MOX - Modeling and Scientific Computing
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STEFANIA FRESCA, Ph.D.

Junior Assistant Professor

Personal Data

Date and place of birth: 24/08/1991, Erba (CO)

Nationality: Italian

Scientific Interests

- **Scientific Machine Learning:** reduced order modeling (data dimensionality reduction), data-driven model identification, graph-based and physics-aware surrogate models, deep reinforcement learning for optimal control, explainability
- **Scientific Computing:** physics-based simulations, numerical methods, partial differential equations, finite elements, optimization, multiphysics and multiscale models
- **Applications:** life sciences, computational fluid dynamics (computational mechanics), MEMS devices

Academic Positions

Feb. 2023 - ongoing **Junior Assistant Professor (RTD-A) in Numerical Analysis**, *MOX (Laboratory for Modeling and Scientific Computing) - Department of Mathematics, Politecnico di Milano*
- Led 2 WPs task of Spoke "Adaptive AI" in the Future Artificial Intelligence Research (FAIR) Project funded by the NextGenerationEU program within the PNRR-PE-AI scheme, PI: N. Gatti.

Nov. 2020 - Feb. 2023 **Post-doc Research Fellow**, *MOX (Laboratory for Modeling and Scientific Computing) - Department of Mathematics, Politecnico di Milano*

Nov. 2017 - Nov. 2020 **Ph.D. Student**, *MOX (Laboratory for Modeling and Scientific Computing) - Department of Mathematics, Politecnico di Milano*
- Carried out within the European Research Council (ERC) Advanced Grant Project "iHEART: an integrated heart model for the simulation of the cardiac function", PI: A. Quarteroni.

Industry Positions

Apr. 2024 - ongoing **Scientific Advisor**, *Corintis SA*, EPFL Innovation Park, Lausanne, Switzerland
- Provided input, advice, guidance, and actionable feedback on scientific machine learning topics relevant to the company's work.

June 2017 - Oct. 2017 **Risk Advisory Intern**, *Ernst & Young*, Milano
- Supported the design of a Datamart, for accounting and reporting information, to be used by the entire bank branch.
- Performed activities of data extraction, through SQL tool, analysis and reporting.
- Developed fully-automated data quality processes tool, through Access and VBA, used by the whole reporting team.

Education

Nov. 2017 - Feb. 2021 **Ph.D. in Mathematical Models and Methods in Engineering**, *Politecnico di Milano*, Italy
Ph.D. Thesis: *Deep learning-based reduced order models for nonlinear parametrized PDEs: application to cardiac electrophysiology.*
Advisors: Alfio Quarteroni, Andrea Manzoni, Luca Dede' (Politecnico di Milano).

Sep. 2015 - Mar. 2016 **Exchange Program**, *Université Pierre et Marie Curie (Sorbonne Universités)*, Paris, France

Mar. 2014 - Apr. 2017 **M.Sc. in Mathematical Engineering - Computational Science and Engineering**, *Politecnico di Milano*, Italy
Master Thesis: *Goal-Oriented mesh adaptivity for topology optimization.*
Advisors: Simona Perotto, Stefano Micheletti (Politecnico di Milano).

Sep. 2010 - Dec. 2013 **B.Sc. in Mathematical Engineering**, *Politecnico di Milano*, Italy
Final Dissertation: *Well-balanced and energy stable schemes for the shallow water equations*.
Advisor: Edie Miglio (Politecnico di Milano).

Publications

Google Scholar: https://scholar.google.com/citations?user=HGeGJpcAAAAJ&hl=it
ResearchGate: https://www.researchgate.net/profile/Stefania-Fresca
ORCID: https://orcid.org/0000-0001-8599-6588
Scopus: https://www.scopus.com/authid/detail.uri?authorId=57219325205

