Nicolò Varallo

Curriculum Vitae - Scientific and Professional Activities (Updated September 2026)

Milano, Italy — nicolo.varallo@polimi.it

Contents

1 PERSONAL INFORMATION

Name, Surname: Nicolò, Varallo
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Nationality: Italian
Date of Birth: 07 July 1998

2 CURRENT POSITION

Post-Doctoral Research Fellow (Contratto di Ricerca – SSD IIND-07/A - Fisica Tecnica Industriale)
Period: June 2026 - Ongoing
Institution: Politecnico di Milano
Department: Energy
Supervisor: Prof. Giorgio Besagni
Research Title: Experimental characterization of fluid dynamics and mass transfer in CO2-ionic liquids bubble columns
Main Activities: multiscale experimental characterization of bubble columns operating with ionic liquids for CO_2 absorption: investigation of single-bubble dynamics, mass transfer mechanisms, bubble swarm interactions, and hydrodynamic scale-up effects in large-diameter bubble columns

3 EDUCATIONAL ACTIVITIES

PhD cum Laude in Energy and Nuclear Science and Technology
Period: February 2023 - May 2026
Institution: Politecnico di Milano
Department: Energy
Supervisor: Prof. Fabio Inzoli
Research Title: Fluid Dynamics of Air-Water Flows in Parallel Risers: Experimental and Numerical Investigations
Main Activities: Experimental and numerical characterization of the multiphase flow distribution through parallel vertical pipes. Design and construction of an experimental facility, development of experimental techniques to characterize the dynamic behaviour of the system and to clarify the multiscale connections between the local and global flow properties. Development and validation of CFD codes aimed at providing information complementary to the experimental results to gain a better insight into the physics of the phenomena

Master of Science in Energy Engineering
Period: September 2020 - December 2022
Institution: Politecnico di Milano
Supervisor: Prof. Giorgio Besagni
Thesis Title: Bubble Column Reactors: the Determinants of the Flow Regime Transitions and Computational Fluid Dynamics Modelling Approaches
Main Activities: Development of a statistical framework for modelling flow regime transitions in large-scale bubble columns. Development and validation of a CFD model, including both mono-dispersed and bi-dispersed approaches, to simulate the flow field under varying operating conditions

Bachelor's Degree in Energy Engineering
Period: September 2017 - September 2020
Institution: Politecnico di Milano

4 GUEST RESEARCHER POSITIONS

Complex Fluids and Flows Unit, Okinawa Institute of Technology (OIST)
Period: June 2026
Institution: Okinawa Institute of Technology (OIST)
Department: Complex Fluids and Flows Unit
Contact: Prof. Marco Edoardo Rosti (marco.rosti@oist.jp)

Main Activities: Direct numerical simulation of single bubbles rising in a quiescent liquid in confined and unconfined containers: influence of confinement on bubble rise velocity and shape

Chemical Engineering and Technology Department, IFP Energies nouvelles (IFPEN), France
Period: March 2026 - May 2026
Institution: IFP Energies nouvelles (IFPEN)
Department: Chemical Engineering and Technology
Contact: Dr. Alexis Tourbier (alexis.tourbier@ifpen.fr)
Main Activities: CFD simulations of industrial-scale bubble columns operating with different liquid phases. Development of a closure model for the drag coefficient and implementation into the source code. Validation of the numerical model based on both local and global flow properties

Computational Fluid Dynamics Department, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany
Period: April 2025 - October 2025
Institution: Helmholtz-Zentrum Dresden-Rossendorf (HZDR)
Department: Computational Fluid Dynamics
Contact: Dr. Dirk Lucas (d.lucas@hzdr.de)
Main Activities: CFD simulations of multiphase flows using a Hybrid Morphology-Adaptive Multi-Fluid Model (MultiMorph). Validation of the numerical framework considering different flow regimes. Coupling with a population balance model to track the evolution of the bubble size

