

Nicola Soave

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Academic Positions

- 12/ 2018-today Assistant Professor (Ricercatore a tempo determinato “senior” (RTD b)), Department of Mathematics, Politecnico di Milano.
- 12/ 2016 - 12/ 2018 Assistant Professor (Ricercatore a tempo determinato “junior” (RTD a)), Department of Mathematics, Politecnico di Milano.
- 04/ 2014 - 11/ 2016 Wissenschaftliche Mitarbeiter (post-doc position), Mathematisches Institut, Justus-Liebig-Universität of Giessen (Germany).

Education

- 01/ 2011-01/ 2014 Doctoral studies in Pure and Applied Mathematics, Università di Milano-Bicocca / Université de Picardie Jules Verne di Amiens (joint supervision).
Diploma: PhD.
Advisors: Prof. Alberto Farina, Prof. Susanna Terracini.
Thesis defended on January 17, 2014.
- 10/ 2008 - 07/ 2010 Graduate studies in Mathematics, Università degli Studi di Torino.
Diploma: Dottore Magistrale (Master degree) in Mathematics, 110/110 cum laude.
- 09/ 2005 - 10/ 2008 Degree in Mathematics, Università degli Studi di Torino.
Diploma: Dottore (degree) in Mathematics, 110/110 cum laude.
- 09/ 2000 - 07/ 2005 High school, Liceo Scientifico “G. Arimondi”, Savigliano (CN), 100/100.

Qualification

- 09/ 2019 - 09/ 2025 “Abilitazione scientifica nazionale (2018) - prima fascia, SC 01/A3, SSD MAT/05” (Italian qualification required to become full professor in Mathematical Analysis).
- 03/ 2017 - 03/ 2023 “Abilitazione scientifica nazionale (2016) - seconda fascia, SC 01/A3, SSD MAT/05” (Italian qualification required to become associate professor in Mathematical Analysis).

Acknowledgments

- 2017 Supported by the Italian grant FFABR (*Fondo per il finanziamento di base delle attività di ricerca*) in the category "Researchers" in 2017.
- 2009 - 2010 The thesis *Aubry-Mather theory, and applications to ordinary differential equations* has been awarded as best master degree thesis in mathematics of the Università degli Studi di Torino in the college year 2009/2010, and with the prize "Luciana Picco Botta".

Scientific research activity

Research interests, keywords

Nonlinear differential equations and systems: existence, multiplicity, qualitative properties and regularity of solutions.

- Variational methods; critical points theory; natural constraints; solitary waves for Schrödinger equations and systems; normalized solutions.
- Symmetry of solutions; 1-dimensional symmetry; radial symmetry; foliated Schwarz symmetry; moving planes method; polarization; rigidity of solutions; Liouville-type theorems.
- Nodal properties of solutions to elliptic equations; unique continuation principle; monotonicity formulae; regularity of the nodal set; sublinear and singular equations.
- Systems of elliptic equations with strong competition; uniform a priori bounds; pattern formation and regularity of interfaces; blow-up methods.
- Fractional Laplacian.

All my papers and preprints are available on [arXiv](#)

Preprints

- [3] N. Soave and S. Terracini. An anisotropic monotonicity formula, with applications to some segregation problems.
- [2] E. Moreira Dos Santos, G. Nornberg, N. Soave. On unique continuation principles for some elliptic systems.
- [1] N. Soave. Normalized ground states for the NLS equation with combined nonlinearities.

Publications

- [31] N. Soave. Normalized ground states for the NLS equation with combined nonlinearities: the Sobolev critical case. Accepted for publication on *Journal of Functional Analysis*.
Doi: 10.1016/j.jfa.2020.108610
- [30] D. Pierotti, N. Soave and G. Verzini. Local minimizers in absence of ground states for the critical NLS energy on metric graphs. Accepted for publication on *Proceedings of the Royal Society of Edinburgh Section A: Mathematics*.
- [29] N. Soave. Saddle-shaped positive solutions for elliptic systems with bistable nonlinearity. *Mathematics in Engineering*, 2(3), 423–437, 2020. Doi: 10.3934/mine.2020019.
- [28] A. Pistoia, N. Soave and H. Tavares. A fountain of positive Bubbles on a Coron's Problem for a Competitive Weakly Coupled Gradient System. *Journal de Mathématiques Pures et Appliquées*, 135: 159–198, 2020. Doi: 10.1016/j.matpur.2019.09.004.