Journal Papers

- S. Brivio, S. Fresca, N. R. Franco, A. Manzoni. Error estimates for POD-DL-ROMs: a deep learning framework for reduced order modeling of nonlinear parametrized PDEs enhanced by proper orthogonal decomposition. *Advances in Computational Mathematics*, 50, 33, 2024.
  https://doi.org/10.1007/s10444-024-10110-1
- L. Cicci, S. Fresca, A. Manzoni, A. Quarteroni. Efficient approximation of cardiac mechanics through reduced order modeling with deep learning-based operator approximation. *International Journal for Numerical Methods in Biomedical Engineering*, e3783, 2024.
  https://doi.org/10.1002/cnm.3783
- N. R. Franco, S. Fresca, F. Tombari, A. Manzoni. Deep Learning-based surrogate models for parametrized PDEs: handling geometric variability through graph neural networks. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 33(12): 12312, 2023.
  https://doi.org/10.1063/5.0170101
- L. Cicci, S. Fresca, M. Guo, A. Manzoni, P. Zunino. Uncertainty quantification for nonlinear solid mechanics using reduced order models with Gaussian process regression. *Computers and Mathematics with Applications*, 149, 1-23, 2023.
  https://doi.org/10.1016/j.camwa.2023.08.016
- S. Fresca, F. Fatone, A. Manzoni. Long-time prediction of nonlinear parametrized dynamical systems by deep learning-based reduced order models. *Mathematics in Engineering*, 5(6):1-36, 2023.
  https://doi.org/10.3934/mine.2023096
- G. Gobat, A. Baronchelli, S. Fresca, A. Frangi. Modeling the periodic response of Micro-Electromechanical Systems through deep learning-based approaches. *Actuators*, 12, 278, 2023.
  https://doi.org/10.3390/act12070278
- P. Conti, G. Gobat, S. Fresca, A. Manzoni, 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, 116072, 2023.
  https://doi.org/10.1016/j.cma.2023.116072
- G. Gobat, S. Fresca, A. Manzoni, A. Frangi. Reduced order modelling of nonlinear vibrating multiphysics microstructures with deep learning-based approaches. *Sensors*, 23(6), 3001, 2023.
  https://doi.org/10.3390/s23063001
- N. R. Franco, S. Fresca, A. Manzoni, P. Zunino. Approximation bounds for convolutional neural networks in operator learning. *Neural Networks*, 161, 129-141, 2023.
  https://doi.org/10.1016/j.neunet.2023.01.029
- L. Cicci, S. Fresca, A. Manzoni. Deep-HyROMnet: A deep learning-based operator approximation for hyper-reduction of nonlinear parametrized PDEs. *Journal of Scientific Computing*, 93:57, 2022.
  https://doi.org/10.1007/s10915-022-02001-8
- S. Fresca, G. Gobat, P. Fedeli, A. Frangi, A. Manzoni. Deep learning-based reduced order models for the real-time simulation of the nonlinear dynamics of microstructures. *International Journal for Numerical Methods in Engineering*, 123(20):4749-4777, 2022.
  https://doi.org/10.1002/nme.7054
  Wiley Top Cited Paper - one of WILEY top 10 most-cited papers published between 1st January 2022 - 31st December 2022.
  Wiley Top Downloaded Paper - received enough downloads to rank within the top 10% of papers published in International Journal for Numerical Methods in Engineering between 1st January 2022 - 31st December 2022.
- L. Cicci, S. Fresca, S. Pagani, A. Manzoni, A. Quarteroni. Projection-based reduced order models for parameterized nonlinear time-dependent problems arising in cardiac mechanics. *Mathematics in Engineering, 5(2):1-38*, 2022.
  https://doi.org/10.3934/mine.2023026
- G. Gobat, A. Opreni, S. Fresca, A. Manzoni, A. Frangi. Reduced order modeling of nonlinear microstructures through Proper Orthogonal Decomposition. *Mechanical Systems and Signal Processing*, 171, 108864, 2022.
  https://doi.org/10.1016/j.ymssp.2022.108864
- S. Fresca, A. Manzoni. POD-DL-ROM: enhancing deep learning-based reduced order models for nonlinear parametrized

PDEs by proper orthogonal decomposition. *Computer Methods in Applied Mechanics and Engineering, 388, 114181*, 2022. https://doi.org/10.1016/j.cma.2021.114181
Most Downloaded Articles - among the most downloaded articles from Computer Methods in Applied Mechanics and Engineering in the last 90 days (last accessed: 09-2023).

