Clarissa ASTUTO
e-mail: clarissa.astuto@unict.it
Affiliation: Department of Mathematics and Computer Science, Università degli Studi di Catania
Position: Fixed-term Assistant Professor (RTD-A)

Research experience

01/03/2024 - present – Fixed-term Assistant Professor (RTD-A) at Università degli Studi di Catania
At: Department of Mathematics and Computer Science, Università degli Studi di Catania, Italia
Research topics: Asymptotic preserving numerical scheme for a two-carrier multiscale model. Polynomial reconstruction of the first derivative of a signal with noise, which describes high-order interaction in a complex system. Graph extraction from biological network formation and machine learning tools to generate synthetic solutions.

06/07/2023 - 28/02/2024 – POSTDOCTORAL FELLOWSHIP at KAUST, Saudi Arabia
At: Applied Mathematics and Computational Sciences Department, King Abdullah University of Science and Technology, Saudi Arabia
Research advisor: Prof. Daniele Boffi
Research topics: Development of an innovative ghost nodal numerical scheme based on finite element methods for solving partial differential equations in arbitrary domains, with applications to biological network formation in a leaf-shaped domain.

06/07/2022 - 05/07/2023 – POSTDOCTORAL FELLOWSHIP at KAUST, Saudi Arabia
At: Applied Mathematics and Computational Sciences Department, King Abdullah University of Science and Technology, Saudi Arabia
Research advisor: Prof. Daniele Boffi
Research topics: Efficient numerical schemes for the resolution of elliptic-parabolic systems of partial differential equations, describing the formation of complex biological network structures.

06/07/2021 - 05/07/2022 – POSTDOCTORAL FELLOWSHIP at KAUST, Saudi Arabia
At: Applied Mathematics and Computational Sciences Department, King Abdullah University of Science and Technology, Saudi Arabia
Research advisor: Prof. Daniele Boffi
Research topics: High order space and time multiscale modeling of a Poisson-Nernst-Planck system in an arbitrary domain.

31/10/2017 - 16/02/2021 – PhD in Mathematics and Computational Sciences
At: Department of Mathematics and Computer Sciences, Università degli Studi di Catania, Italia
Thesis title: *Multiscale Modeling and Numerics of Sorption Kinetics*
PhD supervisors: Prof. Giovanni Russo
Final result: approved with the additional title of Doctor Europaeus

Education

06/10/2017 – Master Degree in Mathematics
At: Department of Mathematics and Computer Sciences, Università degli Studi di Catania, Italia
Thesis title: *Anomalous Sorption Kinetics of an oscillating bubble: numerical modeling in 1D*
Thesis supervisors: Prof. Giovanni Russo

02/10/2015 – Bachelor Degree in Mathematics
At: Department of Mathematics and Computer Sciences, Università degli Studi di Catania, Italia
Thesis title: *Uncertainty Quantification, Polynomial Chaos Expansion and Quadrature rules*
Thesis supervisors: Prof. Giovanni Russo

Visiting activities

1. **03-07/02/2025 – visiting period**
   At: Department of Mathematics, University of L'Aquila, **Italia**
   Collaborator: Prof. Antonio Esposito

2. **01-05/12/2025 – visiting period**
   At: Department of Mathematics, University of Oxford, **Great Britain**
   Collaborators: Prof. Jose Antonio Carrillo and Dr. Umberto Zerbinati

3. **31/10-10/11/2024 – visiting period**
   At: King Abdullah University of Science and Technology, **Saudi Arabia**
   Collaborators: Prof. Daniele Boffi and Prof. Peter Markowich

4. **March 2023 – visiting period**
   At: Department of Mathematics, University of Rennes, **France**
   Research topic: Development of time multiscale methods for highly oscillatory advection-diffusion model coupled with Navier-Stokes equations

for the fluid velocity.
Local supervisors: Prof. Mohammed Lemou

5. **2 months 2019 – Ph.D. visiting period**
At: Department of Mathematics, University of Rennes, **France**
Research topic: Development of time multiscale methods for highly oscillatory advection-diffusion model in arbitrary domain with sorption kinetics applications.
Local supervisors: Prof. Mohammed Lemou

6. **6 months 2018-2019 – Ph.D. visiting period**
At: Brookes University, Oxford, **Great Britain**
Research topic: Development of ghost-points and geometric multigrid methods for a parabolic problem in an arbitrary domain with time-dependent boundary conditions.
Local research advisor: Prof. Armando Coco