- [27] A. Farina, B. Sciunzi and N. Soave. Monotonicity and rigidity of solutions to some elliptic systems with uniform limits. *Communications in Contemporary Mathematics*.
Doi: 10.1142/S0219199719500445.
- [26] N. Soave and S. Terracini. The nodal set of solutions to some elliptic problems: singular nonlinearities. *Journal de Mathématiques Pures et Appliquées*, 128 (2019), 264–296.
- [25] N. Soave and E. Valdinoci, Overdetermined problems for the fractional Laplacian in exterior and annular sets. *Journal d'Analyse Mathématiques*, 137 (2019), no. 1, 101–134.
- [24] T. Bartsch and N. Soave, Multiple normalized solutions for a competing system of Schrödinger equations. *Calculus of Variations and Partial Differential Equations*, 58 (2019), no. 1, Art. 22, 24 pp.
- [23] N. Soave and T. Weth, The unique continuation property of sublinear equations. *SIAM Journal of Mathematical Analysis*, 50 (2018), no. 4, 3919–3938.
- [22] N. Soave and S. Terracini, The nodal set of solutions to some elliptic problems: sublinear equations, and unstable two-phase membrane problem. *Advances in Mathematics*, 334 (2018): 243–299.
- [21] N. Soave, H. Tavares, S. Terracini and A. Zilio, Variational problems with long-range interaction. *Archive for Rational Mechanics and Analysis*. 228 (3): 743–772, 2018.
- [20] S. Dipierro, N. Soave and E. Valdinoci, On stable solutions of boundary reaction-diffusion equations and applications to nonlocal problems with Neumann data. *Indiana University Mathematical Journal*. 67 (1): 429–469, 2018.
- [19] A. Pistoia and N. Soave, On Coron's problem for weakly coupled elliptic systems. *Proc. London Math. Soc.*, 116 (1): 33–67, 2018.
- [18] S. Dipierro, N. Soave and E. Valdinoci, On fractional elliptic equations in Lipschitz sets and epigraphs: regularity, monotonicity and rigidity results. *Mathematische Annalen*, 369: 1283–1326, 2017.
- [17] T. Bartsch and N. Soave, A natural constraint approach to normalized solutions of nonlinear Schrödinger equations and systems. *Journal of Functional Analysis*, 272 (12): 4998–5037, 2017.
See also Correction to: “A natural constraint approach to normalized solutions of nonlinear Schrödinger equations and systems” [J. Funct. Anal. 272 (12) (2017) 4998–5037], *Journal of Functional Analysis*, 275 (2): 516–521, 2018.
- [16] N. Soave and A. Zilio, On phase separation in systems of coupled elliptic equations: asymptotic analysis and geometric aspects. *Annales de l'Institut Henri Poincaré (C) Analyse Non Linéaire*, 34 (3): 625–654, 2017.
- [15] N. Soave and A. Zilio, Multidimensional entire solutions for an elliptic system modelling phase separation. *Analysis and Partial Differential Equations*, 9 (n. 5) (2016), 1019–1041.
- [14] T. Bartsch, L. Jeanjean and N. Soave, Normalized solutions for a system of coupled cubic Schrödinger equations on \mathbb{R}^3 . *Journal de Mathématiques Pures et Appliquées*, 106 (2016), 583–614.
- [13] N. Soave and H. Tavares, New existence and symmetry results for least energy positive solutions of Schrödinger systems with mixed cooperation and competition terms. *Journal of Differential Equations*, 261 (2016), 505–537.
- [12] N. Soave, H. Tavares, S. Terracini and A. Zilio, Hölder bounds and regularity of emerging free boundaries for strongly competing Schrödinger equations with nontrivial grouping. *Nonlinear Analysis: Theory, Methods & Applications*, 138 (2016), 388–427. Special Volume in honor of Juan Luis Vázquez for his 70th birthday.
- [11] N. Soave and A. Zilio, Uniform bounds for strongly competing systems: the optimal Lipschitz case. *Archive for Rational Mechanics and Analysis*, 218 (2015), 647–697.
- [10] N. Soave and S. Terracini, Liouville theorems and 1-dimensional symmetry for solutions of an elliptic system modelling phase-separation. *Advances in Mathematics*, 279 (2015), 29–66.
- [9] N. Soave, On existence and phase separation of solitary waves for nonlinear Schrödinger systems modelling simultaneous cooperation and competition. *Calculus of Variations and Partial*

Differential Equations, 53 (3-4) (2015), 689–718.