- S. Fresca, A. Manzoni, L. Dede', A. Quarteroni. POD-enhanced deep learning-based reduced order models for the real-time simulation of cardiac electrophysiology in the left atrium. *Frontiers in Physiology, 12, 1431*, 2021. https://doi.org/10.3389/fphys.2021.679076
- S. Fresca, A. Manzoni. Real-time simulation of parameter-dependent fluid flows through deep learning-based reduced order models. *Fluids, 6(7), 259*, 2021. https://doi.org/10.3390/fluids6070259
- S. Fresca, A. Manzoni, L. Dede'. A comprehensive deep learning-based approach to reduced order modeling of nonlinear time-dependent parametrized PDEs. *Journal of Scientific Computing, 87(2):1-36*, 2021. https://doi.org/10.1007/s10915-021-01462-7
Based on Web of Science: *Highly Cited Paper* - as of March/April 2023, this paper received enough citations to place it in the top 1% of the academic field of Mathematics based on a highly cited threshold for the field and publication year (last accessed: 09-2023).
Hot Paper - this paper was published in the past two years and received enough citations in May/June 2022 to place it in the top 0.1% of papers in the academic field of Mathematics (last accessed: 09-2022).
- S. Fresca, A. Manzoni, L. Dede', A. Quarteroni. Deep learning-based reduced order models in cardiac electrophysiology. *PLOS ONE, 15(10):1-32*, 2020. https://doi.org/10.1371/journal.pone.0239416

Proceedings (with review)

- N. Farenga, S. Fresca, A. Manzoni. Neural Latent Dynamics Models. *The Symbiosis of Deep Learning and Differential Equations, 36th Conference on Neural Information Processing Systems (NeurIPS)*, 2022. https://openreview.net/pdf?id=Yk_I37Ca8Q
- S. Fresca, A. Manzoni, L. Dede', A. Quarteroni. Deep learning-based reduced order models in cardiac electrophysiology. *7th International Conference on Computational and Mathematical Biomedical Engineering*, 2022. https://www.compbiomed.net/2024/cmbe-proceedings.htm
- S. Fresca, F. Fatone, A. Manzoni. Long-time prediction of nonlinear parametrized dynamical systems by deep learning-based ROMs. *The Symbiosis of Deep Learning and Differential Equations, 35th Conference on Neural Information Processing Systems (NeurIPS)*, 2021. https://openreview.net/pdf?id=kQ_PIYH3NsF

Chapters in Books

- S. Fresca, L. Dede', A. Manzoni. Big Data Analysis and Artificial Intelligence for Medical Sciences. *Publisher: Wiley, Editors: B. Carpentieri, P. Lecca*, 2024.
- L. Cicci, S. Fresca, E. Zappon, S. Pagani, F. Regazzoni, L. Dede', A. Manzoni, A. Quarteroni. Reduced order models for the biomechanics of living organs. *Publisher: Elsevier, Editors: F. Chinesta, E. Cueto, Y. Payan, J. Ohayon*, 403-433, 2023.

Preprints

- N. Farenga, S. Fresca, S. Brivio, A. Manzoni. On latent dynamics learning in nonlinear reduced order modeling. *arXiv preprint arXiv:2408.15183*, 2024.
- S. Brivio, S. Fresca, A. Manzoni. PTPI-DL-ROMs: pre-trained physics-informed deep learning-based reduced order models for nonlinear parametrized PDEs. *arXiv preprint arXiv:2405.08558*, 2024.

Theses

- S. Fresca. Deep learning-based reduced order models for nonlinear parametrized PDEs: application to cardiac electrophysiology. *Ph.D. Thesis*, 2021.
- S. Fresca. Goal-oriented mesh adaptivity for topology optimization. *Master Thesis*, 2017.

Software Libraries

- DL-ROM-Meth: github.com/stefaniafresca/DL-ROM-Meth, Python/Tensorflow.
- DL-ROM: github.com/stefaniafresca/DL-ROM, Python/Tensorflow.
- POD-DL-ROM: github.com/stefaniafresca/POD-DL-ROM, Python/Tensorflow.
- DLROM-hub: github.com/DLROM-hub, Python/Tensorflow/PyTorch.

Talks and Seminars

Invited Seminars

SIMBIOTX Weekly Meeting, *INRIA Paris-Saclay*, 8 Apr. 2024, Paris, France

Lab Seminar, *Medical University of Graz*, 8 Nov. 2023, Graz, Austria, hosted by Gernot Plank

UQSay Seminar, *Université Paris-Saclay*, 19 Oct. 2023, Paris, France, hosted by Filippo Gatti

PDE Seminar, *Institut de Recherche Mathématique Avancée (IRMA), INRIA*, 31 Jan. 2023, Strasbourg, France, hosted by Victor Michel-Dansac

