



Simone Fagioli

Curriculum vitae

updated June 2021

Personal data

Born in Teramo (Italy) on 28/11/1986, married, two daughters, Italian citizen.
Work address: via Vetoio 1, 67100, L'Aquila (Italy).
Phone (office) number: +39 0862 433164.

Positions

Current position

April 2021 – **Assistant Professor with Tenure Track (RTD/B)**, *Università degli Studi dell'Aquila*, L'Aquila (Italy).

Past positions

November 2018 – **Assistant Professor (RTD/A)**, *Università degli Studi dell'Aquila*,
March 2021 L'Aquila (Italy).

May 2017 – October 2018 **Post-doctoral position**, *Università degli Studi dell'Aquila*, L'Aquila (Italy).

March 2015 – April 2017 **Post-doctoral position**, *Università degli Studi dell'Aquila*, L'Aquila (Italy).

Education

February 2015 **PhD in Mathematics**, *Title of the thesis: "Nonlocal interaction equations with two species"*, *Università degli Studi dell'Aquila*, advisor: Prof. Marco Di Francesco.
Evaluation: ottimo con punte di eccellenza.

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- July 2011 **Master's degree in Mathematical Engineering**, *Title of the thesis: "Weak solutions for a nonlocal drift-diffusion system in opinion formation"*, Università degli Studi dell'Aquila, advisor: Prof. Marco Di Francesco.
Evaluation: Summa cum laude
- October 2009 **Bachelor's degree in Mathematics**, *Title of the thesis: "Kinetic models in opinion formation"*, Università degli Studi dell'Aquila, advisor: Prof. Marco Di Francesco.
Evaluation: 103/110

Academic recognitions

- November 2020 **National Scientific Qualification - 01/A3 ANALISI MATEMATICA, PROBABILITÀ E STATISTICA MATEMATICA - Associate Professor**, 09/11/2020 - 09/11/2029.
- November 2020 **National Scientific Qualification - 01/A4 - FISICA MATEMATICA, Associate Professor**, 09/11/2020 - 09/11/2029.
- November 2015 **Selected by the University of L'Aquila as top five young researcher, with short communication of research achievements to the President of Italian Republic (on occasion of his visit to L'Aquila).**

Research interest

My research deals with the study of Partial Differential Equations and their application in several contexts such as biology, social sciences and traffic flow modelling. In particular, I'm interested in:

- 1 Systems of transport equations of nonlocal interaction type with applications to aggregative phenomena in biology and social sciences.
- 2 Cross-diffusion and reaction systems in biology and medicine.
- 3 Models in opinion formation and social sciences.
- 4 Deterministic particle approximation for transport partial differential equations in applied models.

Publications and preprints

Preprints

- [1] L. Alasio, M. Bruna, S. Fagioli and S. Schulz. **Existence and regularity for a system of porous medium equations with small cross-diffusion and nonlocal drifts.** *Submitted preprint*, 2021.
- [2] S. Fagioli and O. Tse. **On gradient flow and entropy solutions for nonlocal transport equations with nonlinear mobility.** *submitted preprint*, 2021.

Published articles

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- [1] S. Fagioli and Y. Jaafra. **Multiple patterns formation for an aggregation/diffusion predator-prey system.** *Accepted on Networks and Heterogeneous Media*, 2021.
- [2] S. Fagioli and E. Radici. **Opinion formation systems via deterministic particles approximation.** *Kinetic and Related Models*, 14 (1), 45-76, 2021.
- [3] N. Ansini and S. Fagioli. **Nonlinear diffusion equations with degenerate fast-decay mobility by coordinate transformation.** *Communications in Mathematical Sciences*, 18(2):459–486, 2020.
- [4] J.A. Carrillo, M. Di Francesco, A. Esposito, S. Fagioli, and M. Schmidtchen. **Measure solutions to a system of continuity equations driven by Newtonian nonlocal interactions.** *Discrete and Continuous Dynamical Systems- Series A*, 40(2):1191–1231, 2020.
- [5] L.C. Berselli, S. Fagioli, and S. Spirito. **Suitable weak solutions of the Navier-Stokes equations constructed by a space-time numerical discretization.** *Journal de Mathematiques Pures et Appliquees*, 125:189 – 208, 2019.
- [6] M. Di Francesco, S. Fagioli, and E. Radici. **Deterministic particle approximation for nonlocal transport equations with nonlinear mobility.** *Journal of Differential Equations*, 266(5):2830–2868, 2019.
- [7] M. Burger, M. Di Francesco, S. Fagioli, and A. Stevens. **Sorting phenomena in a mathematical model for two mutual attracting/repelling species.** *SIAM Journal on Mathematical Analysis*, 50(3):3210–3250, 2018.
- [8] J.A. Carrillo, S. Fagioli, F. Santambrogio, and M. Schmidtchen. **Splitting schemes & segregation in reaction-(cross-)diffusion systems.** *SIAM Journal on Mathematical Analysis*, 50(5):5695–5718, 2018.
- [9] M. Di Francesco, A. Esposito, and S. Fagioli. **Nonlinear degenerate cross-diffusion systems with nonlocal interaction.** *Nonlinear Analysis*, 169:94–117, 2018.
- [10] S. Fagioli and E. Radici. **Solutions to aggregation-diffusion equations with nonlinear mobility constructed via a deterministic particle approximation.** *Mathematical Models and Methods in Applied Sciences*, 28(9):1801–1829, 2018.
- [11] M. Di Francesco, S. Fagioli, and M.D. Rosini. **Deterministic particle approximation of scalar conservation laws.** *Bollettino dell’Unione Matematica Italiana*, 10(3):487–501, Sep 2017.
- [12] M. Di Francesco, S. Fagioli, and M.D. Rosini. **Many particle approximation of the Aw-Rascle-Zhang second order model for vehicular traffic.** *Mathematical Biosciences and Engineering*, 14(1):127–141, 2017.