- [8] N. Soave, Symbolic dynamics: from for the N -centre to the $(N + 1)$ -body problem, a preliminary study, *NoDEA Nonlinear Differential Equations and Applications* 21 (3) (2014), 371–413.
- [7] A. Farina and N. Soave, Monotonicity and 1-dimensional symmetry for solutions of an elliptic system arising in Bose-Einstein condensation, *Archive for Rational Mechanics and Analysis* 213 (1) (2014), 287–326.
- [6] N. Soave and G. Verzini, Bounded solutions for a forced bounded oscillator without friction, *Journal of Differential Equations* 256 (7) (2014), 2526–2558.
- [5] N. Soave and A. Zilio, Entire solutions with exponential growth for an elliptic system modeling phase-separation, *Nonlinearity* 27 (2) (2014), 305–342.
- [4] N. Soave and S. Terracini, Avoiding collisions under topological constraints in variational problems coming from celestial mechanics, *Journal of Fixed Point Theory and its Applications* 14 (2) (2013), 457–501. Special Volume *The Yvonne Choquet-Brubhat Festschrift*.
- [3] A. Farina and N. Soave, Symmetry and uniqueness of nonnegative solutions of some problems in the half-space, *Journal of Mathematical Analysis and Applications* 403 (1) (2013), 215–233.
- [2] N. Soave and S. Terracini, Symbolic dynamics for the N -centre problem at negative energies *Discrete and Continuous Dynamical Systems - Series A* 32 (9) (2012), 3245–3301, Special Volume *Orlando Issue Contributed by the Plenary Speakers*.
See also Addendum to: symbolic dynamics for the N -centre problem at negative energies, 33 (8) (2013).
- [1] A. Capietto and N. Soave, Some remarks on Mather’s theorem and Aubry-Mather sets, *Communications in Applied Analysis*, 15 (2011), 283–298.

Research projects

- 2020 Member the project INDAM-GNAMPA *Proprietà qualitative per soluzioni di EDP non lineari ellittiche e paraboliche, locali e nonlocali*. Principal Investigator: Stefano Vita.
- 2019 Principal Investigator for the project INDAM-GNAMPA *Esistenza e proprietà qualitative per soluzioni di EDP non lineari ellittiche e paraboliche*. € 3000.
- 2016 - 2019 Member of the project PRIN 2015 *Variational Methods, with Applications to problems in Mathematical Physics and Geometry*. Principal Investigator: Andrea Malchiodi. Local coordinator: Gianmaria Verzini.
- 2017 Principal Investigator for the project INDAM-GNAMPA *Aspetti non-locali in fenomeni di segregazione*. € 1200.
- 2013 - 2018 Member of the ERC Advanced Grant n. 339958 project *Complex Patterns for Strongly Interacting Dynamical Systems - COMPAT*. Principal Investigator: Susanna Terracini.
- 2013 Member of the INDAM-GNAMPA project *Birth of pattern in systems with anomalous diffusion and strong competition*. Principal Investigator: Gianmaria Verzini.
- 2011 - 2012 Member of PRIN 2009 *Critical Point Theory and Perturbative Methods for Nonlinear Differential Equations*. Principal Investigator: Prof. Susanna Terracini.

Research visits

- 04/ 2019 KTH Royal Institut of Technology in Stockholm (Sweden) - 1 week. Invited by Henrik Shahgholian.
- 02/ 2019 Hausdorff Institut in Mathematics, Bonn (Germany), invited participant at the workshop ”Geometric measure theory and free boundary problems” (1 week) - trimester program “Evolution of interfaces”. Organizers: Prof. Emanuele Spadaro, László Székelyhidi Jr., Georg Weiss.

- 02/ 2018 University of Washington, Seattle (USA) - 1 week. Invited by Mariana Smit Vega Garcia.
- 10/ 2017 Università della Calabria, Rende (Italy) - 1 week. Invited by Berardino Sciuuzi.
- 11/ 2015 Università di Roma – La Sapienza, Rome (Italy) - 1 week. Invited by Angela Pistoia.
- 09/ 2015 Università degli Studi di Torino, Turin (Italy) - 2 weeks. Invited by Susanna Terracini.
- 07/ 2015 Weierstrass Institute for Applied Analysis and Stochastics, Berlin (Germany) - 2 weeks. Invited by Enrico Valdinoci.
- 03/ 2015 CAMGSD, Instituto Superior Técnico, Universidade de Lisboa (Portugal) - 1 week. Invited by Hugo Tavares.
- 02/ 2015 CAMS - EHESS, Paris (France) - 1 week. Invited by Alessandro Zilio.
- 10/ 2014 Weierstrass Institute for Applied Analysis and Stochastics, Berlino (Germany) - 1 week. Invited by Enrico Valdinoci.
- 02/ 2014 Pacific Institute of Mathematical Science, University of British Columbia, Vancouver (Canada) - 2 weeks. Invited by Juncheng Wei.
- 02/ 2013 Institute Camille Jordan, Université Lyon I, Lyon (France) - 1 month. Invited by Alberto Farina.
- 09/ 2012 Institute Camille Jordan, Université Lyon I, Lyon (France) - 1 week. Invited by Alberto Farina.
- 03/ 2012 Université de Picardie Jules Verne, Amiens (France) - 6 weeks. Invited by Alberto Farina.