Machine Learning and Data Analytics Seminar, *Interdisciplinary Center for Machine Learning and Data Analytics (IZMD), University of Wuppertal*, 5 Dec. 2022, Wuppertal, Germany, hosted by Matthias Ehrhardt

Machine Learning + X Seminars, *CRUNCH Group, Brown University*, 16 Sep. 2022, Providence, U.S., hosted by George Karniadakis

Seminar for Machine Learning and UQ in Scientific Computing, *Centrum Wiskunde & Informatica (CWI)*, 1 Sep. 2022, Amsterdam, The Netherlands, hosted by Benjamin Sanderse

Cardiac Modeling (CaMo) Seminar, *KIT Institute of Biomedical Engineering*, 13 Jan. 2022, Karlsruhe, Germany, hosted by Axel Loewe

Lectures in International Schools

Data Driven & Reduced Order Models in Biomechanics, *Universitat Politècnica de Catalunya*, 7-11 Apr. 2025, Barcelona, Spain

Third Inria-DFKI Summer School in AI, *Inria*, 4-8 Sep. 2023, Sophia Antipolis, France

Keynote Invited Talks

Scientific Machine Learning: Bridging Computational Physics and Machine Learning Workshop, *Centrum Wiskunde & Informatica (CWI)*, 6-8 Dec. 2023, Amsterdam, The Netherlands

Biophysics-based Modeling and Data Assimilation in Medical Imaging Workshop, *Weierstrass Institute for Applied Analysis and Stochastics (WIAS)*, 30 Aug.-1 Sep. 2023, Berlin, Germany

Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering & Technology, IACM Conference, 27-29 Sep. 2021, San Diego, California, U.S.
Minisymposium: Advanced Computational Technologies Enabling Digital Twins

Invited Talks in MS/Session

9^{th} European Congress on Computational Methods in Applied Sciences and Engineering, ECCOMAS CONGRESS 2024, 3-7 June 2024, Lisbon, Portugal
Minisymposium: Exploring New Avenues for the Interaction of Numerical Methods for PDEs and Deep Learning

2024 SIAM Conference on Uncertainty Quantification, 27 Feb.-1 March 2024, Trieste, Italy
Minisymposium: Advances in Data-enhanced Modeling and Applications

Math 2 Product Conference 2023, 30 May-1 June 2023, Taormina, Italy
Minisymposium: Advanced Numerical Methods for Predictive Digital Twins

2023 SIAM Conference on Computational Science and Engineering, 26 Feb.-3 March 2023, Amsterdam, The Netherlands
Minisymposium: Advances in Latent Representation Learning for Scientific Applications

MCF2022 - Modelling the Cardiac Function, iHEART Congress, 29 Sep.-2 Oct. 2022, Cetraro, Italy

GIMC-SIMAI YOUNG 2022, 29-30 Sep. 2022, Pavia, Italy
Minisymposium: Physics-based Machine Learning for Engineering Simulation and Digital Twin

Recent Developments in Machine Learning Techniques for PDEs, *Imperial College Workshop*, 6-8 Sep. 2022, London, UK

7^{th} International Conference on Computational and Mathematical Biomedical Engineering, 27-29 June 2022, Milano, Italy
Minisymposium: Machine Learning, Reduced Order Modeling and Uncertainty Quantification in Biological Systems

8^{th} European Congress on Computational Methods in Applied Sciences and Engineering, ECCOMAS Congress 2022, 5-9 June 2022, Oslo, Norway
Minisymposium: Reduced Order Modeling of Dynamical Systems through Deep Learning Techniques

LYNUM: Lombardy Young NUmerical analysts Meeting, 10 May 2022, Como, Italy

SIMAI 2020+2021 Congress, 30 August-2 Sep. 2021, Parma, Italy
Minisymposium: Numerical Modeling of Cardiac Function and Vascular Circulation

2021 SIAM Conference on Computational Science and Engineering, 1-5 March 2021, Fort Worth, Texas, U.S.
Minisymposium: Advances in Data-enhanced Predictive Modeling in Simulation Science

VPH2020: Virtual Physiological Human, 24-28 August 2020, Paris, France
Session: Methods - Big Data & Learning

Contributed Talks

Mathematics for Artificial Intelligence and Machine Learning, 24 Nov.-25 Nov. 2022, Torino, Italy

Model Reduction and Surrogate Modeling (MORE) Conference, 19-23 Sep. 2022, Berlin, Germany