5 TEACHING ACTIVITIES

5.1 Academic Teaching

Invited Lecturer (20 hours) - PhD Course (1 CFU): Hands-On CFD Modelling: Mesh, Solve, and Analyze Complex Flows in ANSYS Fluent
Invited by Prof. Marco Edoardo Rosti (marco.rosti@oist.jp), Complex Fluids and Flows Unit, Okinawa Institute of Technology (OIST)
Period: June 2026
Course Description: the course in applied Computational Fluid Dynamics (CFD) aims to introduce the basic knowledge required for computational fluid dynamics modelling of complex engineering problems. The course is designed to guide students through the complete workflow of numerical simulation, from mesh generation to validation against experimental data. The aim of the hands-on sessions is to provide a comprehensive overview of the ANSYS Fluent CFD software workflow, covering high-quality 2D and 3D mesh generation, case setup, and post-processing of simulation results. In particular, the course focuses on simulation techniques for single-phase flows, with applications to both external and internal geometries

5.2 Teaching Assistance

Teaching assistant (16 hours)
Course: Fisica Tecnica (083795), 10 CFU, SSD: IIND-07/A. Graduate course in Aerospace Engineering, Politecnico di Milano, Italy
Period: November 2025 - January 2026 Lecturer: Prof. Fabio Inzoli
Main activities: delivering ex-cathedra lessons, student support and hands-on sessions

Teaching assistant (22 hours)
Course: Fisica Tecnica (083795), 10 CFU, SSD: IIND-07/A. Graduate course in Aerospace Engineering, Politecnico di Milano, Italy
Period: November 2025 - January 2026 Lecturer: Prof. Giorgio Besagni
Main activities: delivering ex-cathedra lessons, student support and hands-on sessions

Teaching assistant (13 hours)
Course: Fisica Tecnica (083795), 10 CFU, SSD: ING-IND/10. Graduate course in Aerospace Engineering, Politecnico di Milano, Italy
Period: September 2024 - January 2025 Lecturer: Prof. Fabio Inzoli
Main activities: delivering ex-cathedra lessons, student support and hands-on sessions

Teaching assistant (13 hours)
Course: Fisica Tecnica (083795), 10 CFU, SSD: ING-IND/10. Graduate course in Aerospace Engineering, Politecnico di Milano, Italy
Period: September 2024 - January 2025 Lecturer: Prof. Giorgio Besagni

Main activities: delivering ex-cathedra lessons, student support and hands-on sessions

Teaching assistant (20 hours)
Course: Fisica Tecnica (083795), 10 CFU, SSD: ING-IND/10. Graduate course in Aerospace Engineering, Politecnico di Milano, Italy
Period: September 2023 - January 2024 Lecturer: Prof. Fabio Inzoli
Main activities: delivering ex-cathedra lessons, student support and hands-on sessions

Teaching assistant (20 hours)
Course: Fisica Tecnica (083795), 10 CFU, SSD: ING-IND/10. Graduate course in Aerospace Engineering, Politecnico di Milano, Italy
Period: September 2023 - January 2024 Lecturer: Prof. Giorgio Besagni
Main activities: delivering ex-cathedra lessons, student support and hands-on sessions

Teaching assistant (20 hours)
Course: Fisica Tecnica (083795), 10 CFU, SSD: ING-IND/10. Graduate Course in Computer Science and Engineering, Politecnico di Milano, Italy
Period: March 2023 - June 2023 Lecturer: Prof. Giorgio Besagni
Main activities: delivering ex-cathedra lessons, student support and hands-on sessions

5.3 Other Educational Contribution

Invited Lecturer (2 hours): CFD modelling of bubble columns using the EE modelling approach: from the mono-dispersed to the pure-heterogeneous flow regime
Invited by Prof. Giorgio Besagni (giorgio.besagni@polimi.it), Politecnico di Milano
Graduate Course in CFD for Nuclear Engineering, Politecnico di Milano, Italy
Date: 13 November 2023

5.4 Supervision of Undergraduate Students

Morphology-Adaptive Simulations of Bubbly Flow in Poly-Dispersed Regimes
Supervisor: Prof. Giorgio Besagni
Thesis in collaboration with Computational Fluid Dynamics Department, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany (Dr. Fabian Schlegel: f.schlegel@hzdr.de)