Conferences

- **Invited speaker**

1. *Advances in Ordered Fluids and Alignment Phenomena: Modeling, Analysis, and Numerical Methods* – Golferenzo, Oltrepò Pavese, **Italia** – 14-19/09/2026
2. *Applied Partial Differential Equations: Modelling, Analysis and Numerics* – Sichuan University, Chengdu, **China** – 16-18/05/2026
3. *Advanced Numerical Methods for Parametric PDEs* – Gran Sasso Science Institute, L'Aquila, **Italia** – 11-13/02/2026
4. Seminar at Oxford University – Oxford – 04/12/2025
5. *COUPLED Problems 25* – Villasimius, **Italia** – 26-28/05/2025
6. *3C Conference: Challenges in Computational methods for Complex environmental applications* – Chambery, **France** – 21-23/05/2025
7. Seminar at University of L'Aquila – L'Aquila, **Italia** – 05/02/2025
8. *Numerical Methods for Hyperbolic Balance Laws and Related Problems* – Ferrara, **Italia** – 17-19/12/2024
9. seminar at SIAM chapter – KAUST, **Saudi Arabia** – 03/11/2024
10. *International Congress on Industrial and Applied Mathematics* (ICIAM) – Tokyo, **Japan** – 21-25/08/2023
11. *Innovative numerical methods for evolutionary partial differential equations and applications, final workshop* – Catania, **Italia** – 20-22/02/2023
12. *Multiscale analysis and methods for PDEs: fluids and active matter dynamics* – Singapore, **Singapore** – 6-10/02/2023

13. *Efficient high-order time discretization methods for PDEs* – Anacapri, **Italia** – 11-13/05/2022

- **Contributed talk**

1. *From Micro To Macro in Mathematical Biology* – Politecnico di Torino, Torino, – 09-11/02/2026
2. AMS-UMI Joint meeting – Palermo, **Italia** – 23-26/07/2024
3. *The 19th International Conference on "Hyperbolic Problems: Theory, Numerics and Applications"* (HYP2024) – Shanghai, **China** – 1-5/07/2024
4. *Conference on Domain Decomposition Methods* (DD28) – KAUST, **Saudi Arabia** – 28/01-01/02/2024
5. *African Conference on Computational Mechanic* (AfriComp) – Cape Town, **South Africa** – 2-4/11/2022
6. *International Conference on Hyperbolic Problems* (HYP2022) – Malaga, **Spain** – 20-24/06/2022
7. *Convegno nazionale della Società Italiana di Matematica Applicata e Industriale* (SIMAI) – Parma, **Italia** – 31/08-03/09/2021
8. *The International Congress on Industrial and Applied Mathematics* (ICIAM) – Valencia, **Spain** – 15-19/07/2019

- **Participation**

– Inauguration ceremony of the Academic Year at the *Accademia dei Lincei* – Roma, **Italia** – 14/10/2026
– *Aggregation-Diffusion Equations* – CIRM, Marseille, **France** – 08-12/04/2024
– Structure-preserving methods for nonlinear hyperbolic problems – Oberwolfach seminars, **Germany** – 24-30/11/2019
– MODCLIM - Erasmus+ Project – Catania, **Italia** – 15-19/02/2015; Koblenz, **Germany** – 22-26/04/2015

- **Organizer of minisymposium**

– *Asymptotic-Preserving Schemes and Multiscale Approaches in Biology and Fluid Dynamics*, WCCM-ECCOMAS – Munich, **Germany** – 19-24/07/2026
– *Pattern formation and emergent phenomena in life sciences*, SIAM Conference on Dynamical Systems – Denver, **USA** – 11-15/05/2025

- **Organizer of workshop**

– ETNA: *Efficient Time-stepping Numerical Approaches for PDEs Forward and Inverse models with applications* – Catania, **Italia** – 26-28/11/2025

- **Chair**
  - Masterclass on Numerical Analysis and Scientific Computing – KAUST, **Saudi Arabia** – 25-26/05/2022

Research Grants

- Principal Investigator
  - GNCS 2026 Grant, Istituto Nazionale di Alta Matematica (INdAM), Italia, 2026.
  - Principal Investigator, ISCRA Class C Project, CINECA, 2024. Allocation of computational resources on G100 / Leonardo HPC systems.
- Participation
  - GNCS 2026 Grant, Istituto Nazionale di Alta Matematica (INdAM), Italia, 2025. Principal Investigator: Dr. Emanuele Macca
  - GNCS 2026 Grant, Istituto Nazionale di Alta Matematica (INdAM), Italia, 2023. Principal Investigator: Dr. Giulia Bertaglia
  - Italian Ministerial grant PRIN 2022 "Efficient numerical schemes and optimal control methods for time-dependent partial differential equations", No. 2022N9BM3N.
  - Italian Ministerial grant PRIN 2022 PNRR "FIN4GEO: Forward and Inverse Numerical Modeling of hydrothermal systems in volcanic regions with application to geothermal energy exploitation", No. P2022BNB97.
  - Italian Ministerial grant PRIN 2022 "Advanced numerical methods for time dependent parametric partial differential equations with applications", No. 2022KA3JBA.
  - ITN-ETN Horizon 2020 Project ModCompShock, "Modeling and Computation on Shocks and Interfaces", Project Reference 642768
  - Italian Ministerial grant PRIN 2017 "Innovative numerical methods for evolutionary partial differential equations and applications", No. 2017KKJP4X

