



## Contacts

### Email

azzinifilippo@gmail.com

filippo.azzini2@unibo.it

I was born in Bologna on August 13, 1994. I am a Ph.D. graduate with experience in CFD simulations of heat and mass transfer in various types of systems, as well as in experimental analysis of single-phase and two-phase flows in microchannels. My passion for engineering drives me to explore different topics and projects, allowing me to continuously expand my knowledge and develop a multidisciplinary skill set. My open and collaborative personality helps me build strong relationships with the people I work with.

# Filippo Azzini

ENERGY ENGINEER, Ph.D.

## EDUCATION AND TRAINING

### Alma Mater Studiorum-Università di Bologna | 2020-2025

Ph.D, in the DIMSAI program (Mechanical and Advanced Engineering Sciences)

My research was focused on the fluid flow and thermal behaviour of microfluidic systems. In the last year, my work has been centred around CFD simulations and experimental measurements in the field of microfluidics. More specifically, I have worked on machine learning techniques for drop recognition and measurements inside microchannels, CFD simulations of breakdown phenomena inside micro-junctions, experimental and numerical analysis of buoyancy effects inside microchannels, and CFD simulations of a micro-heat exchanger for nuclear applications

### Alma Mater Studiorum-Università di Bologna | 2017-2020

Master Degree in energy engineering (L-9) Grade: 110/110 L

Thesis Title: Numerical Study and Optimization of a Cooling System for Electric Car Batteries. The thesis can be divided into two main parts, the first part related to the numerical simulation of lithium battery pack cooling and the comparison between different fluids, while the second part focused on geometric optimization, using open-source codes, of a fluid collector

### Alma Mater Studiorum-Università di Bologna | 2013-2017

Bachelor's Degree in energy engineering (L-9) Grade: 95/110

Thesis Title: Flow Blockage Analysis on a GEN-IV LFR Fuel Pin Bundle Simulator.

### Passed the government exam and licensed as a profession engineer | 2021

## EXPERIENCES

### Research Fellow at Alma Mater Studiorum , Bologna, 2024-ongoing

My research focuses on analyzing thermal and electrical energy consumption in buildings. I develop Python-based tools for monitoring, simulating, and analyzing energy trends and energy landscape. I also conduct experimental measurements in microfluidic systems using particle tracking and perform computational fluid dynamics (CFD) simulations.

### Consultant for ART-ER and Regione Emilia Romagna | 2025-ongoing

External consultant for ART-ER and Regione Emilia-Romagna. The aim of this work is to analyze and georeference the CRITER and SACER databases, and to develop a Python-based model for estimating building energy performance classes

### Collaboration with ENEA Brasimone Research Center | 2023

Collaborated with the Fusion and Nuclear Safety Technologies Department (innovative projects) and Westinghouse on numerical simulations of a micro lead-super critical water primary heat exchanger for lead-cooled fast reactors.

Work package leader on an ASI project for the design of a Space Nuclear Reactor (SNR) for lunar applications, focusing on balance-of-plant, thermal management, and heat rejection systems.

### Collaboration with TETRAPAK | 2023

Collaboration between UniBo and Tetrapak for the design and optimization of a glue gun

### Collaboration with 3D4MEC | 2023

Consulting at 3d4mec company with the aim of optimizing the geometry of the intake nozzle of a 3D printing chamber to enhance the fluid dynamics of the suction system.

### Research Period at Jožef Stefan Institute R-4 Reactor Engineering Division - (Ljubljana, SLO) | September 2023-December 2023

# PROFESSIONAL SKILLS

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## -Programming language:

-Python, C++/C, JAVA

## -Software:

-Computational fluid dynamics (CFD): STARCCM+, OpenFOAM, Basilisk, COMSOL

-Computer-aided design (CAD): NX, Solid Edge, Creo, FreeCAD, Blender

-Others: DAKOTA, YOLO, Matlab, DefocusTracker, Office 365, Arduino, LabView, QGIS, Blender

## -Languages:

Italian (native speaker), English (B2), French (A1)

# Publications

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## Paper indexed on Scopus

- Azzini, F., B. Pulvirenti, G. L. Morini, C. Biserni, "Droplet Diameter Variability Induced by Flow Oscillations in a Micro Cross-Junction," *Applied Sciences*, vol. 15, no. 18, Art. 10107, 2025.
- Azzini, F., G. L. Morini, B. Pulvirenti, M. Rossi, M. Rojas-Cárdenas, "Thermally-Driven Microfluidic Swirler for Flow Manipulation," *International Journal of Thermal Sciences*, vol. 215, 2025.
- Azzini, F., A. M'Hadbi, M. El Ganaoui, B. Pulvirenti, G. L. Morini, M. Rojas-Cárdenas, M. Rossi, "Assessment of Mixing Efficiency of Thermally Driven Microfluidic Swirlers," *FLOW*, vol. 5, 2025.
- Azzini, F., G. Martino, C. Naldi, B. Pulvirenti, "Numerical Analysis of Innovative Systems for Thermal Management of Li-ion Batteries Using Phase Change Materials" *Defect and Diffusion Forum*, vol. 445, pp. 267–278, 2025.
- Azzini, F., B. Pulvirenti, C. Naldi, G. Martino, G.L. Morini, "Design Automation and Optimization of Micro Cross-Junctions for Droplet Generation Using CFD and Machine Learning Approaches," *Defect and Diffusion Forum*, vol. 445, pp. 67–76, 2025.
- D'Errico G.A., G. Martino, C. Naldi, M. Dongellini, F. Azzini, C. Biserni, G.L. Morini, "Effect of the Fin Density on the Thermal Performance of a Finned-Tube Heat Exchanger Loaded with a Paraffinic PCM," *Defect and Diffusion Forum*, vol. 445, pp. 179–188, 2025.
- Azzini, F., B. Pulvirenti, M. Rossi, G. L. Morini, "Squeezing Droplet Formation in a Flow-Focusing Micro Cross-Junction," *Micromachines*, vol. 15, no. 3, Art. 339, 2024.
- Carrelli C., F. Lodi, M. Tarantino, B. Ferrucci, F. Azzini, A. Venturini, "Towards a Feasibility Study for a Lunar Space Nuclear Reactor" *Proceedings of the International Conference on Nuclear Engineering (ICONE)*, conference paper, 2022.
- Azzini, F., B. Pulvirenti, G. L. Morini, "A Python-Based Approach for Drop Analysis in Micro-Fluidic Devices" in *Proceedings of the International Conference on Micro and Nano Flows*, 2023.
- Azzini, F., B. Pulvirenti, G. L. Morini, "Numerical Modelling of Droplet Formation in a Micro Cross-Junction," in *Proceedings of the 29th Mediterranean Conference on Control and Automation (MED)*, 2021.

In addition, I presented works at international conferences (CLIMA, UIT, EXHFT, AIVELA)

# Mentorship and Supervision

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## -Academic tutor at the University of Bologna for the following courses:

- Laboratorio di termotecnica M
- Progettazione di impianti a pompa di calore M
- Gestione dell'energia T

## -Supervisor of more than 20 bachelor's and master's theses in the fields of CFD and technical physics.

## -Expert committee member in Technical Physics for the 2025 State Examination for the Professional Qualification of Engineers