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- [13] M. Di Francesco, S. Fagioli, M.D. Rosini, and G. Russo. **Deterministic particle approximation of the Hughes model in one space dimension.** *Kinetic and Related Models*, 10(1):215–237, 2017.
- [14] M. Di Francesco and S. Fagioli. **A nonlocal swarm model for predators-prey interactions.** *Mathematical Models and Methods in Applied Sciences*, 26(02):319–355, 2016.
- [15] M. Di Francesco and S. Fagioli. **Measure solutions for non-local interaction PDEs with two species.** *Nonlinearity*, 26:2777–2808, 2013.

Book chapter

- [1] M. Di Francesco, S. Fagioli, M.D. Rosini, and G. Russo. **Follow-the-Leader approximations of macroscopic models for vehicular and pedestrian flows.** In N. Bellomo, P. Degond, and E. Tadmor, editors, *Active Particles, Volume 1*, chapter 9, pages 333–378. Birkhäuser Basel, 2017.

Proceedings

- [1] S. Fagioli, A. Festa, C. Lattanzio, M. Bellotti, G. Cutrupi, C. Criminisi, G. Muratore, D. Micheli, and A. Vannelli. **On the Validity of the LWR Model.** *To appear on "Transportation Research Board 2021 Annual Meeting"*, 2021.
- [2] M. Di Francesco, S. Fagioli, M.D. Rosini, and G. Russo. **A deterministic particle approximation for non-linear conservations laws.** In Klingenberg C. and Westdickenberg M., editors, *Theory Numerics and Applications of Hyperbolic Problems I*, pages 487–499. Springer Proceedings in Mathematics & Statistics 236, 2018.

Research projects

As Principal Investigator

- 2016 **GNAMPA miniproject**, *Modelli fluido-dinamici con applicazioni alla fisica, alla biologia e alle scienze sociali.*

As Participant

- 2017 **GNAMPA miniproject**, *Analisi dei modelli matematici della fisica della biologia e delle scienze sociali*, P.I. Stefano Spirito.
- 2015 **PRIN 2015**, *Hyperbolic systems of conservation laws and fluid dynamics: anlysis and application*, P.I. Stefano Bianchini.
- 2015 **GNAMPA miniproject**, *Analisi e stabilità per modelli di equazioni alle derivate parziali nella matematica applicata*, P.I. Paolo Antonelli.
- 2013 **GNAMPA miniproject**, *Stabilità, comportamenti asintotici e limiti singolari per modelli iperbolici-parabolici nelle scienze applicate*, P.I. Donatella Donatelli.

2012 **PRIN 2012**, *Equazioni a derivate parziali nonlineari di tipo iperbolico, dispersivo ed equazioni di trasporto: aspetti teorici e applicativi*, P.I. Stefano Bianchini.

Supervision of doctoral students and post-doctoral researchers

- 2020 - Member of the Doctoral Committee in Mathematics and Models, Università degli Studi dell'Aquila, Ciclo XXXVI - since 08-04-2020.
- 2019 - 2020 Supervision of the post-graduate research grant: "Asymptotic behaviour for an aggregation/diffusion predator-prey model". Grant holder: Dr. Yahya Jaafra.
- 2016 - Co-supervision of doctoral students at Università degli Studi dell'Aquila within the Doctoral Program in Mathematics and Models.
- Antonio Esposito: he defended his thesis in March 2019.
 - Yahya Jaafra: he defended his thesis in April 2020.
 - Valeria Iorio: currently year II student.

