

# Paolo Conti

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## Experience

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### The Alan Turing Institute

Research Associate in AI for Physical Systems

London, UK

March 2025 – Ongoing

- Developed **AutoEmulate**, an open-source Python package for AI-powered emulation of large-scale simulations. Integrated with the PyTorch ecosystem for GPU acceleration and uncertainty quantification. Deployed in climate modeling, cardiac digital twins, and battery optimization workflows, achieving 10–100× speedups.
- Designed and implemented a multi-fidelity transformer architecture for large-scale, multi-modal data. Applied to Antarctic sea ice forecasting, achieving 18% lower error compared to single-fidelity models.

### Polytechnic University of Milan

Postdoctoral Research Associate

Milan, Italy

Oct 2024 – Feb 2025

Conceptualized and developed the **EKF-SINDy** framework for robust, explainable, and scalable *digital twins*, integrating nonlinear dynamics identification with online learning.

- Enabled real-time estimation and updates of non-stationary physical systems. Achieved < 1% error in parameter estimation from noisy, partial measurements of micro electro-mechanical systems (MEMS).

### Imperial College London

Visiting Research Scientist

London, UK

Oct 2023 – Dec 2023

Led the research and software development of **VENI-VINDy-VICI**, a *physical generative* framework for reduced-order modeling with uncertainty quantification using variational autoencoders and variational dynamics identification.

- Achieved 98% data compression and 60× faster simulation time compared to high-fidelity numerical solvers, while providing robust uncertainty estimates for long-term predictions.

### AI Institute in Dynamic System – University of Washington

Machine Learning Scientist Intern

Seattle (WA), USA

Oct 2022 – May 2023

- Designed ML methods to learn physics-informed reduced-order models from time-series data of engineering devices. Reduced long-term forecasting errors by 85% compared to black-box ML models, with applications to MEMS (micromirrors and resonators).
- Developed a multi-fidelity framework for forecasting high-resolution solutions from multi-modal data, achieving 9× speedups and 80% higher accuracy than state-of-the-art single-fidelity models.

## Education

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### Polytechnic University of Milan

PhD in Scientific Machine Learning

Milan, Italy

May 2021 – Sept 2024

Conducted research on physics-informed ML methods for data-driven reduced-order modeling and multi-modal predictions in computational science and engineering.

- Designed interpretable and uncertainty-aware ML frameworks for modeling physical systems using generative AI and reduced-order modeling. Applied to large-scale problems (>1M DOFs) in fluid dynamics, MEMS, and computational biology.
- Developed advanced multi-fidelity and multi-modal surrogate models, including transformer-based architectures, to learn high-dimensional dynamical systems from heterogeneous data sources.

Teaching Assistant for courses in Numerical Mathematics, Dynamical Systems, and Scientific Communication.

### Polytechnic University of Milan

MSc in Mathematical Engineering – Score: 110/110 cum laude

Milan, Italy

Oct 2018 – Apr 2021

BSc in Mathematical Engineering – Score: 110/110

Oct 2015 – Sept 2018

- Coursework: Algorithms & Parallel Computing for Computational Science, Applied & Bayesian Statistics, Reinforcement Learning, Numerical Methods for Partial Differential Equations, Model Identification & Data analysis.

### Sorbonne University

Student Exchange








Paris, France

Sept 2019 – July 2020

- Completed coursework in the Applied Mathematics department and in Sorbonne Polytech.




## Publications

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- [1] P. **Conti**, M. Guo, A. Frangi, and A. Manzoni. “Progressive multi-fidelity learning for physical system predictions”. *arXiv preprint arXiv:2510.13762* (2025).  [Progressive-MF-NNs](#).
- [2] P. **Conti**, J. Kneifl, A. Manzoni, A. Frangi, J. Fehr, S. L. Brunton, and J. N. Kutz. “VENI, VINDy, VICI: a generative reduced-order modeling framework with uncertainty quantification”. *arXiv preprint arXiv:2405.20905* (2025). Under review at Neural Networks.  [VENI-VINDy-VICI](#).
- [3] J. Lips, H. Lens, and P. **Conti**. “Soft Sensor Design using Hierarchical Multi-Fidelity Modeling with Bayesian Optimization for Variable Selection”. *Dynamics and Control of Process Systems* (2025).  [MultiFidelityBO\\_SoftSensor](#).
- [4] L. Rosafalco, P. **Conti**, A. Manzoni, S. Mariani, and A. Frangi. “Online learning in bifurcating dynamic systems via SINDy and Kalman filtering”. *Nonlinear Dynamics* (2025).  [EKF-SINDy](#).
- [5] F. Zacchei, P. **Conti**, A. Frangi, and A. Manzoni. “Multi-Fidelity Delayed Acceptance: hierarchical MCMC sampling for Bayesian inverse problems combining multiple solvers through deep neural networks”. *arXiv preprint arXiv:2512.16430* (2025).  [MFDA](#).
- [6] P. **Conti**, M. Guo, A. Manzoni, A. Frangi, S. L. Brunton, and J. Nathan Kutz. “Multi-fidelity reduced-order surrogate modelling”. *Proceedings of the Royal Society A* 480.2283 (2024).  [MultiFidelity\\_POD](#).
- [7] L. Rosafalco, P. **Conti**, A. Manzoni, S. Mariani, and A. Frangi. “EKF–SINDy: Empowering the extended Kalman filter with sparse identification of nonlinear dynamics”. *Computer Methods in Applied Mechanics and Engineering* 431 (2024).  [EKF-SINDy](#).
- [8] P. **Conti**, G. Gobat, S. Fresca, A. Manzoni, and A. Frangi. “Reduced order modeling of parametrized systems through autoencoders and SINDy approach: continuation of periodic solutions”. *Computer Methods in Applied Mechanics and Engineering* 411 (2023).
- [9] P. **Conti**, M. Guo, A. Manzoni, and J. S. Hesthaven. “Multi-fidelity surrogate modeling using long short-term memory networks”. *Computer Methods in Applied Mechanics and Engineering* 404 (2023).  [MultiFidelity\\_NNs](#).
- [10] M. Guo, A. Manzoni, M. Amendt, P. **Conti**, and J. S. Hesthaven. “Multi-fidelity regression using artificial neural networks: efficient approximation of parameter-dependent output quantities”. *Computer Methods in Applied Mechanics and Engineering* 389 (2022).  [MultiFidelity\\_NNs](#).