Synergies between Data Science and PDE Analysis, *HCM Workshop*, 13-17 June 2022, Bonn, Germany

First UMI meeting of PhD students, 100 UMI - 800 UniPD Conference, 26-27 May 2022, Padova, Italy

Mathematics of Deep Learning, *Deep Learning and Partial Differential Equations Workshop*, Isaac Newton Institute, 15-19 November 2021, Cambridge, UK

MCF2021 - Modelling the Cardiac Function: Theory, Numerical Methods, Clinical Applications, iHEART Congress, 1-3 July 2021, Milano, Italy

International Conference on Computational Methods for Coupled Problems in Science and Engineering, *COUPLED PROBLEMS 2021*, 13-16 June 2021, Cagliari, Italy
Minisymposium: Recent Advances in Model and Complexity Reduction for Coupled Problems

MCF2020 - Modelling the Cardiac Function, iHEART Congress, 31 August-2 Sep. 2020, Milano, Italy

MCF - Modelling the Cardiac Function, RISM Congress, 22-24 July 2019, Varese, Italy

Posters

The Symbiosis of Deep Learning and Differential Equations Workshop, 35^{th} Conference on Neural Information Processing Systems (NeurIPS), 6-14 Dec. 2021, San Diego, U.S.

International CAE Conference and Exhibition, 17-18 Nov. 2021, Vicenza, Italy

Workshop on Mathematical Machine Learning and Application, CCMA 2020, 14-16 Dec. 2020, Penn State, U.S.

Workshop/Minisymposia Organization

Mathematics for our Health (M4H) Workshop, 7-8 Nov. 2024, Milano, Italy
Organizers: S. Fresca, C. Masci, S. Pagani, F. Regazzoni, D. Riccobelli, A. Signori (Politecnico di Milano, Italy)

9^{th} European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS CONGRESS 2024), 3-7 June 2024, Lisbon, Portugal
Minisymposium: Recent Advances in Deep Reinforcement Learning of Complex Dynamical Systems
Organizers: N. Botteghi (University of Twente, The Netherlands), S. Fresca (Politecnico di Milano, Italy)

9^{th} European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS CONGRESS 2024), 3-7 June 2024, Lisbon, Portugal
Minisymposium: Deep Learning and Reduced Order Modeling for Differential Equations
Organizers: N. R. Franco (Politecnico di Milano, Italy), F. Pichi (Ecole Polytechnique Fédérale de Lausanne, Switzerland), S. Fresca (Politecnico di Milano, Italy)

2024 SIAM Conference on Uncertainty Quantification (UQ24), 27 Feb.-1 March 2024, Trieste, Italy
Minisymposium: Reduced order modeling, Learning, UQ, and their interaction
Organizers: N. R. Franco (Politecnico di Milano, Italy), S. Fresca (Politecnico di Milano, Italy), M. Guo (University of Twente, The Netherlands), A. Manzoni (Politecnico di Milano, Italy)

2023 SIAM Conference on Computational Science and Engineering, 26 Feb.-3 March 2023, Amsterdam, The Netherlands
Minisymposium: Reduced Order Modeling of Differential Equations through Deep Learning Algorithms
Organizers: N. R. Franco, S. Fresca (Politecnico di Milano, Italy)

Funded Research Projects

Feb. 2023 - ongoing **Participant (RTD-A),** *Future Artificial Intelligence Research (FAIR) Project*, Politecnico di Milano, Italy
funded by the NextGenerationEU program within the PNRR-PE-AI scheme (M4C2, Investment 1.3, Line on Artificial Intelligence), PI: Prof. Nicola Gatti.

Nov. 2022 - Feb. 2023 **Participant (Post-doc),** *AI4MEMS Project*, Politecnico di Milano, Italy
funded by STEAM Joint Research Center ST Microelectronics-PoliMI, PI: Prof. A. Manzoni.

Nov. 2020 - Oct. 2022 **Participant (Post-doc),** *Toward UQoRE (T-UQoRE) Project*, Politecnico di Milano, Italy
funded by Fondazione Cariplo (grant agreement no. 2019-4608), PI: Prof. A. Manzoni.

Nov. 2017 - Oct. 2020 **Participant (Ph.D.),** *An Integrated Heart Model for the simulation of the cardiac function (iHEART) Project*, Politecnico di Milano, Italy
funded by European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement no. 740132), PI: Prof. Alfio Quarteroni.

