

# FEDERICO GHIOLDI

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## SUMMARY

- **Assistant Professor** at the Department of Aerospace Science and Technology (DAER) in Politecnico di Milano (Italy)
- **Graduate Teaching Assistant** at Politecnico di Milano for CFD / Propulsion MSc and BSc courses
- **Multi-year experience** in CFD analysis with a core focus on combustion problems in Aerospace.
- **CFD developer** of hybrid techniques for heterogeneous (GPGPU) High-Performance Computing
- **European Projects Participant:** software developer in Horizon-2020 projects under Principal Investigator Prof. F. Piscaglia
- **"Key Innovator"** recognition by the European Commission's Innovation Radar for GPU acceleration of reactive CFD simulations

## EDUCATION

<b>Doctoral Degree in Aerospace Engineering</b> <i>Politecnico di Milano (Italy)</i>	<b>with honors</b> 11/2019-01/2023
<b>Master Degree in Aeronautical Engineering</b> <i>Politecnico di Milano (Italy)</i>	<b>110/110 with honors</b> 10/2016-04/2019

## TEACHING AND MENTORING

• Teaching Assistant for the M.Sc. course " <i>Computational Techniques for Thermochemical Propulsion</i> "	09/2020 - present
• Teaching Assistant for the M.Sc. course " <i>Aerodynamics</i> "	09/2022 - present
• Teaching Assistant for the B.Sc. course " <i>Aerospace Propulsion</i> "	09/2024 - present
• Teaching Assistant for the M.Sc. course " <i>High Performance Computing in Aerospace</i> "	09/2025 - present
• Mentoring 3-5 students per year in their M.Sc. Thesis activities	09/2020 - present

## RESEARCH VISITS

- Visiting Professor, Combustion, Acoustics & Flow Physics Lab. (CAPS) in ETH Zurich; Sup.: Prof. C. Frouzakis 02/2025 - 05/2025

## RELEVANT PROJECTS

<b>exaFOAM</b>	<b>05/2021 - 04/2024</b>
Project to overcome the current limitations of CFD technology exploiting massively parallel HPC architectures. Developments implemented in the open-source software OpenFOAM. Consortium composed of 12 partners (including OpenCFD). Main carried out developments include:	
<ul style="list-style-type: none"><li>• hybrid CPU-GPU solution of reactive flow problems;</li><li>• re-design of the solution method employed for chemical ODEs integration to suite the GPU massive parallelism;</li><li>• GPU acceleration of ray-tracing calculation for radiative heat transfer in OpenFOAM.</li></ul>	

□ Implemented innovations categorized as "Tech Ready" by the EU Commission's Innovation Radar with potential to address existing market needs (12/2024).

<b>ENGIMMONIA</b>	<b>09/2021 - 09/2024</b>
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The project addresses 5 objectives to prove reliability and cost-effectiveness of ammonia engines; it targets future decarbonization of the maritime shipping sector. Consortium is composed of 22 partners from 8 EU countries. Main carried out developments include:

- multi-injection in dual-fuel configurations (diesel + ammonia);
- new breakup model: coupling of Huh-Gosman, Reitz-KHRT, and Rayleigh-Taylor approaches;
- automatic mesh generation of multi hexa-block morphing structures, suited for advanced mesh motion techniques.

<b>Green Propulsion Optimization at Vitesco</b>	<b>11/2019 - present</b>
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The project aims at developing Fast Computational Methods for Optimal Thermal Design of Anisotropic Multilayer Structures for Electrified Propulsion Systems. Goals are reducing the environmental impacts of the automotive industry and promoting emission-free mobility and long term sustainability.

## TECHNICAL SKILLS

- **CFD development and analysis:** +5 years experience (OpenFOAM), mainly covering incompressible and compressible flows, chemically reactive flow problems, combustion models, lagrangian particle tracking, HPC methods.
- **Programming capability:** +5 years experience in C++, C, CUDA-C, Bash, Python, and Matlab.
- **CAD software:** +5 years experience in the use of Solid Works, Solid Edge, Inventor, Salome, AutoCAD.
- **Other software worth of mention:** Fluent, Git, XFLR5, FreeFEM++, Office suite, ~~ETX~~

## PERSONAL

<b>Languages</b>	<b>Italian:</b> mother tongue (native). <b>English:</b> professional proficiency (C1, TOEIC score 965). <b>Spanish:</b> elementary.
<b>Attributes</b>	Competitive attitude; dynamic, creative, adaptive, results-oriented problem solver. Thrive in a team environment.
<b>Speaking</b>	Confident and professional speaker; persuasive speaker in public, to groups, or via electronic media.
<b>Hobbies</b>	Team and individual sports, board games. Community service.
<b>Voluntary work</b>	Volunteer experiences; help to elderly and people with disabilities. Member of Italian blood donation association.