Direct Numerical Simulation of Single Rising Bubble: Determining the Influence of Confinement on Aspect Ratio and Interfacial Area
Supervisor: Prof. Giorgio Besagni
Thesis in collaboration with Complex Fluids and Flows Unit, Okinawa Institute of Technology (OIST), Japan (Prof. Marco Edoardo Rosti: marco.rosti@oist.jp)

Computational Fluid Dynamics Simulations of Multiphase Jets
Supervisor: Prof. Giorgio Besagni
Thesis in collaboration with Computational Fluid Dynamics Department, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany (Dr. Roland Rzehak: r.rzehak@hzdr.de)

Numerical Investigation of Mass Transfer Phenomena in a Bubble Column with Ionic Liquid for CO_2 absorption
Supervisor: Prof. Giorgio Besagni

Direct Numerical Simulation of Single Rising Bubble: Determining Aspect Ratio and Interfacial Area
Supervisor: Prof. Giorgio Besagni
Thesis in collaboration with Complex Fluids and Flows Unit, Okinawa Institute of Technology (OIST), Japan (Prof. Marco Edoardo Rosti: marco.rosti@oist.jp)

CFD Simulation of Horizontal Annular Flow through an Orifice Plate using a Hybrid Morphology-Adaptive Two-Fluid Model
Supervisor: Prof. Giorgio Besagni
Thesis in collaboration with Computational Fluid Dynamics Department, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany (Dr. Fabian Schlegel: f.schlegel@hzdr.de)

Computational fluid dynamics modelling of bubble column reactors: the Eulerian-Eulerian and

Multifield Morphology Adaptive Two-Fluid approaches
Supervisor: Prof. Giorgio Besagni
Thesis in collaboration with Computational Fluid Dynamics Department, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany (Dr. Fabian Schlegel: f.schlegel@hzdr.de)

On the stability of a bubble column: Euler–Euler simulation with co-current and counter-current flow
Supervisor: Prof. Giorgio Besagni
Thesis in collaboration with Computational Fluid Dynamics Department, Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany (Dr. Roland Rzehak: r.rzehak@hzdr.de)

Computational fluid-dynamics modeling and statistical analysis of gas-liquid downwards annular flow
Supervisor: Prof. Giorgio Besagni
Thesis in collaboration with Department of Chemical Engineering - Faculty of Engineering, Imperial College, United Kingdom (Prof. Christos Markides: c.markides@imperial.ac.uk)

6 RESEARCH ACTIVITIES

6.1 Research Field Description

I obtained a PhD in Energy and Nuclear Science and Technology from Politecnico di Milano in 2026. During my doctoral studies, I worked at the "Laboratorio Termo-Idraulico Sperimentale e CFD (TheCFD Lab@Energy)". My research focuses on multiphase fluid dynamics, where I combine experimental and numerical approaches to study complex multiphase flows. In particular, I aim to address the inherently multiscale nature of these systems by establishing quantitative links between local and global flow properties.

Research Activity #1. Experimental Investigations of Multiphase Flows

My experimental research focuses on the multiscale analysis of multiphase flows, with particular attention to bubble column reactors, spanning from the bubble scale to the reactor scale. At the local scale, I investigate single-bubble dynamics, bubble swarm interactions, and interfacial phenomena governing momentum and mass transfer. These studies are aimed at developing physically grounded closure relations for Euler–Euler simulations and at improving the understanding of flow regime transitions in gas–liquid systems. At the reactor scale, my work focuses on the hydrodynamics and transport phenomena in bubble columns, including applications to CO_2 absorption systems employing ionic liquids as absorbent media, where mass-transfer mechanisms play a crucial role in process efficiency.