Grants and Awards

2024 **Fellowship provided by Istituto Nazionale di Alta Matematica**, two-months funding for the visiting research period at University of Cambridge (3000€/month)

2023 **Certificate in recognition of commitments and merits in scientific research granted by L'Oréal-UNESCO**, For Women in Science Program, Italy

2022 **Runner-up best Ph.D. award in biomedical engineering granted at the 7th International Conference on Computational & Mathematical Biomedical Engineering (CMBE22)**, International Journal for Numerical Methods in Biomedical Engineering (IJNMBE), Milano, Italy

2022 **Grant provided by Istituto Nazionale di Alta Matematica - Gruppo Nazionale per il Calcolo Scientifico**, Finanziamento Progetto Giovani Ricercatori 2021, funding for conferences/travels (1500€)

2021 **Best poster award granted by International CAE Conference and Exhibition**, Vicenza, Italy (1000€)
Multi-step Deep Learning-based Reduced Order Models for Geometric Nonlinearities in MEMS, G. Gobat, S. Fresca, A. Manzoni, A. Frangi.

2019 **Grant provided by IHU Liryc - L'Institut de Rythmologie et de Modélisation Cardiaque**, funding covering lodging and boarding costs for the 2019 Cardiac Electrophysiology Summer School organized by IHU Liryc in Bordeaux, France

2015 - 2016 **Grant provided by Politecnico di Milano**, full funding for the duration of the exchange program at Université Pierre et Marie Curie (Sorbonne Universités) in Paris, France

Visiting Periods

Sep. 2024 - Dec. 2024 **Department of Computer Science, University of Cambridge**, Cambridge, U.K.
collaborating with Prof. Pietro Liò's group

Sep. 2024 Invited **Mechanical Engineering Department, University of Washington**, Seattle, U.S.
hosted by Prof. Steven Brunton

Nov. 2023 Invited **Computational Cardiology Laboratory, Medical University of Graz**, Graz, Austria

March 2023 Invited **Isaac Newton Institute for Mathematical Sciences**, *The mathematical and statistical foundation of future data-driven engineering*, University of Cambridge, Cambridge, U.K.

Teaching Activity

Feb. 2024 - June 2024 **Lecturer**, *Calcolo Numerico (Numerical Methods)*, B.Sc. in Biomedical Engineering, Politecnico di Milano, 20h, 5 CFU

Jan. 2024 **Lecturer**, *Advanced Numerical Methods for Predictive Digital Twins*, Ph.D. Program in Mathematical Models and Methods in Engineering, Politecnico di Milano, 25h, 10 CFU

Sep. 2023 - Dec 2023 **Teaching Assistant**, *Numerical Analysis for Machine Learning*, M.Sc. in Mathematical Engineering, Politecnico di Milano, 30h, 10 CFU

Feb. 2023 - June 2023 **Teaching Assistant**, *Calcolo Numerico ed Elementi di Analisi (Applied Numerical Analysis)*, B.Sc. in Aerospace Engineering, Politecnico di Milano, 40h, 10 CFU

Sep. 2022 - Dec. 2022 **Teaching Assistant**, *Computational Statistics*, M.Sc. in Mathematical Engineering, Politecnico di Milano, 12h, 8 CFU

Feb. 2022 - June 2022 **Teaching Assistant**, *Calcolo Numerico ed Elementi di Analisi (Applied Numerical Analysis)*, B.Sc. in Aerospace Engineering, Politecnico di Milano, 40h, 10 CFU

Sep. 2021 - Dec. 2021 **Teaching Assistant**, *Computational Statistics*, M.Sc. in Mathematical Engineering, Politecnico di Milano, 12h, 8 CFU

Oct. 2020 - Dec. 2020 **Teaching Assistant**, *Matlab Course - Analisi I*, B.Sc. in Mathematical Engineering, Politecnico di Milano, 9h, 10 CFU

Oct. 2019 - Dec. 2019 **Teaching Assistant**, *Matlab Course - Analisi I*, B.Sc. in Mathematical Engineering, Politecnico di Milano, 10h, 10 CFU

Feb. 2019 - June 2019 **Teaching Assistant**, *Calcolo Numerico ed Elementi di Analisi (Applied Numerical Analysis)*, B.Sc. in Aerospace Engineering, Politecnico di Milano, 48h, 10 CFU