Visiting research periods

- October 2019 **Centre for Analysis, Scientific Computing, and Applications**, Eindhoven University of Technology, Eindhoven (NL).
- January-March 2017 **Department of Mathematics**, Imperial College, London (UK).
- June 2014 **Department of Mathematics**, University of Catania, Catania (Italy).
- February-March 2014 **Department of Mathematical Sciences**, University of Bath, Bath (UK).
- October 2012-March 2012-November 2013 **Department of Mathematical Sciences**, University of Bath, Bath (UK).
- November 2012 **Institute for Computational and Applied Mathematics**, University of Münster, Münster (Germany).
- March-May 2012 **Departamento de Matemáticas**, Universitat Autònoma de Barcelona, Barcelona (Spain).

Organization of scientific events

- 2019 **Cross-diffusion systems, gradient flows, and their perturbations**, L'Aquila (Italy), Organizing committee.
- 2018 **136th European Study Groups with Industry (ESGI)**, L'Aquila (Italy), Organizing committee.
- 2017 **Optimal Transport and PDE's in Applied Sciences**, L'Aquila (Italy), Organizing committee.
- 2015 **Collective dynamics in gradient flows and entropy driven structures**, L'Aquila (Italy), Organizing committee.

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2014 **Spring School on Microscopic descriptions and mean-field equations in physics and social sciences**, Bath (UK), Organizing committee.

Invitations to conferences and workshops, seminars and talks

Invited speaker at conferences and workshops

- February 2020 **"Stationary states for systems of cross diffusion nonlocal interactions"**, *Recent Advances in Degenerate Parabolic Systems with Applications to Mathematical Biology*, Laboratoire Jacques-Louis Lions, Paris.
- January 2020 **"Nonlinear diffusion equations with degenerate mobilities"**, *Workshop on PDEs: Modelling, Analysis and Numerical Simulation, PDE-MANs 2020*, Granada.
- May 2019 **"Aggregation/Diffusion equations via deterministic particles approximation"**, *Workshop: Probabilistic and variational methods in kinetic theory*, Bonn.
- July 2017 **"Sorting phenomena in a mathematical model for two mutually attracting/repelling species"**, *Workshop on Aggregation-Diffusion PDEs: Variational Principles, Nonlocality and Systems*, Anacapri.
- June 2017 **"Sorting phenomena in a mathematical model for two mutually attracting/repelling species"**, *Workshop on PDEs: Modelling, Analysis and Numerical Simulation*, Granada.

Invited seminars at Universities

- October 2019 **"Deterministic particle approximation for equations in traffic flow and biology."**, *Eindhoven University of Technology*, Eindhoven.
- March 2017 **"Systems of nonlocal interaction equations"**, *Applied PDEs Seminar at Imperial College*, Imperial College London.
- November 2012 **"Nonlocal interaction equations with two species"**, *Institute for Computational and Applied Mathematics, University of Münster*, Münster (Germany).

Contributed talks

- June 2019 **"Aggregation/diffusion models for opinion formation"**, *Crowds, models and control*, CIRM-Marseille.
- September 2018 **"System of nonlocal interactions PDEs with Newtonian potentials in 1d"**, *Interactive workshop on hyperbolic equations*, Ferrara.
- June 2018 **"Systems of Cross-diffusion with nonlocal interactions"**, *XVII International Conference on Hyperbolic Problems Theory, Numerics, Applications*, Penn State.

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- September 2017 **"Suitable weak solutions of Navier-Stokes obtained by a full discrete scheme"**, *XVII Italian Meeting on Hyperbolic Equations IperPV2017*, Pavia.
- 2016 **"Deterministic particle approximation of scalar conservation laws"**, *GSSI summer school on fluid dynamics and related topics*, L'Aquila (Italy).
- October 2015 **"Many particle approximation of nonlinear scalar conservation laws for vehicular traffics"**, *XVI Italian Meeting on Hyperbolic Equations IperGSSI2015*, L'Aquila (Italy).
- July 2014 **"Nonlocal interaction equations with two species"**, *SIMAI 2014: SisCo-SIMAI mini-symposium*, Taormina (Italy).
- September 2013 **"Measure solutions for nonlocal interaction PDEs with two species"**, *XXXVIII Summer School on Mathematical Physics*, Contributed talk, Ravello (Italy).

Posters

- June 2015 **"Nonlocal interaction equations with two species"**, *Numerical approximations of hyperbolic systems with source terms and applications*, Poster, Cortona (Italy).
- May 2014 **"Nonlocal interaction equations with two species"**, *Spring School on Microscopic descriptions and mean-field equations in physics and social sciences*, Bath (UK).