## Software & Scientific Projects

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-  **AutoEmulate:** Developed a Python library for accelerating large-scale simulations with AI.
-  **VENI-VINDy-VICI:** Developed a Python package for dynamics identification based on physical generative AI.
-  **EKF-SINDy digital twin:** Coupling data assimilation with system identification to build a digital twin.

## Technologies

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**Programming:** Python (TensorFlow, PyTorch), C/C++, R, MATLAB, SQL, CUDA.

**Languages:** English (Fluent), Italian (Native Language), French (Intermediate), Spanish (Intermediate).

## Achievements

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### Academic Awards

- *Best Poster Award* at the 6th International Workshop on Model Order Reduction Techniques (MORTech) (2023).
- *Best Project Award* at Deep Learning School at the Machine Learning Genoa Center (2021).
- *European Grant “Best Exchange Student”* for the academic results during the study abroad at Sorbonne University.
- *Academic & Sport Merit scholarship*, awarded by Polytechnic University of Milan. Four-time recipient (2015 – 2018).

### Sport Career awards – Aerobic Gymnastics

- *Medal of Athletic Value for the sport career*, awarded by the Italian National Olympic Committee (2023).
- *Oscar awards for Gymnastics*, awarded by the Italian National Olympic Committee (2015).
- Member of the National Team of Aerobic Gymnastics (2010 – 2021). World Championship medalist (2016, 2021) and European Champion (2015).

## Activities

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### LGBTQ+ rights activist and volunteer

- Organized and coordinated Bergamo Pride (2020 – 2024). Promoted awareness and prevention events; fundraising and volunteering programs for the LGBTQ+ community; led educational and social activities.
- Member of the LGBTQ+ equality network at The Alan Turing Institute. Led educational activities to raise awareness issues faced by the LGBTQ+ community.

**International gymnastic coach and choreographer:** Coached and choreographed teams in Italy, France, Finland, Hungary, Lithuania and USA.

## Selected Conferences and Workshops

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### Invited Seminar

- “*Data-driven modeling of dynamical system*” Imperial College London – London, May 2024.
- “*Between the physical and digital worlds*” Caterina Caniana Education Institute – Milan, Jan 2024.
- “*Modeling from measurements*”, SimTech institute of University of Stuttgart – Oct 2023.
- “*Multi-fidelity reduced-order modeling*”, AI for dynamical systems seminar talks – Milan Polytechnic, July 2023.
- “*Deep learning reduced-order modeling of parametrized systems*”, University of Washington – Seattle, Feb 2023.

### Minisymposium Organizer

- “*Predictive data-driven model reduction and discovery for dynamical systems*” minisymposium at the 1st Artificial Intelligence and Computational Methods in Applied Science conference (AICOMAS) – Paris, Feb 2025.

### Tutorial Instructor

- “*AutoEmulate workshop*”, Accelerating large-scale simulations with AI – London, May 2025.
- “*Modeling from measurements*”, Numerical & ML techniques for dynamics identification – Milan, May 2024.
- “*Multi-fidelity modeling*” at the “Scientific ML and Dynamical Systems Autumn School” – Amsterdam, Oct 2023

### Oral Presenter

- Physics-Enhancing Machine Learning workshop – Institute of Physics, London, Oct 2025.
- AAAI Symposium on Integrated Approaches to Computational Scientific Discovery – Arlington (VA), Nov 2024.
- 9th European Congress on Comp. Methods in Applied Sciences & Engineering (ECCOMAS) – Lisbon, June 2024.
- SIAM conference on uncertainty quantification (SIAM UQ) – Trieste, Feb 2024.
- Math 2 Product (M2P) Emerging Technologies in Computational Science – Taormina, May 2023.
- AAAI Symposium on computational approaches to scientific discovery – San Francisco, Mar 2023.
- SIAM conference on computational science and engineering (CSE) – Amsterdam, Feb 2023.

### Poster Presenter

- 6th International Workshop on Model Order Reduction Techniques (MORTech) – Paris, Nov 2023.
- Common Task Framework for AI in Science and Engineering – Seattle, Feb 2023.
- Mediterranean Machine Learning (M2L) Summer School (organized by Google DeepMind) – Milan, Sept 2022.

### Participant

- Third Workshop on Multimodal AI (MultimodalAI’25) – London, Sept 2025.
- Neural Information Processing Systems (NeurIPS 2022) – New Orleans, Nov 2022.
- Mathematics of Machine Learning summer school (organized by Microsoft Research) – Cortona & NYC, Aug 2022.