Organization of scientific activities

- 2020 Conference *Nonlinear Meeting in Milan 2020*, Politecnico di Milano (with M. Garrione); January 30 - 31.
- 2019 Conference *Analytic and Geometric Aspects of PDEs*, Politecnico di Milano (with G. Catino, D. D. Monticelli, and G. Verzini); May 27 - 30.

Minicourses at schools

- 02/2019 Minicourse at the *Spring School on Local and Nonlocal Elliptic and Geometric Problems*. School organized by AIMS Senegal and the Goethe-University of Frankfurt, and held at the African Institute for Mathematical Sciences (AIMS) in Mbour, Senegal.
Title: On the nodal set of solutions to elliptic equations.

Invited speaker at conferences

- 09/2019 XXI congresso dell'Unione Matematica Italiana, Pavia (Italy).
- 06/ 2019 Intensive Week of PDEs at Cogne, Cogne (Italy).
- 05/ 2019 Brescia-Trento Nonlinear Days - Edition III, Università degli Studi di Trento (Italy).
- 09/ 2018 Workshop on Nonlinear Analysis and PDEs, Caserta (Italy).
- 07/ 2018 ICM 2018 Satellite conference on Nonlinear Partial Differential Equations, Fortaleza (Brazil).
- 07/ 2018 Workshop on Variational Problems arising from Physics and Geometry. Rauischholzhausen Castle, Marburg (Germany).
- 02/ 2018 Workshop on Variational Methods in Analysis, Geometry and Physics. Scuola Normale Superiore di Pisa (Italy).
- 01/ 2018 Workshop on Interaction models: Mean Field Games, pattern formation and related topics. Università di Padova (Italy).
- 11/ 2017 First Belgium-Chile-Italy conference in PDEs. Université Libre de Bruxelles (Belgium).
- 05/ 2017 International Conference on Elliptic and Parabolic Problems, Gaeta (Italy).

- 02/ 2017 Equazioni alle Derivate Parziali e Disuguaglianze Analitico-Geometriche Associate, Politecnico di Milano, Milan (Italy).
- 01/ 2017 Workshop Roma Caput PDE. Università di Roma - La Sapienza, Rome (Italy).
- 12/ 2016 Workshop Nonlinear Partial Differential Equations and Mathematical Physics, Tsinghua Sanya International Mathematics Forum (TSIMF), Sanya (China).
- 10/ 2016 Nonlinear PDE days, Frankfurt-Giessen-Karlsruhe-Köln. Justus-Liebig-Universität of Giessen (Germany).
- 07/ 2016 Summer School on Elliptic PDE's at Tenerife, Università de la Laguna, Tenerife (Spain).
- 06/ 2016 PDEs at the Grand Paradis, Cogne (Italy).
- 06/ 2016 Recent trends on elliptic nonlocal equations, Fields Institute in Toronto, Toronto (Canada).
- 05/ 2016 Bruxelles - Torino seminars in PDEs, Università degli Studi di Torino, Turin (Italy).
- 09/ 2015 Workshop on Nonlinear PDEs, Brussels (Belgium).
- 07/ 2015 Equadiff conference 2015, Lyon (France).
- 09/ 2014 Joint meeting of German and Polish Mathematical Societies, Poznań (Poland).
- 07/ 2014 10th AIMS international conference on dynamical systems, differential equations and applications, Madrid (Spain).
- 01/2013 BIRS workshop New perspectives on the N -body problem, Banff centre, Banff (Canada).
- 07/ 2012 9th AIMS international conference on dynamical systems, differential equations and applications, Orlando (Florida, USA).
- 06/ 2012 International workshop and advanced school on variational methods in N -body and vortex dynamics, Università del Salento, Lecce (Italy).

Speaker at conferences

- 01/ 2014 School on nonlinear elliptic problems, Università di Milano - Bicocca, Milano, Italy.
- 01/ 2014 Workshop on Variational methods in elliptic equations and systems, Lisbon (Portugal).