## PUBLICATIONS

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- F. Ghioldi, F. Piscaglia, "Accelerated combustion simulations of hydrogen-air flames in the HYLON burner", Physics of Fluids (2025), DOI
- F. Ghioldi, F. Piscaglia, "A hybrid CPU-GPU Paradigm to Accelerate Reactive CFD Simulations", International Journal for Numerical Methods in Fluids (2024), DOI
- F. Piscaglia, F. Ghioldi, "GPU acceleration of CFD Simulations in OpenFOAM", Aerospace (2023), DOI
- F. Ghioldi, F. Piscaglia, "Acceleration of Supersonic/Hypersonic Reactive CFD Simulations via Heterogeneous CPU-GPU Supercomputing", Computer & Fluids (2023), DOI
- F. Ghioldi, J. H  lie, F. Piscaglia, "Multivariable Optimization of Pyramidal Compound Substrates for Cooling of Power-Electronics in Modern Hybrid and Electric Propulsion Systems", Applied Thermal Engineering (2023), DOI
- F. Ghioldi, J. H  lie, F. Piscaglia, "A Fast Computational Method for the Optimal Thermal Design of Anisotropic Multilayer Structures with Discrete Heat Sources for Electrified Propulsion Systems", Int. J. of Heat and Mass Transfer (2021), DOI

## CONFERENCE PRESENTATIONS

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- F. Ghioldi, C.E. Frouzakis, F. Piscaglia, "A Generalized Dynamic Thickened Flame Framework for Hydrogen Combustion in Aero-engines with CSP Diagnostics", The 20<sup>th</sup> OpenFOAM Workshop (OFW20) (2025)
- F. Piscaglia, F. Ghioldi, F. Chiappari, F. Lentini, I. Spisso, J. E. Guerrero, "An OpenFOAM Library for the Implicit Density-based Solution of High-Enthalpy Hypersonic Flows", 11<sup>th</sup> European Conference for Aeronautics and AeroSpace Sciences (EUCASS) (2025)
- F. Ghioldi, F. Piscaglia, "Investigating Reactive Flow Dynamics and Pollutant Formation in Aero-Engines via a Dynamic Thickened Flame LES Combustion Model in OpenFOAM", 11<sup>th</sup> European Conference for Aeronautics and AeroSpace Sciences (EUCASS) (2025)
- F. Ghioldi, F. Piscaglia, "Accelerating Hydrogen Combustion Simulations in Aero-Engines with Advanced CFD and GPGPU Techniques", AIAA SciTech Forum (2025)
- F. Piscaglia, F. Ghioldi, J. E. Guerrero Rivas, I. Spisso, "A Unified Implicit Density-based GPU Coupled Solver for Hypersonic Flows Computations in OpenFOAM", AIAA SciTech Forum (2025)
- F. Ghioldi, J. E. Guerrero Rivas, I. Spisso, F. Piscaglia, "A Unified GPGPU Implicit Density-Based Solver for Hypersonic and Combustion Simulations in OpenFOAM", 2<sup>nd</sup> Italian OpenFOAM User Meeting (2024)
- F. Ghioldi, F. Piscaglia, S. M. Aithal, "Efficient Design of Low-NOx Hydrogen Combustors by GPU-Accelerated Simulations in OpenFOAM", 35<sup>th</sup> Int. Conf. on Parallel Computational Fluid Dynamics (2024)
- F. Piscaglia, E. Gallorini, F. Ghioldi, A. Marie, J. P. Fradin, J. H  lie, "Experimental Validation of Thermal-Adjoint Topological Optimization for Cooling Plate Design", 30<sup>th</sup> International Workshop on Thermal Investigation of ICs and Systems (2024)
- F. Piscaglia, F. Ghioldi, F. Magugliani, S. M. Aithal, "Accelerated CFD of Aerospace Propulsion Systems in OpenFOAM", 14<sup>th</sup> Int. Workshop on Combustion and Propulsion (2024)
- F. Ghioldi, F. Piscaglia, "GPU Acceleration of CFD Simulations in OpenFOAM", 18<sup>th</sup> OpenFOAM Workshop (2023)
- F. Ghioldi, F. Piscaglia, "GPU-Accelerated Simulation of Supersonic Combustion in Scramjet Engines by OpenFOAM", 33<sup>rd</sup> International Conference on Parallel Computational Fluid Dynamics (2022)
- D. Costero, F. Ghioldi, S. M. Aithal, F. Piscaglia, "Novel Developments for Rapid Reactive CFD Simulations of Dual-Fuel IC Engines", 33<sup>rd</sup> Int. Conf. on Parallel Computational Fluid Dynamics (2022)
- E. Gallorini, F. Ghioldi, S. M. Aithal, F. Magugliani, F. Piscaglia, "A Methodology for the Aero-thermal Optimization of Hybrid and Electric Propulsion Systems", 9th Annual OpenFOAM User Conference (2021)
- F. Ghioldi, E. Gallorini, S. M. Aithal and F. Piscaglia, "A CFD Methodology for the Optimal Thermal Design of the Propulsion System in Electric Motors", AIDAA, XXVI International Congress (2021)
- F. Ghioldi, F. Piscaglia, "A CPU-GPU Paradigm to Accelerate Turbulent Combustion and Reactive-Flow CFD Simulations", 8th Annual OpenFOAM User Conference (2020)