Elisa Sovrano

Curriculum Vitæ

Personal Information

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Scientific production indicators

Scopus – documents: 22; total citations: 160; h-index: 7.
Google scholar – total citations: 211; h-index: 8.

Introduction

My research is driven in the area of nonlinear analysis concerning the theory of ordinary and partial differential equations and dynamical systems. I am interested in applications in the field of population dynamics and biology applications. I deal with dynamical systems theory, topological and variational methods, and bifurcation techniques to investigate:

- existence, multiplicity, and qualitative properties of solutions to semilinear and quasilinear elliptic boundary value problems;
- existence and regularity of solutions to nonlinear parabolic problems (e.g., reaction-diffusion equations associated with nonlinear diffusion);
- chaotic dynamics in discrete and continuous dynamical systems.

Academic career

2022/09/01–to date: Assistant professor (Researcher RTdB) at the Department of Sciences and Method for Engineering, Univ. Modena and Reggio Emilia (Italy).

2021/11/01–2022/08/31: Postdoc researcher at the Department of Sciences and Method for Engineering, Univ. Modena and Reggio Emilia (Italy). *Supervised by L. Malaguti.*

2019/11/01–2021/10/31: Postdoc researcher funded by FSMP (Fondation Sciences Mathématiques de Paris) at CNRS (Centre National de la Recherche Scientifique) – CAMS (Centre d'Analyse et de Mathématique Sociales) – EHESS (École des Hautes Études en Sciences Sociales), Paris (France). *Supervised by H. Berestycki.*

2019/01/01–2019/10/31: Postdoc researcher funded by INdAM (Istituto Nazionale di Alta Matematica) at the Department of Mathematics and Geosciences, Univ. Trieste (Italy). *Supervised by P. Omari.*

2018/07/01–2018/12/31: Postdoc researcher at CMUP (Centre for Mathematics of Univ. Porto), Porto (Portugal). *Supervised by I.S. Labouriau.*

2018/03/07–2018/04/11: Visiting researcher at CMAF-CIO (Center for Mathematics, Fundamental Applications and Operations Research), Univ. Lisbon (Portugal).

2018/02/26: Ph.D. (cum laude) in Computer Science, Mathematics and Physics, Univ. Udine (Italy). Mention Doctor Europaeus. Title of the thesis: Nonlinear differential equations having non-sign-definite weights. *Supervised by F. Zanolin.*

2014/03/19: MSc (cum laude) in Mathematics, Univ. Udine (Italy). Title of the thesis: Snap-back repellers. *Supervised by F. Zanolin.*

Scientific qualification

2020/11/09–2029/11/09: Italian National Scientific Habilitation as Associate Professor – **ASN 2018-2020 "Settore Concorsuale 01/A3 - II Fascia"** (certificate: http://bit.ly/ASN-ES).

Visits & International collaborations

2023 Univ. Lisbona (Portogallo), hosted by C. Rebelo
2021 Politecnico Milano (Italia), hosted by M. Garrione
2019 Univ. Ferrara (Italia), hosted by A. Corli
Univ. Porto (Portogallo), hosted by I. S. Labouriau.
2018 Univ. Chicago (Illinois), hosted by T. Dupont and T. Nagylaki
Univ. Vienna (Austria), hosted by R. Bürger
Univ. Lisbona (Portogallo), hosted by C. Rebelo
Univ. Torino (Italy), hosted by A. Boscaggin.
2017 Univ. Lisbona (Portogallo), hosted by C. Rebelo
Univ. Vigo (Spagna), hosted by E. Liz.
2016 Univ. Lisbona (Portogallo), hosted by C. Rebelo.

Papers

[23] F. Colasuonno, B. Noris, E. Sovrano. Continuous dependence for p-Laplace equations with varying operators **Discrete Contin. Dyn. Syst. Ser. S**, 2024.

[22] M. Garrione, E. Sovrano. Stationary fronts and pulses for multistable equations with saturating diffusion. **NoDEA Nonlinear Differential Equations Appl.**, 30(2), 31, 2023.

[21] E. Liz, E. Sovrano. Stability, bifurcations and hydra effects in a stage-structured population model with threshold harvesting. **Commun. Nonlinear Sci. Numer. Simul.**, 109(106280), 15 pp., 2022.

