

# Paolo Conti

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## Experience

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- The Alan Turing Institute** London, UK  
March 2025 – Ongoing  
*Research Associate in AI for Physical Systems*
- 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** Milan, Italy  
Oct 2024 – Feb 2025  
*Postdoctoral Research Associate*
- 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** London, UK  
Oct 2023 – Dec 2023  
*Visiting Research Scientist*
- 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** Seattle (WA), USA  
Oct 2022 – May 2023  
*Machine Learning Scientist Intern*
- 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** Milan, Italy  
May 2021 – Sept 2024  
*PhD in Scientific Machine Learning*
- 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** Milan, Italy  
Oct 2018 – Apr 2021  
*MSc in Mathematical Engineering* – Score: 110/110 cum laude
- Polytechnic University of Milan** Milan, Italy  
Oct 2015 – Sept 2018  
*BSc in Mathematical Engineering* – Score: 110/110
- Coursework: Algorithms & Parallel Computing for Computational Science, Applied & Bayesian Statistics, Reinforcement Learning, Numerical Methods for Partial Differential Equations, Model Identification & Data analysis.
- Sorbonne University** Paris, France  
Sept 2019 – July 2020  
*Student Exchange*
- Completed coursework in the Applied Mathematics department and in Sorbonne Polytech.

## Publications

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- [1] 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”. *Neural Networks* (2026).  VENI-VINDy-VICI.
- [2] 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.
- [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. Zachei, 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.