with [Laurent Pujo-Menjouet](#) and [Mostafa Adimy](#)
- Trento, Italy, 5 – 8 December 2022; 27 – 31 March 2023. At University of Trento, working with [Andrea Pugliese](#) and [Sara Sottile](#)
- Amsterdam and Groningen, the Netherlands, 21 – 25 November 2022. At Vrije Universiteit Amsterdam and Rijksuniversiteit Groningen, working with [Bob Rink](#) and [Hildeberto Jardón-Kojakhmetov](#)

Visiting Ph.D. student:

- München, Germany, 15 April – 15 June 2019. At Technische Universität München (TUM), working with [Christian Kuehn](#) and [Hildeberto Jardón-Kojakhmetov](#)

COMMUNICATIONS

Invited speaker , Biomath 2025 , Sofia, Bulgaria. Title: “A general kinetic model for the spread of infectious diseases in continuously structured compartments”	15 – 20 June 2025
Invited speaker , BIMSA Computational Math Seminar , Beijing. Title: “Geometric Singular Perturbation Theory in epidemic modelling: motivation and examples”	22 May 2025
Invited speaker , CDLab , Udine. Title: “A general kinetic model for the spread of infectious diseases in continuously structured compartments”	1 April 2025
Invited speaker , EPIMAT seminar , Trento. Title: “A general kinetic model for the spread of infectious diseases in continuously structured compartments”	11 March 2025
Invited speaker , Numerical Aspects of Hyperbolic Balance Laws and Related Problems , Ferrara. Title: “A general kinetic model for the spread of infectious diseases in continuously structured compartments”	17 – 19 December 2024
Scientific committee , Complex Networks 2024 , Istanbul, Turkey. Member of the scientific committee which evaluates abstract and article submissions.	10 – 12 December 2024
Invited speaker , MACBES team , Inria d’Université Côte d’Azur. Title: “Various approaches to the mathematical modelling of epidemics”	18 November 2024
Minisymposium organizer , ECMTB 2024 , Toledo. Minisymposium: “Travelling wave phenomena in biology”	22 – 26 July 2024
Invited speaker , GIMC SIMAI YOUNG 2024 , Napoli. Title: “A general kinetic model for the spread of infectious diseases in continuously structured compartments” Part of the minisymposium “MS01 – Mathematical Models for Socio-Epidemiological Dynamics”	10 – 12 July 2024
Invited speaker , Laboratoire de Mathématiques Appliquées du Havre . Title: “Various approaches to the mathematical modelling of epidemics”	2 May 2024
Invited speaker , Integrated Mathematical approaches to Socio-Epidemiological Dynamics , Trento. Title: “A general kinetic model for the spread of infectious diseases in continuously structured compartments”	29 – 31 January 2024
Scientific committee , Complex Networks 2023 , Menton Riviera, France. Member of the scientific committee which evaluates abstract and article submissions.	28 – 30 November 2023
Poster presentation , Special Semester on Mathematical Methods in Medicine , Linz, Austria. Title: “A general kinetic model for the spread of infectious diseases in continuously structured compartments”. Part of workshop 1 “Epidemics modeling”	30 October – 3 November 2023
Invited speaker , SIMAI 2023 , Matera. Title: “A general kinetic model for the spread of infectious diseases in continuously structured compartments”. Part of the minisymposium “MS03: Recent Advances on the mathematical and numerical modeling of epidemics”	28 August – 1 September 2023
Invited speaker , Inria Lyon. Title: “Various approaches to the mathematical modelling of epidemics”	7 June 2023
Scientific committee , FRCCS 2023 , Le Havre. Member of the scientific committee which evaluates abstract and article submissions.	31 May – 02 June 2023
Contributed speaker , Workshop MSE , Napoli. Title: “A geometric analysis of the SIRS model with secondary infections”	18 – 19 May 2023
Invited speaker , University of Trento. Mathematics Seminar , title: “Delayed loss of stability in multiple time scale models of natural phenomena”	7 December 2022
Invited speaker , Rijksuniversiteit Groningen. Floris Takens Seminar , title: “Entry-exit functions in fast-slow systems with intersecting eigenvalues”	23 November 2022
Invited speaker , Vrije Universiteit Amsterdam. Extra Dynamics Seminar , title: “A Geometric Singular Perturbation approach to epidemic compartmental models”	21 November 2022
Invited speaker , University of Edinburgh. Applied and Computational Mathematics , title: “Delayed loss of stability in multiple time scale models of natural phenomena”	14 October 2022
Minisymposium organizer and contributed speaker , ECMTB 2022 , Heidelberg. Title: “A generalization of the full SNARE-SM model”. Minisymposium: “Recent advances in mathematical modelling in neuroscience”	19 – 23 September 2022
Contributed speaker , ENOC 2022 , Lyon. Title: “Delayed loss of stability in multiple time scale models of natural phenomena”. Part of the minisymposium “MS-05 Slow-Fast Systems and Phenomena”	17 – 22 July 2022