[20] A. Corli, L. Malaguti, E. Sovrano. Wavefront solutions to reaction-convection equations with Perona-Malik diffusion. **J. Differential Equations**, 308, 474–506, 2022.

[19] G. Feltrin, E. Sovrano, A. Tellini. On the number of positive solutions to an indefinite parameter-dependent Neumann problem. **Discrete Contin. Dyn. Syst.**, 42(1), 21–71, 2022.

[18] I. Coelho, C. Rebelo, E. Sovrano, Extinction or coexistence in periodic Kolmogorov systems of competitive type. **Discrete Contin. Dyn. Syst.**, 41(12), 5743–5764, 2021.

[17] P. Omari, E. Sovrano. Positive solutions of superlinear indefinite prescribed mean curvature problems. **Commun. Contemp. Math.**, 23:03, 2050017, 2021.

[16] E. Sovrano. How to Construct Complex Dynamics? A Note on a Topological Approach. **Internat. J. Bifur. Chaos Appl. Sci. Engrg.**, 30(2):2050034, 7, 2020.

[15] P. Omari, E. Sovrano. Positive solutions of indefinite logistic growth models with flux-saturated diffusion. **Nonlinear Anal.**, 201:111949, 26, 2020.

[14] I. S. Labouriau, E. Sovrano. Chaos in periodically forced reversible vector fields. **J. Singul.**, 22:227–240, 2020.

[13] A. Boscaggin, G. Feltrin, E. Sovrano. High Multiplicity and Chaos for an Indefinite Problem Arising from Genetic Models. **Adv. Nonlinear Stud.**, page 000010151520202094, 2020.

[12] G. Feltrin, E. Sovrano, F. Zanolin. Periodic solutions to parameter-dependent equations with a ϕ-Laplacian type operator. **NoDEA Nonlinear Differential Equations Appl.**, 5(5):Paper No. 38, 27, 2019.

[11] E. Sovrano, F. Zanolin. Ambrosetti-Prodi periodic problem under local coercivity conditions. **Adv. Nonlinear Stud.**, 18(1):169–182, 2018.

[10] E. Sovrano. A negative answer to a conjecture arising in the study of selection-migration models in population genetics. **J. Math. Biol.**, 76(7):1655–1672, 2018.

[9] E. Sovrano. Ambrosetti-Prodi type result to a Neumann problem via a topological approach. **Discrete Contin. Dyn. Syst. Ser. S**, 11(2):345–355, 2018.

[8] G. Feltrin, E. Sovrano. Three positive solutions to an indefinite Neumann problem: a shooting method. **Nonlinear Anal.**, 166:87–101, 2018.

[7] G. Feltrin, E. Sovrano. An indefinite nonlinear problem in population dynamics: High multiplicity of positive solutions. **Nonlinearity**, 31(9):4137–4161, 2018.

[6] E. Sovrano, F. Zanolin. A periodic problem for first order differential equations with locally coercive nonlinearities. **Rend. Istit. Mat. Univ. Trieste**, 49:335–355, 2017.

[5] E. Sovrano, F. Zanolin. Indefinite weight nonlinear problems with Neumann boundary conditions. **J. Math. Anal. Appl.**, 452(1):126–147, 2017.

[4] E. Sovrano, F. Zanolin. The Ambrosetti-Prodi periodic problem: Different routes to complex dynamics. **Dynam. Systems Appl.**, 26:589–626, 2017.

[3] E. Sovrano. About Chaotic Dynamics in the Twisted Horseshoe Map. **Internat. J. Bifur. Chaos Appl. Sci. Engrg.**, 26(6):1650092, 10, 2016.

[2] E. Sovrano, F. Zanolin. Remarks on dirichlet problems with sublinear growth at infinity. **Rend. Istit. Mat. Univ. Trieste**, 47:267–305, 2015.

[1] E. Sovrano, F. Zanolin. Dolcher fixed point theorem and its connections with recent developments on compressive/expansive maps. **Rend. Istit. Mat. Univ. Trieste**, 46:101–121, 2014.

Preprints

[3] E. Muñoz-Hernández, V. Sovrano, V. Taddei, Coupled reaction-diffusion equations with degenerate diffusivity: wavefront analysis.

[2] L. Malaguti, E. Sovrano. Wavefronts in coupled degenerate reaction-diffusion equations for bacterial growth models.