Feb. 2018 - June 2018 **Teaching Assistant**, *Calcolo Numerico ed Elementi di Analisi (Applied Numerical Analysis)*, B.Sc. in Aerospace Engineering, Politecnico di Milano, 48h, 10 CFU

Nov. 2017 - Jan. 2018 **Teaching Assistant**, *Metodi Analitici e Numerici per l'Ingegneria (Numerical Methods)*, B.Sc. in Mechanical Engineering, Politecnico di Milano, 5 CFU

Theses co-Advising

M.Sc. thesis **Alice Ragonesi**, Master Program in Mathematical Engineering - Statistical Learning, Politecnico di Milano, Ongoing

M.Sc. thesis **Filippo Baldini**, Master Program in Mathematical Engineering - Computational Science and Computational Learning, Politecnico di Milano, Ongoing

M.Sc. thesis **Pietro Devecchi**, Master Program in Mathematical Engineering - Computational Science and Computational Learning, Politecnico di Milano, Ongoing

M.Sc. thesis **Nicola Farenga**, Master Program in Mathematical Engineering - Computational Science and Computational Learning, Politecnico di Milano, Ongoing

M.Sc. thesis **Edoardo Zuanon**, *"Efficient approximation of PDEs defined on domains with variable shape through POD-enhanced deep learning-based reduced order models"*, Master Program in Mathematical Engineering - Computational Science and Computational Learning, Politecnico di Milano, 2023

M.Sc. thesis **Filippo Tombari**, *"Deep Learning-based surrogate models for parametrized PDEs: including geometrical features through graph neural networks"*, Master Program in Mathematical Engineering - Computational Science and Computational Learning, Politecnico di Milano, 2023

M.Sc. thesis **Simone Brivio**, *"Physics-informed deep learning-based reduced order modeling for parametric operators"*, Master Program in Mathematical Engineering - Computational Science and Computational Learning, Politecnico di Milano, 2022

M.Sc. thesis **Federico Capello**, *"Approximate Bayesian Ensembling for Physics-Informed Deep Learning Architectures"*, Master Program in Mathematical Engineering - Statistical Learning, Politecnico di Milano, 2021

M.Sc. thesis **Federico Fatone**, *"Long-time prediction of nonlinear parametrized dynamical systems through deep learning-based reduced order models"*, Master Program in Mathematical Engineering - Statistical Learning, Politecnico di Milano, 2021

B.Sc. thesis **Marco Morrone**, *"Physics-informed neural networks for the solution of PDEs"*, Bachelor Program in Mathematical Engineering, Politecnico di Milano, 2019

Projects co-Advising

M.Sc. project **Silvia Pastori, Francesca Zambetti, Andrea Rella**, Numerical Analysis For PDEs, Master Program in Mathematical Engineering, Politecnico di Milano, Ongoing

M.Sc. project **Niccolò Perrone, Rayan Emara**, Numerical Analysis For PDEs, Master Program in Mathematical Engineering, Politecnico di Milano, Ongoing

M.Sc. project **Andrea Toccaceli, Niccolo Grillo**, *"Puzzle solving with graph neural networks and deep reinforcement learning"*, Advanced Programming for Scientific Computing, Master Program in Mathematical Engineering, Politecnico di Milano, 2024

M.Sc. project **Marcello Svagna, Pietro Devecchi, Filippo Baldini**, *"Backward step flow control with deep reinforcement learning"*, Advanced Programming for Scientific Computing, Master Program in Mathematical Engineering, Politecnico di Milano, 2024

M.Sc. project **Filippo Tombari**, *"Deep learning-based reduced order models for parametrized PDEs: including geometrical features through Graph Neural Networks"*, Advanced Programming for Scientific Computing, Master Program in Mathematical Engineering, Politecnico di Milano, 2023

M.Sc. project **Arash Andrea Roknian**, *"Forward UQ with deep learning-based ROMs"*, Computational Statistics, Master Program in Mathematical Engineering, Politecnico di Milano, 2022

M.Sc. project **Luca Caivano, Paulina Moskwa, Manfred Nesti**, *"Neural differential equations"*, Computational Statistics, Master Program in Mathematical Engineering, Politecnico di Milano, 2022

M.Sc. project **Roberto Valendino, Ilaria De vittori, Elisabetta Garbin**, *"Neural ODE processes"*, Computational Statistics, Master Program in Mathematical Engineering, Politecnico di Milano, 2022