Conferences, workshops and schools as participant

- 2020 **Recent Advances in Degenerate Parabolic Systems with Applications to Mathematical Biology**, Laboratoire Jacques-Louis Lions, Paris.
- 2020 **Workshop on PDEs: Modelling, Analysis and Numerical Simulation, PDE-MANs 2020**, Granada.
- 2019 **Crowds, models and control**, CIRM-Marseille.
- 2019 **Workshop: Probabilistic and variational methods in kinetic theory**, Bonn.
- 2018 **Interactive workshop on hyperbolic equations**, Ferrara.
- 2018 **XVII International Conference on Hyperbolic Problems Theory, Numerics, Applications**, Penn State (US).
- 2018 **9th Summer school Methods and Models of Kinetic Theory M&MKT 2018**, Porto Ercole (Italy).
- 2018 **136th European Study Groups with Industry (ESGI)**, L'Aquila(Italy).
- 2017 **XVII Italian Meeting on Hyperbolic Equations (IperPV)**, Pavia (Italy).
- 2017 **Workshop on Aggregation-Diffusion PDEs: Variational Principles, Nonlocality and Systems**, Anacapri (Italy).

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- 2017 **Workshop on PDEs: Modelling, Analysis and Numerical Simulation**, Granada (Spain).
- 2017 **Optimal Transport and PDE's in Applied Sciences**, L'Aquila (Italy).
- 2016 **GSSI summer school on fluid dynamics and related topics**, L'Aquila (Italy).
- 2016 **Cime summer school: Nonlocal and nonlinear diffusion and interactions: new methods and directions**, Cetraro (Italy).
- 2015 **XVI Italian Meeting on Hyperbolic Equations IperGS-SI2015**, L'Aquila (Italy).
- 2015 **Nonlocal Nonlinear Partial Differential Equations and Applications**, Anacapri (Italy).
- 2015 **Numerical approximations of hyperbolic systems with source terms and applications**, Cortona (Italy).
- 2015 **Collective dynamics in gradient flows and entropy driven structures**, L'Aquila (Italy).
- 2014 **SIMAI 2014**, Taormina (Italy).
- 2014 **Summer School on Geometric Measure Theory and Geometric Analysis**, Basel (Switzerland).
- 2014 **Spring School on Microscopic descriptions and mean-field equations in physics and social sciences**, Bath (UK).
- 2013 **XXXVIII Summer School on Mathematical Physics**, Ravello (Italy).
- 2013 **Tenth meeting on Hyperbolic Conservation Laws: Recent results and Research perspectives**, L'Aquila (Italy).
- 2013 **Seventh Summer School in Analysis and Applied Mathematics**, Roma (Italy).
- 2013 **Basel Junior Symposium in Analysis**, Basel (Switzerland).
- 2012 **ESF-EMS-ERC COM Research Conference Applied Partial Differential Equations in Physics, Biology and Social Sciences: Classical and Modern Perspectives**, Barcelona (Spain).
- 2012 **Scuola Matematica Inter-universitaria**, Cortona (Italy).
- 2011 **Frontiers of Mathematics and Application - Summer Course UIMP 2011**, Santander (Spain).
- 2011 **Seismath - Mathematical Models in Seismology I.P.**, L'Aquila (Italy).
- 2010 **MathMods 2010 - Mathematical Models in Life Science I.P.**, L'Aquila (Italy).
- 2009 **MathMods 2009 - Mathematical Models in Life Science I.P.**, Alba Adriatica (Italy).

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2009 **Co-Nan: Computational Nanotechnology I.P.**, Gdansk (Poland).

Teaching activities

Courses for within Doctoral programs

Spring 2019 **An Introduction to Optimal Mass Transport**, *Doctorate program in Mathematics and Models*, English.
Università degli Studi dell'Aquila

Spring 2018 **An introduction to Numerical Methods for scalar conservation laws**, *Doctorate program in Mathematics and Models*, English.
Università degli Studi dell'Aquila

Courses for Bachelor and Master Degrees

Fall 2020 **Analysis B**, *Bachelor Degree in Mathematics and Bachelor Degree in Physics*, Italian.
Università degli Studi dell'Aquila

Fall 2020 **Biomathematics**, *Master Degree in Mathematical Engineering and Mathematical Modelling*, English.
Università degli Studi dell'Aquila

Fall 2019 **Functional Analysis in Applied Mathematics and Engineering**, *Master Degree in Mathematical Engineering and Mathematical Modelling*, English.
Università degli Studi dell'Aquila