[1] H. Berestycki, E. Sovrano. Reaction-diffusion equations with transmission conditions.

Peer reviewing

Certified reviews on Publons for international journals: Advances in Difference Equations; Boundary Value Problems; Mathematische Nachrichten; Nonlinear Analysis; Open Mathematics; Rocky Mountain Journal of Mathematics (http://bit.ly/Publons-ES).

Conferences & Seminars

Communications (IT: invited talk; CT: contributed talk; P: poster)

2024	**VIII Symposium on Nonlinear Analysis**, (Toruń, Poland, 2024/06/17–21). IT: *Wavefront for reaction-diffusion systems with degenerate diffusivity.* **Workshop Modeling, Control and Games through Partial Differential Equations**, (Brescia, Italy, 2024/04/17–18). IT: *Wavefront for systems of reactive-diffusive equations with degenerate diffusivity.*
2023	**Differential equations and dynamics in Alba (in honor of the career of Fabio Zanolin)**, (Alba, Italy, 2023/09/11-13). IT: *A journey on Ambrosetti-Prodi problems and chaotic dynamics.* **Workshop Nonlinear Partial Differential Equations and Dynamical Systems**, (Madrid, Spain, 2023/06/12–14). IT: *Flux-saturated diffusion's influence on stationary fronts and pulses in multistable reaction-diffusion equations.* **13th AIMS Conference on Dynamical Systems Differential Equations and Applications**, (Wilmington, NC USA, 2023/05/31–06/04). ITs: *Impact of threshold harvesting on the dynamics of age-structured populations; Wavefront analysis for reactive-convective Perona-Malik equations.*
2022	**Equadiff15**, (Brno, Czech Republic, 2022/07/11–15). IT: *Reactive-convective Perona-Malik equations: regular vs. nonregular wavefronts.* **Non-linear elliptic PDE in Hauts-de-France**, (Valenciennes, France, 2022/06/27–30). IT: *Positive solutions to logistic indefinite problems driven by the mean curvature operator.*

	Second mini-workshop on Differential Equations and Dynamical Systems - Working on some recent trends, (Foz do Arelho, Portugal, 2022/04/20–22). IT: *Reaction-convection equations with non-monotone diffusion: what are the consequences of this diffusion on wavefronts?*.
2021	**Two Days Workshop in Nonlinear Analysis 2021**, (Zoom, 2021/09/02–03). IT: *Wavefronts for the reactive-convective Perona-Malik equation.* **Nonlinear Phenomena: between ODEs and PDEs (INdAM Workshop)**, (Zoom, 2021/06/07–09). IT: *Wavefronts for the reactive-convective Perona-Malik equation.*
2019	**International Workshop on Differential Equations** (Lisbon, Portugal, 2019/09/05–06) CT: *Positive solutions of a superlinear indefinite prescribed mean curvature problem.* **International Conference on Differential & Difference Equations and Applications** (Lisbon, Portugal, 2019/07/01–05/07). IT: *An indefinite nonlinear problem in population genetics: high multiplicity and chaos.*
2018	**ReaDi meeting: Reaction-diffusion equations, Modelling and Social sciences** (Paris, France, 2018/12/06–07). IT: *Multiplicity of positive solutions for indefinite nonlinear problems in population genetics.* **Giornate di Equazioni Differenziali Ordinarie: metodi e prospettive** (Ancona, Italy, 2018/09/27–29). IT: *About indefinite Neumann problems with oscillating nonlinear potentials: multiplicity of positive solution.* **International Conference on Nonlinear Analysis and Boundary Value Problems** (Santiago, Spain, 2018/09/04–07). IT: *Chaos in a family of difference equations: a topological proof.* **11th European Conference on Mathematical and Theoretical Biology** (Lisbon, Portugal, 2018/07/23–27). Poster: *High multiplicity of positive solutions to indefinite problems arising in population genetics.* **12th AIMS Conference on Dynamical Systems Differential Equations and Applications** (Taipei, Taiwan, 2018/07/05–09). ITs: *Ambrosetti-Prodi type result under local coercivity conditions*; *Existence and multiplicity of periodic solutions to local coercive equations with a ϕ-Laplacian type operator.* **Mini-workshop on ExtraOrdinary Differential Equations** (Lisbon, Portugal, 2018/03/28–30). IT: *Multiplicity of positive solutions for some indefinite problems.* **9th Workshop DSABNS** (Torino, Italy, 2018/02/07–09). CT: *Indefinite nonlinear weight problems in population genetics.*
2017	**Intensive week of PDEs at Spa** (Spa, Belgium, 2017/12/11–15). IT: *Indefinite nonlinear problems in population genetics: multiplicity of positive solutions.* **Equadiff 2017** (Bratislava, Slovakia, 2017/07/24–28). Poster: *Ambrosetti-Prodi boundary value problems: multiplicity of solutions and chaotic dynamics.* IT: *Multiplicity of positive solutions for indefinite weight problems motivated by population genetics.* **International Conference on Differential & Difference Equations and Applications** (Amadora, Portugal, 2017/06/05–09). CT: *Multiplicity of positive solutions for indefinite Neumann problems with an oscillating nonlinear potential.*
2016	**Nonlinear Meeting in Udine 2017 on the occasion of Pierpaolo Omari's 60th birthday** (Udine, Italy, 2016/01/23–26). CT: *Neumann problems with indefinite weight: modelling population genetics.* **ODEs Under Christmas Trees** (Udine, Italy, 2016/12/22). IT: *Neumann problems with indefinite weight: modelling population genetics.* **11th AIMS Conference on Dynamical Systems Differential Equations and Applications** (Orlando, Florida, 2016/07/01–04). ITs: *Chaotic Dynamics in the Twisted Horseshoe Map Via a Topological Approach*; *Remarks on the Ambrosetti-Prodi Periodic Problem.* **Boundary Value problems in FVG** (SISSA, Trieste, Italy, 2016/02/04). IT: *Positive solutions of Dirichlet problems with an indefinite weight.*
2015	**VII Symposium on Nonlinear Analysis SNA 2015**, (Toruń, Poland, 2015/09/14–18). CT: *Positive solutions of Dirichlet problems with an indefinite weight.*