During my PhD (2023–2026) at the "Laboratorio Termo-Idraulico Sperimentale e CFD (TheCFD Lab@Energy)", supported by a doctoral scholarship funded by Eni, I investigated flow instabilities and phase maldistribution phenomena in systems with parallel channels and risers, relevant to oil and gas transport applications. To address these problems, I designed and developed an experimental facility consisting of a horizontal pipe feeding two vertical risers. The experimental characterization considered both local flow properties, such as liquid wave velocity and local void fraction, and global flow properties, such as gas and liquid holdup and flow regime transitions. This work aimed to clarify the coupling between local and global flow dynamics and to identify the mechanisms responsible for instability-driven phase maldistribution in complex multiphase systems.

Research Activity #2. Numerical Investigations of Multiphase Flows
This research activity focuses on the development and application of numerical methods for multiphase flows. The numerical approaches are based on CFD models implemented in ANSYS Fluent and OpenFOAM. To support the development and validation of these approaches, I undertook a guest research stay at HZDR in 2025. During this period, the focus was on advanced numerical methods for the simulation of multiphase flows. As a key outcome, the MultiMorph model was successfully coupled with a population balance model and extended to account for multiple dispersed phases. Besides this, my research interests also include the numerical modelling of bubble columns, spanning from the bubble scale to the reactor scale. The bubble scale is investigated through DNS in collaboration with OIST (Prof. Marco Edoardo Rosti, head of the Complex Fluids and Flows Unit). During my research visit at OIST, I investigated the influence of confinement on bubble shape and terminal velocity. The information derived from the bubble-scale analysis is used to develop closure models to be implemented in an Euler–Euler framework aimed at studying the reactor scale. This activity is performed in collaboration with HZDR (Dr. Dirk Lucas, Head of the Computational Fluid Dynamics Department) and IFP Energies nouvelles (IFPEN) (Dr. Alexis Tourbier), where I carried out a research visit in 2026.

6.2 National/International Research Collaboration

Researcher in the **SESAM Research Group, Department of Energy**, Politecnico di Milano, Italy
Period: February 2023 - Ongoing
Research Contribution: experimental and numerical investigation of multiphase flows, focusing on the multiscale connection between local and global flow properties and on the development of numerical models to gain deeper insight into the physical phenomena

Collaboration with **Computational Fluid Dynamics Department, Helmholtz-Zentrum Dresden-Rossendorf (HZDR)**, Germany
Period: June 2023 - Ongoing
Contact: Dr. Dirk Lucas (d.lucas@hzdr.de), Dr. Fabian Schlegel (f.schlegel@hzdr.de), Dr. Roland Rzehak (r.rzehak@hzdr.de), Dr. Hendrik Hessenkemper (h.hessenkemper@hzdr.de)
Research Contribution: numerical simulation of multiphase flows within the Euler–Euler and MultiMorph approaches. Experimental study of single-bubble dynamics and bubble swarms

Collaboration with **Complex Fluids and Flows Unit, Okinawa Institute of Technology (OIST)**, Japan
Period: January 2024 - Ongoing
Contact: Prof. Marco Edoardo Rosti (marco.rosti@oist.jp)
Research Contribution: DNS simulations of a single bubble rising in a quiescent liquid: study of bubble rise velocity, bubble shape, and the effect of confinement on bubble dynamics

Collaboration with **Chemical Engineering and Technology Department, IFP Energies nouvelles (IFPEN)**, France
Period: October 2024 - Ongoing
Contact: Dr. Frederic Augier (frederic.augier@ifpen.fr)
Research Contribution: CFD simulations of industrial-scale bubble columns within the Euler–Euler framework

Collaboration with **Department of Chemical Engineering - Faculty of Engineering, Imperial College**, United Kingdom
Period: March 2023 - October 2023
Contact: Prof. Christos Markides (c.markides@imperial.ac.uk)
Research Contribution: Multiscale analysis of annular flows. Development of CFD codes to simulate gas–liquid annular flows and investigate their multiscale nature

7 PUBLICATIONS

7.1 Publications in International Journals

J1 **Varallo, N.**, Manfrè, R., Mereu, R., Besagni, G., Krull, B., Schlegel, F., & Lucas, D. (2026). Capabilities and limitations in the computational modelling of homogeneous flow regimes in a pilot-scale bubble column with focus on lateral lift force. *Nuclear Engineering and Design*. Accepted for publication

