

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*. Studies in Applied Mathematics 155, no. 2 (2025): 155, e70091
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

- [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 €
- [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 €

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 the course *Analisi matematica 1*, for first year students of Bachelor’s Degree in Industrial Engineering, September 2025 – February 2026
- 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:

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| <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Mathematical Methods in the Applied Sciences • Mathematics • Mathematics and Computers in Simulation • Nonlinear Analysis: Hybrid Systems • Nonlinear Analysis: Real World Applications • Nonlinear Dynamics • Physica D: Nonlinear Phenomena • Qualitative Theory of Dynamical Systems • Results in Applied Mathematics • SIAM Journal on Applied Dynamical Systems (SIADS) |
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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), French (basic).