Invited seminars

2021/11/30 Politecnico Milano, Italia (*Sign-indefinite logistic growth models with flux-saturated diffusion*)
2021/05/13 Univ. Ferrara, Italia (*The effects of flux-saturated diffusion on indefinite logistic-growth models*)
2019/12/09 Univ. Picardy Jules Verne, Francia (*Multiplicity of positive solutions for indefinite nonlinear*

problems in population genetics)

2018/11/14 Univ. Chicago, Illinois (*Multiplicity of clines for indefinite nonlinear problems in population genetics*)

2018/09/21 Univ. Porto, Portogallo (*A topological route to detect chaos in two families of dynamical systems*)

2017/03/31 Univ. Vigo, Spagna (*Neumann problems with an indefinite weight applied to population genetics*)

2016/07/14 Univ. Lisbona, Portogallo (*Remarks on the Ambrosetti-Prodi periodic problem*)

Organization of scientific events

Conferences (co-organizer)

INdAM Workshop 2025 *Planned* (Rome, Italy, 2025/06/9–13), 16 speakers, ~40 participants

Nonlinear Meeting 2024 (Reggio Emilia, Italy, 2024/09/12-13), 6 speakers, ~30 participants

Minisymposium @9th European Congress of Mathematics (Seville, Spain, 2024/07/15–19) "Dynamical aspects of nonlinear problems in reaction-diffusion equations, Hamiltonian systems, and ODEs"

Minisymposium @Equadiff15 (Brno, Czech Republic, 2022/07/11–15) "Advances for problems with nonlinear differential operators", 5 speakers

Christmas Meeting 2020 (Zoom, 2021/12/22), 3 speakers, ~25 participants

Nonlinear Meeting 2021 (Zoom, 2021/03/22-23), 6 speakers, ~90 participants

Christmas Meeting 2020 (Zoom, 2020/12/17), 3 speakers, ~40 participants

Nonlinear Meeting 2017 (Univ. Udine, 2016/01/23–26), 13 speakers, ~40 participants

Series of seminars (co-organizer)

2020/09/01–to date @DEG1 research group, ~2 seminars per month

2021/02/01–2021/10/31 @CAMS' Ph.D. students and postdocs, 1 seminar per month

Research projects & Awards

Individual projects

(2019/11/01–2021/10/31) – *PI of the project*: "Reaction-Diffusion Equations in Population Genetics: a study of the influence of geographical barriers on traveling waves and non-constant stationary solutions" Postdoc fellowship from FSMP (Science Mathematics Foundation of Paris), France.