J2 Ferrario, A., **Varallo, N.**, Besagni, G., & Mereu, R. (2026). Gas holdup and flow regime transitions in a large-diameter bubble column: impact of gas phase properties. In *Journal of Physics: Conference Series* (Vol. 3258, No. 1, p. 012002). IOP Publishing (doi: `https://doi.org/10.1088/1742-6596/3258/1/012002`)

J3 **Varallo, N.**, Ferrario, A., Zardin, S., Mereu, R., Besagni, G., & Rzehak, R. (2026). On the stability of the homogeneous flow regime in bubble columns. In *Journal of Physics: Conference Series* (Vol. 3258, No. 1, p. 012004). IOP Publishing (doi: `https://doi.org/10.1088/1742-6596/3258/1/012004`)

J4 Nedeltchev, S., Mühlbauer, A., Ferrario, A., **Varallo, N.**, Marchini, S., Pjontek, D., ... & Besagni, G. (2025). Comprehensive Analysis of the Overall Gas Holdup Profiles in Various Air-Water Bubble Columns. *Journal of Chemical Engineering of Japan*, 58(1), 2588982 (doi: `https://doi.org/10.1080/00219592.2025.2588982`)

J5 Ferrario, A., **Varallo, N.**, Besagni, G., & Mereu, R. (2025). Influence of the gas phase on a large-scale bubble column fluid dynamics: Gas holdup, flow regime transitions, and bubble size distributions. *Chemical Engineering Science*, 302, 120792 (doi: `https://doi.org/10.1016/j.ces.2024.120792`)

J6 **Varallo, N.**, Besagni, G., Mereu, R., & Inzoli, F. (2025). Computational fluid dynamics simulation of the homogeneous flow regime in a large-scale bubble column. In *Journal of Physics: Conference Series* (Vol. 2940, No. 1, p. 012003). IOP Publishing (doi: `https://doi.org/10.1088/1742-6596/2940/1/012003`)

J7 **Varallo, N.**, Mereu, R., Besagni, G., & Inzoli, F. (2024). Computational fluid dynamics modelling of

large-scale bubble columns: from the mono-dispersed to the pure heterogeneous flow regime. In *Journal of Physics: Conference Series* (Vol. 2766, No. 1, p. 012059). IOP Publishing (doi: `https://doi.org/10.1088/1742-6596/2766/1/012059`)

J8 **Varallo, N.**, Besagni, G., & Mereu, R. (2024). A lumped parameter approach for determining the pressure gradient in gas-liquid annular flows. In *Computer Aided Chemical Engineering* (Vol. 53, pp. 31–36). Elsevier (doi: `https://doi.org/10.1016/B978-0-443-28824-1.50006-5`)

J9 **Varallo, N.**, Besagni, G., Mereu, R., & Inzoli, F. (2024). Two Phase Bubble Columns: the Determinants of the Flow Regime Transitions. In *Journal of Physics: Conference Series* (Vol. 2685, No. 1, p. 012061). IOP Publishing (doi: `https://doi.org/10.1088/1742-6596/2685/1/012061`)

J10 **Varallo, N.**, Mereu, R., Besagni, G., & Markides, C. N. (2024). Computational fluid dynamics modelling of the regular wave flow regime in air-water downwards annular flows. *Chemical Engineering Research and Design*, 201, 631–644 (doi: `https://doi.org/10.1016/j.cherd.2023.11.062`)

J11 **Varallo, N.**, Besagni, G., & Mereu, R. (2023). Computational fluid dynamics simulation of the heterogeneous regime in a large-scale bubble column. *Chemical Engineering Science*, 280, 119090 (doi: `https://doi.org/10.1016/j.ces.2023.119090`)

J12 **Varallo, N.**, Besagni, G., & Mereu, R. (2023). Bubble Column Reactors: the Variables Influencing the Mono-dispersed Homogeneous Flow Regime. *Chemical Engineering Transactions*, 100, 361–366 (doi: `https://doi.org/10.3303/CET23100061`)