Contributed speaker , 100 UMI - 800 UniPD , Padova. Title: “ <i>A Geometric Singular Perturbation approach to epidemic compartmental models</i> ”	23 – 27 May 2022
Seminar organizer , Inria – Université Côte d’Azur. MathNeuro seminars , cycle of seminars on mathematical models in neuroscience	April – September 2022
Invited speaker , University of Edinburgh. Edinburgh Dynamical Systems Study Group , title: “ <i>Entry-exit functions: beyond eigenvalue separation</i> ”	11 March 2022
Invited speaker , University of Edinburgh. Edinburgh Dynamical Systems Study Group , title: “ <i>A Geometric Singular Perturbation approach to epidemic compartmental models</i> ”	18 June 2021
Organizer, scientific committee and contributed speaker , DSABNS 2020 , Trento. Title: “ <i>A GSPT approach to epidemics on homogeneous graphs</i> ”	4 – 7 February 2020
Invited speaker , University of Trento. Doc in Progress , title: “ <i>An introduction to Geometric Singular Perturbation Theory</i> ”	12 September 2019
Contributed speaker , Edinburgh Slow-Fast-Ival , Edinburgh. Title: “ <i>A GSPT approach to perturbed SIR and SIRWS models</i> ”	4 – 5 July 2019
Contributed speaker , DSABNS 2019 , Naples. Title: “ <i>A GSPT approach to perturbed SIR and SIRWS models</i> ”	3 – 6 February 2019
Invited speaker , Technische Universität München (TUM). Oberseminar Dynamics , title: “ <i>A GSPT approach to perturbed SIR and SIRWS models</i> ”	21 January 2019

REVIEWING

Journals:

- [Advances in Difference Equations](#)
- [Applied Mathematical Modelling](#)
- [Bollettino dell’Unione Matematica Italiana](#)
- [Contemporary Mathematics](#)
- [Epidemiologia](#)
- [International Journal of Biomathematics](#)
- [Journal of Biological Systems](#)
- [Journal of Complex Networks](#)
- [Journal of Mathematical Biology](#)
- [Mathematical Biosciences and Engineering](#)
- [Mathematical Methods in the Applied Sciences](#)
- [Mathematics](#)
- [Mathematics and Computers in Simulation](#)
- [Nonlinear Analysis: Hybrid Systems](#)
- [Nonlinear Dynamics](#)
- [Physica D: Nonlinear Phenomena](#)
- [Results in Applied Mathematics](#)
- [SIAM Journal on Applied Dynamical Systems \(SIADS\)](#)

ATTENDED CONFERENCES, SCHOOLS AND WORKSHOPS

Selected participant , Modeling, analysis, and control of multi-agent systems across scales , Pisa.	22 – 26 January 2024
Selected participant , NeuroMod Meeting 2022 , Antibes.	30 June – 1 July 2022
Selected participant , MoDiS – Modelling Diffusive Systems: Theory & Biological Applications , Edinburgh.	6 – 9 September 2021
Selected participant , online Hausdorff School: Diffusive Systems , Bonn.	12 – 15 April 2021
Selected participant , Mathematical Biology on the Mediterranean Conference , Samos.	1 – 8 September 2019
Selected participant , Multiscale Phenomena in Geometry and Dynamics , München.	22 – 26 July 2019
Selected participant , Mathematics for BioMedicine , Rome.	8 – 11 October 2018
Selected participant , The Helsinki Summer School on Mathematical Ecology and Evolution 2018 , Turku.	19 – 26 August 2018

MEMBERSHIP AND COLLABORATIONS

GNFM – INdAM Member of the group Gruppo Nazionale di Fisica Matematica , of the Istituto Nazionale di Alta Matematica	2025 – present
EMS - TAG - MLS Member of the EMS Topical Activity Group Mathematical Modelling in Life Sciences (EMS - TAG - MLS) of the European Mathematical Society	2024 – present
ESMTB Member of the European Society for Mathematical and Theoretical Biology (ESMTB)	2024 – present
Collaborazioni Matematiche con il Sud Globale - UMI Member of the group Collaborazioni Matematiche con il Sud Globale (Mathematical Collaborations with the Global South) of the Unione Matematica Italiana	2024 – present
MSE - UMI Member of the group Modellistica Socio-Epidemiologica (Social-Epidemiological Modelling) of the Unione Matematica Italiana	2023 – present
CSSF Member of the Complex Systems Society France	2023 – present
Mathematical Epidemiology group, University of Trento Collaborator of the Mathematical Epidemiology group , University of Trento	2021 – present
GNAMPA – INdAM Member of the group Gruppo Nazionale per l’Analisi Matematica, la Probabilità e le loro Applicazioni , of the Istituto Nazionale di Alta Matematica	2017 – 2021

SOFTWARE

\LaTeX , Matlab, Wolfram Mathematica, Python, Microsoft Office tools.

LANGUAGES

Italian (mother tongue), English (C1).