Teaching activities

- **Lecturer**
  - Matematica 2 – Department of Chemistry, Università degli Studi di Catania – 2025/2026 - 2026/2027
  - Ulteriori attivita formative – Department of Mathematics and Computer Science, Università degli Studi di Catania – 2025/2026 - 2026/2027

- **Educational support**
  - Tutorato di Calcolo Numerico – Università degli Studi di Catania – 2020/2021

Third Mission activities

- OrientaMat - Summer School – Università degli Studi di Catania – 02-04/09/2025
- Graduate seminar – KAUST, Saudi Arabia – 12/10/2023
- AMS - Applied Mathematics School – KAUST, Saudi Arabia – 08-12/08/2023

Editorial activity

- Junior Editor "Open Mathematics"

References

[CA1] Raudino A., Grassi A., Lombardo G., Russo G., Astuto C., Corti M. Anomalous sorption kinetics of self-interacting particles by a spherical trap, *Communication in Computational Physics* (CiCP), 2021.

[CA2] Astuto C., Boffi D., Haskovec J., Markowich P., Russo G. Comparison of Two Aspects of a PDE Model for Biological Network Formation, *Mathematical and Computational Applications*, 2022.

[CA3] Astuto C., Coco A., Russo G. A finite-difference ghost-point multigrid method for multi-scale modelling of sorption kinetics of a surfactant past an oscillating bubble, *Journal of Computational Physics* (JCP), 2023.

[CA4] Astuto C., Raudino A., Russo G. Multiscale Modeling of Sorption Kinetics, *Multiscale Modeling & Simulation*, (MMS) *SIAM*, 2023.

[CA5] Astuto C., Boffi D., Haskovec J., Markowich P., Russo G. Asymmetry and condition number of an elliptic-parabolic system for biological network formation, *Communications on Applied Mathematics and Computation*, 2023.

[CA6] Astuto C., Boffi D., Credali F., Finite element discretization of a biological network formation system: a preliminary study, *SEMA SIMAI Springer Series*, 2024.

[CA7] Astuto C., Haskovec J., Markowich P. and Portaro S., Self-regulated biological transportation structures with general entropy dissipations, part I: the 1D case, *Journal of Dynamics and Games*, 2024.

[CA8] Astuto C., Lemou M., Russo G., Time multiscale modeling of sorption kinetics I: uniformly accurate schemes for highly oscillatory advection-diffusion equation, *Multiscale Modeling & Simulation*, (MMS) *SIAM*, 2025.

[CA9] Astuto C., High order multiscale methods for advection-diffusion equation in highly oscillatory regimes: application to surfactant diffusion and generalization to arbitrary domains, *Communication in Computational Physics* (CiCP), 2025.

[CA10] Astuto C., Boffi D., Russo G., Zerbinati U., A nodal ghost method based on variational formulation and regular square grid for elliptic problems on arbitrary domains in two space dimensions, *Computer Methods in Applied Mechanics and Engineering* (CMAME), 2025.

[CA11] Astuto C., Coco A. and Zerbinati U., A comparison of the Coco-Russo scheme and ghost-FEM, *Springer Series*, 2026.

[CA12] Astuto C., Markowich P., Portaro S. and Russo G., Self-regulated biological transportation structures with general entropy dissipation: 2D case and leaf-shaped domain, *Multiscale Modeling and Numerical Analysis* (M2AN), 2026 (to appear).

[CA13] Astuto C. and Russo G., chapter in *Choose Your Own Adventure in Mathematical Modeling : A Modular Book for Learning Mathematical Modeling, SIAM* (submitted)

[CA14] Astuto C. and Russo G., Asymptotic Preserving and Accurate scheme for Multiscale Poisson-Nernst-Planck (MPNP) system, (submitted) arXiv:2507.01402, 2025.

[CA15] Astuto C., Standard versus Asymptotic Preserving Time Discretizations for the Poisson–Nernst–Planck System in the Quasi-Neutral Limit, (submitted) arXiv:2511.07964, 2025.

[CA16] H. Dilip, C. Astuto, A. Coco and G. Russo, High order ghost-FEM for incompressible Navier-Stokes equations on moving domains, (submitted) arXiv:2603.19928, 2026.