J13 Besagni, G., **Varallo, N.**, & Mereu, R. (2023). Computational fluid dynamics modelling of two-phase bubble columns: A comprehensive review. *Fluids*, 8(3), 91 (doi: `https://doi.org/10.3390/fluids8030091`)

7.2 Contributions in National/International Conferences

C1 Regert, V., **Varallo, N.**, & Besagni, G. (2026). Numerical Investigation of Bubble Columns with Ionic Liquids for CO_2 Absorption. *CHISA 2026*, Prague, Czech Republic, 23–27 August 2026

C2 Aissaoui, D. E., Ferrario, A., **Varallo, N.**, Hessenkemper, H., & Besagni, G. (2026). Influence of Bubble Release Mechanism on the Rise Velocity and Deformation of Single Bubbles in Aqueous Ionic Liquid Solutions. *CHISA 2026*, Prague, Czech Republic, 23–27 August 2026

C3 Aissaoui, D. E., Ferrario, A., **Varallo, N.**, Rennebaum, H. S., Penn, A., & Besagni, G. (2026). Experimental Investigation of Flow Regime Transitions in a Rectangular Bubble Column Using Bed Expansion and MRI-Based Gas Holdup Measurements. *CHISA 2026*, Prague, Czech Republic, 23–27 August 2026

C4 Krull, B., Tagliabue, E., Meller, R., Lehnigk, R., Tekavčič, M., **Varallo, N.**, Besagni, G., & Schlegel, F. (2026). Morphology-Adaptive Euler–Euler Modeling of Bubbly Multiphase Flows. *WCCM–ECCOMAS 2026*, Munich, Germany, 19–24 July 2026

C5 **Varallo, N.**, Aissaoui, D. E., Ferrario, A., Hessenkemper, H., & Besagni, G. (2026). Preliminary assessment of the drag coefficient of single bubbles rising in water–ionic liquid mixtures. *43rd UIT International Heat Transfer Conference*, Torino, Italy, 22–24 June 2026

C6 **Varallo, N.**, Krull, B., Schlegel, F., & Inzoli, F. (2026). Prediction of flow regime transition in a vertical upward air–water two-phase flow using a Morphology-Adaptive Multi-Fluid Model. *43rd UIT International Heat Transfer Conference*, Torino, Italy, 22–24 June 2026

C7 **Varallo, N.**, Ferrario, A., Zardin, S., Mereu, R., Besagni, G., & Rzehak, R. (2025). On the stability of the homogeneous flow regime in bubble columns. *42nd UIT International Heat Transfer Conference*, Florence, Italy, 23–28 June 2025

C8 **Varallo, N.**, & Inzoli, F. (2025). Experimental study of air–water flow through parallel risers: preliminary results. *42nd UIT International Heat Transfer Conference*, Florence, Italy, 23–28 June 2025

C9 Ferrario, A., **Varallo, N.**, & Besagni, G. (2025). Gas holdup and flow regime transitions in a large-diameter bubble column: impact of gas phase properties. *42nd UIT International Heat Transfer Conference*, Florence, Italy, 23–28 June 2025

C10 Ferrario, A., **Varallo, N.**, Zardin, S., Rzehak, R., & Besagni, G. (2025). A criterion for determining the transition between the homogeneous and the heterogeneous flow regimes in two-phase bubble columns. *10th Thermal and Fluids Engineering Conference (TFEC)*, Virtual, 9–12 March 2025

C11 Besagni, G., Ferrario, A., **Varallo, N.**, Colombo, L. P. M., Parozzi, F., Morandi, S., & Del Corno, A. (2025). Flow structure characterization by image analysis on pool scrubbing under globular and jet injection regimes.