Invited talks in Analysis seminars

- 01/ 2020 Università di Milano-Bicocca, PDEs sessions in Bicocca: free boundary problems. Milan (Italy).
- 11/ 2018 Università degli Studi Roma Tre, Rome (Italy).
- 02/ 2018 University of Washington, Seattle (USA).
- 10/ 2017 Scuola Normale Superiore di Pisa (Italy).
- 10/2017 Università della Calabria, Rende (Italy).
- 12/ 2016 Politecnico di Milano (Italy).
- 04/ 2016 Philipps-Universität Marburg (Germany).
- 11/ 2015 Università di Roma - La Sapienza (Italy).
- 09/ 2015 Università degli Studi di Torino (Italy).
- 07/ 2015 Justus-Liebig-Universität Giessen (Germany).
- 04/ 2015 Università degli Studi di Torino (Italy).
- 03/ 2015 Università di Pisa (Italy).
- 03/ 2015 Universidade de Lisboa (Portugal).
- 03/ 2015 Università di Roma Tor Vergata (Italy).
- 02/ 2015 CAMS-EHESS Paris (France).
- 01/ 2015 Goethe-Universität Frankfurt (Germany).

- 06/ 2014 Justus-Liebig-Universität Giessen (Germany).
- 11/ 2013 Università degli Studi di Milano-Bicocca (Italy).
- 10/ 2013 Justus-Liebig-Universität Giessen (Germany).
- 04/ 2013 Università Statale di Milano (Italy).
- 03/ 2013 Università degli Studi di Torino (Italy).
- 02/ 2012 Università degli Studi di Milano-Bicocca (Italy).
- 01/ 2012 Politecnico di Milano (Italy).
- 12/ 2011 Università degli Studi di Torino (Italy).

Participation in evaluation committees

- 2019 At Politecnico di Milano, for the selection of the following positions: Teaching Assistants (T.A.) for Basic Mathematical Analysis course.

Reviewer Activity

Reviewer for *MathReviews*

Referee for:

Advances in Math.;
J. Functional Analysis;
Comm. in Partial Differential Equations;
Transactions AMS;
Comm. in Mathematical Physics;
SIAM J. of Mathematical Analysis;
Calc. Var. and PDEs;
J. Differential Equations;
Nonlinear Analysis TMA;
Proc. of the Royal Society of Edinburgh - Section A;
Adv. in Differential Equations;
Revista Matemática Iberoamericana;
Physics Letters A;
Annali della Scuola Normale Superiore di Pisa, classe di Scienze;
Discrete and Continuous Dynamical Systems;
Mathematical Methods and Models in Applied Sciences;
NoDEA;
SIGMA;
Complex Variables and Elliptic Equations;
J. Math. Anal. and Appl.;
Comm. in Pure and Applied Analysis;
Computers and Math. with Applications;
Applied Mathematics Letters.

Bibliometrics

Databases checked on April 26, 2020.

- ISI-WoS 252 citations (205 without self citations), 159 citing articles, h-index 10.
- Scopus 242 citations (197 without self citations), 155 citing articles, h-index 10.
- MathSciNet 208 citations, 144 citing authors.

Teaching activity

PhD courses

2019-20
2017-18 Semilinear Elliptic Equations, with Gianmaria Verzini, PhD course in Mathematical Models and Methods in Engineering, Politecnico di Milano (Italy).

Holder of regular courses

2019-20
2018-19, 2017-18
2016-17 Calculus 1, Degree in Control Engineering, Computer Eng., Telecommunications Eng., Electric Eng., Electronic Eng., Politecnico di Milano (Italy).
Calculus 2, Degree in Civil Engineering, Politecnico di Milano (Italy).

Assistant

2018-19 Real and Functional Analysis, Master Degree in Mathematical Engineering, Politecnico di Milano (Italy).
2016-17, 2015-16 Calculus 1, Degree in Physics, Justus-Liebig-Universität of Giessen (Germany).
2014-15 Calculus 3 and Calculus 4, Degree in Mathematics, Justus-Liebig-Universität Giessen (Germany).
2013-14 Partial Differential Equations, Degree in Mathematics, Justus-Liebig-Universität Giessen (Germany).
2013-14 Calculus 2, Degree in Mathematics, Università degli Studi di Milano-Bicocca (Italy).
2011-12 Maths 1, Degree in Science and Technology for the Environment, Università degli Studi di Milano-Bicocca (Italy).

Other activities

2015-16 Organizer of the reading course on Morse Theory, Master and PhD in Mathematics, Justus-Liebig-Universität Giessen (Germany).

Language skills

Mother tongue: Italian.

Other languages: English (advanced), German (intermediate), French (elementary).