M.Sc. project **Simone Brivio**, *"DeepONet neural networks"*, Computational Statistics, Master Program in Mathematical Engineering, Politecnico di Milano, 2022

M.Sc. project **Nicola Farenga**, *"Neural ODEs"*, Computational Statistics, Master Program in Mathematical Engineering, Politecnico di Milano, 2022

M.Sc. project **Federico Capello**, *"GRAPH-DL-ROMs: Non intrusive reduced order models by graph neural networks"*, Advanced Programming for Scientific Computing, Master Program in Mathematical Engineering, Politecnico di Milano, 2021

Journal Reviewing

- Artificial Intelligence Journal
- Nonlinear Dynamics
- Proceedings of the Royal Society A
- International Journal for Numerical Methods in Engineering
- Engineering with Computers
- Journal of Computational Physics
- Mathematics in Engineering
- Frontiers in Physiology
- Journal of Computational Science
- Computers and Fluids
- AIAA Journal
- EP Europace

Project Reviewing

- National Research and Development Agency of the Ministry of Science, Technology, Knowledge and Innovation of Chile

Membership in Scientific Societies (Present/Past)

Society for Industrial and Applied Mathematics (SIAM), U.S.
Società Italiana di Matematica Applicata e Industriale (SIMAI), Italy
Gruppo Nazionale per il Calcolo Scientifico (GNCS), Italy
Unione Matematica Italiana (UMI), Italy
Polimi Alumni, Italy
Associazione Ingegneri Matematici (AIM), Italy

Additional Courses/Workshops/Schools

July 2021 **Computer Vision Crash Course**, *MaLGa - Machine Learning Genoa Center*, Genova, (admission upon selection)

Oct. 2019 **Mathematical and Computational Aspects of Machine Learning School**, *Ennio De Giorgi Mathematical Research Center of Scuola Normale Superiore*, Pisa, (admission upon selection)

July 2019 **2019 Cardiac Electrophysiology Summer School**, *IHU Liryc - L'Institut de Rythmologie et de Modélisation Cardiaque*, Bordeaux, (admission upon selection)

Feb. 2019 **Advances in Deep Learning with Applications in Text and Image Processing**, *Politecnico di Milano*

Sep. 2018 **Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization**, *deeplearning.ai, Coursera*

Sep. 2018 **Natural Language Processing: an Overview with Python**, *Politecnico di Milano*

Apr. 2018 **Mathematical and Numerical Modeling of the Cardiovascular System** (INdAM Workshop), *Sapienza - Universitá di Roma*

Media

Interview "Conosci chi fa ricerca" section on the Mathematics Department's website at Politecnico di Milano, 2024. [link]

Post Coventor MEMS+ Blog, "Using Machine Learning to Develop a Real-Time Model of a MEMS Disk Resonating Gyroscope", 2023.

Article Enginsoft Newsletter - RESEARCH & INNOVATION, "Deep learning-based reduced order models: the new frontier in numerical simulation for microsystems", 2022. [link]

Talk MCF2021 Congress, "Deep learning-based reduced order models for the real-time approximation of nonlinear time-dependent parametrized PDEs", 2021. [link]

Talk 36^{th} international CAE conference and exhibition, "How medicine and engineering interrelate - a female bioengineering perspective", 2020. [link]

Interview iODONNA, "Politecnico di Milano: una dottoranda studia come curare il cuore con la matematica", 2020. [link]

Interview youtube channel iHEART Project, "How will artificial intelligence contribute to computational cardiac medicine of the future?", 2020. [link]

Talk RISM Congress, "Deep learning-based model order reduction for cardiac electrophysiology", 2019. [link]

Computer Skills

OS Mac OS X, UNIX/Linux, Windows.

Programming C/C++, Matlab, Python, TensorFlow, Keras, JAX, FreeFem++, MPI, OpenMP, Mathematica, SQL, VBA, LaTeX.

Software software versioning (git), ParaView, Phoenics, Gmsh, MS Office (Excel, PowerPoint, Word).

Libraries Isogeometric Analysis C++ library *isoglib*, Finite Elements C++ library *LifeV*.

Cloud Computing Amazon Web Services (AWS), Google Colab.

Languages

Italian: **Native**. English: **Fluent** [TOEIC score: 955/990 (22 January 2014)]. Spanish: **Intermediate** [DELE score: 88.08/100 (May 2009)]. French: **Basic**.

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