2019/01/01–2019/10/31 – *PI of the project*: "Problems in Population Dynamics: from Linear to Nonlinear Diffusion"
(2019/01/01–2019/10/31), Postdoc fellowship from INdAM, Italy.

Group projects

2023–2025 – *Member of the PRIN Project*: "Modeling, Control and Games through Partial Differential Equations" PI: R. Colombo (Univ. Brescia)

2023-2024 – *project*: "Analisi qualitativa di problemi differenziali non lineari" PI: G. Feltrin (Univ. Udine)

2020-2021 – *project*: "Problemi ai limiti per l'equazione della curvatura media prescritta" PI: A. Boscaggin (Univ. Turin)

2017–2018 – *project*: "Problemi differenziali con peso indefinito: tra metodi topologici e aspetti dinamici" PI: A. Sfecci (Univ. Trieste)

2016–2017 – *project*: "Problemi differenziali non lineari: esistenza, molteplicità e proprietà qualitative delle soluzioni" PI: M. Garrione (Politecnico di Milano)

2015-2016 – *project*: "Problemi al contorno associati ad alcune classi di equazioni differenziali non lineari" PI: F. Obersnel (Univ. Trieste)

Awards

Ph.D. Thesis Award (2019) in the field of Computer science, Mathematics and Physics, Univ. Udine.

Academic activities

Teaching

A.A. 2024/2025 *Teaching classes of Mathematical Analysis*, BSc Management Engineering, Univ. Modena and Reggio Emilia (68 h); *Teaching classes of Mathematical Models and Methods for Engineering*, BSc Management Engineering, Univ. Modena and Reggio Emilia (18 h)

A.A. 2023/2024 *Teaching classes of Mathematical Analysis*, BSc Management Engineering, Univ. Modena and Reggio Emilia (108 h); *Teaching classes of Mathematical Models and Methods for Engineering*, BSc Management Engineering, Univ. Modena and Reggio Emilia (18 h); *Teaching classes of Mathematical Analysis II*, BSc Strategic Science, Univ. Modena and Reggio Emilia (30 h)

A.A. 2022/2023 *Teaching classes of Mathematical Analysis*, BSc Management Engineering, Univ. Modena and Reggio Emilia (108 h); *Teaching classes of Mathematical Analysis II*, BSc Strategic Science, Univ. Modena and Reggio Emilia (30 h)

A.A. 2021/2022 *Exercise classes of Mathematical Analysis*, BSc Engineering, Univ. Udine (31 h)

A.A. 2017/2018 *Exercise classes of Mathematical Analysis*, BSc Engineering, Univ. Udine (32 h); *Exercise lessons of Mathematical Analysis*, BSc Mathematics, Univ. Udine (20 h); *Exercise lessons of Advanced Geometry*, BSc Mathematics, Univ. Udine (20 h); *Teaching classes of Precalculus*, BSc Engineering, Univ. Udine (20 h)

A.A. 2015/2016 *Exercise lessons of Mathematical Analysis*, BSc Mathematics, Univ. Udine (24 h); *Teaching classes of Precalculus*, BSc Engineering, Univ. Udine (20 h)

Institutional responsibilities

A.A. 2022/2023 Ph.D. committee member, Department of Applied Mathematics and Mathematical Analysis, Complutense Univ. of Madrid (Spain) – Candidate: E. Muñoz Hernández.

A.A. 2021/2022 Ph.D. committee member, Department of Applied Mathematics, Univ. of Granda (Spain) – Candidate: M. Garzón.

A.A. 2020/2021 Ph.D. committee member, Department of Applied Mathematics and Mathematical Analysis, Complutense Univ. of Madrid (Spain) – Candidate: S. Fernández.

Administrative appointments

2023- Member of the *Incoming Assessment Committee* at the Department of Sciences and Method for Engineering (Univ. of Modena and Reggio Emilia).

2024- Member of the *Incoming Student Orientation Committee* at the Department of Sciences and Method for Engineering (Univ. of Modena and Reggio Emilia).

2024- Member of the *Quality Assurance Management Group for M.Sc. in Managment Engineering* at the Department of Sciences and Method for Engineering (Univ. of Modena and Reggio Emilia)

Last update 2024/11/06