

Anas Jnini

Scientific Machine Learning Researcher

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Education

- PhD Candidate** | *Università degli Studi di Trento, Italy* **2022–2026**
- Awarded a Leonardo S.p.A Scholarship for pioneering research in integrating Deep Learning and Scientific Machine Learning with Computational Fluid Dynamics simulations.
- Master's degree in Mechanical Engineering, Automation and Control** | *EPFL, Switzerland* **2018–2021**
- Bachelor's degree in Mechanical Engineering** | *EPFL, Switzerland* **2015–2018**

Experience

- Visiting Researcher** | *Brown University, Division of Applied Mathematics, USA* **2025**
- Collaborating with The CRUNCH Group (The collaborative research group of Prof. George Em Karniadakis) on a project benchmarking state-of-the-art optimizers for Physics-Informed Neural Networks (PINNs).
- Visiting Researcher** | *Leonardo Labs, Genoa, Italy* **2025**
- Developing ML-based surrogate models for CFD systems applied to aeronautics.
- Aerospace Engineer** | *Akkodis, Blagnac, Toulouse, France* **2022**
- Designed, integrated, and validated flight control, autopilot, and piloting law systems of the Airbus XLR project.
- Master Thesis** | *Biorobotics lab at EPFL, Lausanne, Switzerland* **2021**
- Developed a novel framework for learning the dynamics and planning trajectories of musculoskeletal systems using Deep Learning and Optimal Control.
- Aerospace Simulation Engineer: Internship** | *ATR Aircraft, Toulouse, France* **2020**
- Designed a Digital Twin in Simulink for the new Aircraft's STOL (Short Take-Off and Landing) system.

Publications and Preprints

- [1] *Gauss-Newton Natural Gradient Descent for Physics-Informed Computational Fluid Dynamics*. (2025). Elsevier's Computers & Fluids. [arXiv:2402.10680]
- [2] *Riemann Tensor Neural Networks: Learning Conservative Systems with Physics-Constrained Networks*. (2025). 42nd International Conference on Machine Learning (ICML 2025). [arXiv:2503.00755]
- [3] *Dual Natural Gradient Descent for Scalable Training of Physics-Informed Neural Networks*. (2025). Transactions on Machine Learning Research (TMLR). [arXiv:2505.21404]
- [4] *CuVegas: Accelerating Multidimensional Monte Carlo Integration: A Parallelized CUDA-based Implementation of the VEGAS Enhanced Algorithm*. (2024). Under review at ACM Transactions on Mathematical Software. [arXiv:2408.09229]
- [5] *Gradient-Free Homotopy Residual Learning for Fast Training of Nonlinear PDE Surrogates*. (2026). Under review at the International Conference on Machine Learning (ICML).
- [6] *Curvature-Aware Optimization for High-Accuracy Physics-Informed Neural Networks*. (2026). Preprint submitted to Elsevier's Computer Methods in Applied Mechanics and Engineering (CMAME). [arXiv:2604.05230]

Invited Talks, Workshop Papers and Competitions

- Riemann Tensor Neural Networks: Learning Conservative Systems with Physics-Constrained Networks 2025**
- Poster presentation at MSML 2025
 - Invited Talk at IMOS LAB (EPFL) Journal Club.
- Gauss–Newton Natural Gradient Descent for Physics-Informed Computational Fluid Dynamics 2024–2025**
- Spotlight talk at the CRUNCH Seminar, Brown University (Recording)
 - Speaker at the PINN-PAD: Physics Informed Neural Networks in PADova (Slides)
- Taylor Mode Neural Operators: Enhancing Computational Efficiency in Physics-Informed Neural Operators 2024**
- Poster presentation at NeurIPS 2024 Workshop ML4PS
- Physics-Constrained DeepONet for Surrogate CFD Models: A Curved Backward-Facing Step Case 2024**

- Poster presentation at ICLR 2024 Workshop on AI4DifferentialEquations (OpenReview)
- Runner-up, Kaggle Stanford Flame AI Workshop Challenge** | *Stanford University, CA* **2023**
- Second place in the Stanford Flame AI Workshop Challenge, a competition on turbulence and flowfield simulations. Developed a super-resolution model to reconstruct high-resolution turbulent flowfields using attention mechanisms and ensemble learning.

Academic Service

Reviewer | *International Conference on Machine Learning (ICML); Neural Networks (Elsevier); Transactions on Machine Learning Research (TMLR); 31st International European Conference on Parallel and Distributed Computing* **2024-**

Principal Teaching Assistant and Lecturer | *Università degli Studi di Trento, Italy* **2024-**

- Delivered lectures and managed course content for "Introduction to Parallel Programming".

Program Committee Member | *20th ACM International Conference on Computing Frontiers* **2023**

- Artifact Evaluation Committee Member.

Graduate Research Assistant | *EPFL, Automatic Control Laboratory, Lausanne* **2019**

- In charge of experimental setups and algorithms in control theory.

Teaching Assistant | *EPFL, Mechanical Engineering Faculty, Lausanne* **2017–2020**

- Assisted in teaching and supporting students in Analysis (Principal assistant), Material Science, Chemistry, Programming, Mechanical Systems, and Continuum Mechanics.

Technical Expertise

Research Areas: Scientific Machine Learning, Physics-Informed Neural Networks (PINNs), Neural Operators, Computational Fluid Dynamics (CFD), Surrogate Modeling, Optimization Algorithms, High-Performance Computing (HPC), Scientific Computing, and Parallel Algorithms.

Programming and Development: Python, C++, C, Julia; experience with CUDA, MPI, and OpenMP for parallel and GPU computing; software engineering best practices using Git and Docker.

Machine Learning Frameworks: PyTorch, TensorFlow, JAX

Simulation and Modeling Tools: OpenFOAM, MATLAB/Simulink, Abaqus, NI LabVIEW.

Complementary Expertise: Model-Based Systems Engineering, Optimal Control, Reinforcement Learning, Numerical Methods for PDEs.

Soft Skills: Scientific communication, mentoring and teaching, interdisciplinary collaboration, analytical problem-solving, and creative research thinking.

Languages

French: Native · **Arabic:** Native · **English:** Fluent · **Spanish:** Limited working proficiency · **Italian:** Limited working proficiency

Referees

- **Prof. Dr. Flavio Vella** Associate Professor, University of Trento
Tel: +39 461 282050 Email: flavio.vella@unitn.it
- **Dr. Antonio Sciarappa** Head of HPC/Cloud Research Unit, Leonardo Labs
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