Fall 2019 **Biomathematics**, *Master Degree in Mathematical Engineering and Mathematical Modelling*, English.
Università degli Studi dell'Aquila

Spring 2019 **An Introduction to Optimal Mass Transport**, *Doctorate program in Mathematics and Models*, English.
Università degli Studi dell'Aquila

Fall 2018 **Analysis B**, *Bachelor Degree in Mathematics*, Italian.
Università degli Studi dell'Aquila

Spring 2018 **Analysis 2**, *Bachelor Degree in Civil and Construction-Architectural Engineering*, Italian.
Università degli Studi dell'Aquila

Tutoring

Fall 2017 **Exercises classes**, *Functional Analysis*, Master Degree in Mathematical Engineering-MathMods program, English.
Università degli Studi dell'Aquila

Fall 2017 **Tutor**, *Analysis 2*, Bachelor Degree in Mathematics and Bachelor Degree in Physics, Italian.
Università degli Studi dell'Aquila

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- Fall 2016 **Exercises classes**, *Mathematical Methods for Engineering*, Master Degree in Mathematical Engineering-MathMods program, English.
Università degli Studi dell'Aquila
- Fall 2016 **Tutor**, *Analysis 2*, Bachelor Degree in Mathematics and Bachelor Degree in Physics, Italian.
Università degli Studi dell'Aquila
- Spring 2016 **Exercises classes**, *Analysis 2*, Bachelor Degree in Information Engineering, Italian.
Università degli Studi dell'Aquila
- Fall 2015 **Exercises classes**, *Functional Analysis*, Bachelor Degree in Mathematics and Master Degree in Mathematical Engineering-MathMods program, English.
Università degli Studi dell'Aquila
- Fall 2015 **Exercises classes**, *Analysis 2*, Bachelor Degree in Mathematics and Bachelor Degree in Physics, Italian.
Università degli Studi dell'Aquila
- Fall 2014 **Exercises classes**, *Functional Analysis*, Bachelor Degree in Mathematics and Master Degree in Mathematical Engineering-MathMods program, English.
Università degli Studi dell'Aquila
- Fall 2014 **Tutor**, *Analysis 2*, Bachelor Degree in Mathematics, Italian.
Università degli Studi dell'Aquila
- Fall 2013 **Tutor**, *Analysis 2*, Bachelor Degree in Mathematics, Italian.
Università degli Studi dell'Aquila

Supervision of Master and Bachelor students

- 2020 **Maria Santina Carbonelli**, *Master Degree in Mathematical Engineering*, On the existence and asymptotic behaviour of a chemotaxis model with logistic growth.
- 2020 **Cecilia Di Primio**, *Master Degree in Mathematics*, Mathematical Analysis of Chemotaxis-Navier Stokes systems, co-supervised with Prof. Donatella Donatelli.
- 2019 **Michela Sallese**, *Bachelor Degree in Mathematics*, Sincronizzazione completa per il modello di Kuramoto.
- 2018 **Davide D'Innocente**, *Bachelor Degree in Mathematics*, Un modello di tipo swarming per interazioni preda-predatore.

Administrative work

- November 2018 - Member of the Study Course Committee in Mathematical Engineering (MSc course)
- November 2018 - Member of the Study Course Committee in Mathematics (BSc and MSc courses)

- April 2020 - Member of the Committee of the Study Course in Mathematical Engineering for the Promotion of the Study Programmes Mathematical Engineering and Mathematical Modelling
- September 2020 - Member of the Study Course Committee in Physics (BSc and MSc courses)

Transfer of knowledge activity with private industries

- 2019 - Collaboration with TIM - Telecom Italia Mobile spa on the possible applications of mathematical modelling of vehicular mobility flows, to real contexts by using real mobility data. This study intends to demonstrate the feasibility of reconstructibility with data of road mobility flows in urban and extra-urban areas at different scales of description of the phenomenon (micro / macro), experimentally confirming the goodness of the models produced. The final goal is to use this evaluation and the comparison with real road traffic flows, in order to estimate the effects on vehicular traffic deriving from road changes (so-called what-if scenarios), evaluating the potential benefits also in environmental terms for effects of increase or decrease in vehicular fluidity.

Languages

- Italian **Mother tongue.**
English **Level B1.**
Spanish **Basic.**

Computational and programming skills

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|----------|----------------------------|-----------|--------------------------------------|
| Software | Microsoft Office | Packages | Mathematica, Matlab, \LaTeX |
| Systems | MacOS, Unix/Linux, Windows | Languages | Java |

Memeberships

- GNAMPA, Indam
- SisCo-SIMAI
- UMI