10th Thermal and Fluids Engineering Conference (TFEC), Virtual, 9–12 March 2025

C12 Ferrario, A., **Varallo, N.**, Besagni, G., & Mereu, R. (2024). Multiscale Analysis of Flow Regimes and Stabilization in a Large-Diameter Bubble Column: Impact of Gas Phase Properties. *20th Multiphase Flow Conference and Short Course: Simulation, Experiment and Application*, Dresden, Germany, 11–15 November 2024

C13 **Varallo, N.**, Mazzetti, N., Besagni, G., Mereu, R., & Colombo, L. P. M. (2024). Computational fluid dynamics simulations of oil–water mixture flowing through a sudden expansion. *International Conference on Numerical Methods in Multiphase Flows–5*, Reykjavik, Iceland, 25–28 June 2024

C14 **Varallo, N.**, Besagni, G., & Mereu, R. (2024). Numerical investigation of film thickness and wave statistics in gas–liquid downwards annular flows. *International Conference on Numerical Methods in Multiphase Flows–5*, Reykjavik, Iceland, 25–28 June 2024

C15 **Varallo, N.**, Besagni, G., Mereu, R., & Inzoli, F. (2024). Computational fluid dynamics simulation of the homogeneous flow regime in a large-diameter bubble column. *41st UIT International Heat Transfer Conference*, Naples, Italy, 19–21 June 2024

C16 **Varallo, N.**, & Inzoli, F. (2024). Computational fluid dynamics simulation of a three-phase gas–liquid–liquid flow in a complex geometry. *41st UIT International Heat Transfer Conference*, Naples, Italy, 19–21 June 2024

C17 **Varallo, N.**, Besagni, G., & Mereu, R. (2024). Computational fluid dynamics modelling of large-scale bubble columns: from the mono-dispersed to the pure heterogeneous flow regime. *9th European Thermal Science Conference*, Bled, Slovenia, 9–13 June 2024

C18 **Varallo, N.**, Besagni, G., & Mereu, R. (2023). A lumped parameter approach for determining the pressure gradient in gas–liquid annular flows. *34th European Symposium on Computer Aided Process Engineering*, Florence, Italy, 2–6 June 2023

C19 **Varallo, N.**, Besagni, G., Mereu, R., & Inzoli, F. (2023). Two Phase Bubble Columns: the Determinants of the Flow Regime Transitions. *40th UIT International Heat Transfer Conference*, Assisi, Italy, 25–28 June 2023

C20 **Varallo, N.**, Besagni, G., & Mereu, R. (2023). Two Phase Bubble Columns: the Variables Influencing the Mono-Dispersed Homogeneous Flow Regime. *16th International Conference on Chemical and Process Engineering*, Naples, Italy, 21–24 May 2023

7.3 Code Repository

R1 Schlegel, F., Bilde, K. G., Draw, M., Evdokimov, I., Hänsch, S., Kamble, V. V., Khan, A., Kota, S. P., Krull, B., Lehnigk, R., Li, J., Lyu, H., Meller, R., Petelin, G., Riviera, E., Tekavic, M., **Varallo, N.** (2025, October 21). *Multiphase Code Repository by HZDR for OpenFOAM Foundation Software* (Version 12-s.1-hzdr.2). Rodare. DOI: `https://doi.org/10.14278/rodare.4050`

Contribution: extension of the code to handle multiple dispersed phases of the same physical phase during the transition from dispersed to continuous morphologies

8 CONFERENCE SERVICE

Session Chair at the 16th International Conference on Chemical and Process Engineering (ICHEAP 16), Naples, Italy, 21–24 May 2023

9 AWARDS

Best Poster Award – CHISA 2026, Prague, Czech Republic, 23–27 August 2026. *Awarded poster:* Aissaoui, D. E., Ferrario, A., **Varallo, N.**, Hessenkemper, H., & Besagni, G. (2026). Influence of Bubble Release Mechanism on the Rise Velocity and Deformation of Single Bubbles in Aqueous Ionic Liquid Solutions. *CHISA 2026*.
Best Paper Award – MDPI Fluids, 2023. *Awarded paper:* Besagni, G., **Varallo, N.**, & Mereu, R. (2023). Computational Fluid Dynamics Modelling of Two-Phase Bubble Columns: A Comprehensive Review. *Fluids*, 8, 91.

10 REVIEW ACTIVITIES

Peer Reviewer for Chemical Engineering Science, Chemical Engineering Research and Design, Applied Thermal Engineering, European Journal of Mechanics