Clarissa ASTUTO
e-mail: clarissa.astuto@unict.it
Affiliation: University of Catania
Position: Fixed-term Assistant Professor (RTD-A)

Research experience

01/03/2024 - present – Fixed-term Assistant Professor at University of Catania
At: Department of Mathematics and Computer Science, University of Catania, Italy
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
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.

06/07/2022 - 05/07/2023 – Postdoctoral Fellowship at KAUST
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
At: Applied Mathematics and Computational Sciences Department, King Abdullah University of Science and Technology, Saudi Arabia
Research advisor: Prof. Daniele Boffi
Research topics: 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, University of Catania, Italy

Thesis title: *Multiscale Modeling and Numerics of Sorption Kinetics*
PhD supervisors: Prof. Giovanni Russo
Final result: approved with the additional title of Doctor Europaeus

Abroad visiting activities

- **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

- **2 months 2019 – Ph.D. visiting period**
  At: Department of Mathematics, University of Rennes, France
  Research topic: Development of time multiscale methods to describe the oscillations of a bubble immersed in water, where a surfactant freely diffuses. The system considered is an advection-diffusion equation.
  Local supervisors: Prof. Mohammed Lemou

- **March 2023 – PostDoc visiting period**
  At: Department of Mathematics, University of Rennes, France
  Research topic: Development of time multiscale methods to couple the advection-diffusion equation with the Stokes equations for the velocity.
  Local supervisors: Prof. Mohammed Lemou

Conferences

- **Contributed talk**
  - The 19th International Conference on "Hyperbolic Problems: Theory, Numerics and Applications" (HYP2024) – Shanghai – 1-5/07/2024
  - Conference on Domain Decomposition Methods (DD28) – KAUST – 28/01-01/02/2024
  - International Congress on Industrial and Applied Mathematics (ICIAM) – Tokyo – 20-25/08/2023
  - PRIN 2017: Innovative numerical methods for evolutionary partial differential equations and applications, final workshop – Catania – 20-22/02/2023
  - African Conference on Computational Mechnanic (AfriComp) – Cape Town – 2-4/11/2022
  - Efficient high-order time discretization methods for PDEs – Anacapri – 11-13/05/2022

  - International Conference on Hyperbolic Problems (HYP2022) – Malaga – 20-24/06/2022
  - Convegno nazionale della Società Italiana di Matematica Applicata e Industriale (SIMAI) – Parma – 31/08-03/09/2021
  - The International Congress on Industrial and Applied Mathematics (ICIAM) – Valencia – 15-19/07/2019

- **Invited speaker**
  - University of L'Aquila – 05/02/2025
  - SIAM chapter – KAUST – 03/11/2024
  - "Multiscale analysis and methods for PDEs: fluids and active matter dynamics" – Singapore – 6-10/02/2023

- **Organizer of minisymposium**
  - Pattern formation and emergent phenomena in life sciences, SIAM Conference on Dynamical Systems – Denver – 11-15/05/2025

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

Teaching activity

- **Lectures**
  - Graduate seminar – KAUST – 12/10/2023
  - AMS - Applied Mathematics School – KAUST – 08-12/08/2023

- **Educational support**
  - Tutorato di Calcolo Numerico – University of Catania – 2020/2021

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

[CA8] 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.

[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), (accepted) 2025.

[CA10] Astuto C., Boffi D., Russo G., Zerbinati U., A symmetric finite difference ghost point method for elliptic problems on arbitrary domain in one and two space dimensions, (submitted), 2024.

[CA11] Astuto C., Coco A. and Zerbinati U., A comparison of the Coco-Russo scheme and ghost-FEM, *Springer Series* (accepted), 2025.

[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, (submitted), 2024.