Francesco Regazzoni

Curriculum Vitae et Studiorium

MOX - Laboratory for Modeling and Scientific Computing
Dipartimento di Matematica, Politecnico di Milano
Piazza Leonardo da Vinci 32, 20133 Milano, Italy

francesco.regazzoni@polimi.it
regazzoni.faculty.polimi.it
FrancescoRegazzoni
francesco.regazzoni

Contents

Part I - Academic profile

Personal information

Born in Lecco, April 27th, 1992
Italian citizenship.

Academic experience

Tenure-track Assistant Professor in Numerical Analysis — May 2024 – to date
(Ricercatore a tempo determinato in tenure track – L.240/2010, art.24, c.3 – "RTT") — Milan (Italy)
Department of Mathematics, Politecnico di Milano

Junior Assistant Professor in Numerical Analysis — May 2021 – May 2024
(Ricercatore a tempo determinato (Junior) – L.240/2010, art.24, c.3, lett.a – "RTDa") — Milan (Italy)
Department of Mathematics, Politecnico di Milano

Post-doctoral Research Fellow — Nov 2019 – Apr 2021
(Assegnista di ricerca – L.240/2010, art.22) — Milan (Italy)
Department of Mathematics, Politecnico di Milano
Responsible for the research: Prof. Pasquale Ciarletta

Scientific qualifications

Italian National Scientific Qualification as Associate Professor — Dec 11, 2023
(Abilitazione Scientifica Nazionale – L.240/2010, art.16)
S.C. 01/A5 Analisi Numerica (Numerical Analysis). Validity: 11/12/2023 – 11/12/2035

International scientific boards

EMS Young Academy (EMYA) — 2023 to date
Nominated member of the EMS Young Academy (EMYA), established by the European Mathematical Society (EMS) with the aim of strengthening the role in the mathematical community and the perspective of the generation of young mathematicians in Europe.

EDUCATION

Ph.D. in Mathematical Models and Methods in Engineering Nov 2016 – Oct 2019
Politecnico di Milano, Department of Mathematics
Advisor: Prof. A. Quarteroni, Coadvisor: Prof. L. Dede'
Thesis: Mathematical Modeling and Machine Learning for the Numerical Simulation of Cardiac Electromechanics
Thesis defense: 18/02/2020 (Milan) – Evaluation: *Laude*

Master Degree in Mathematical Engineering (LM-44 mathematics and physics: modelling for engineering) Oct 2014 – Sep 2016
Politecnico di Milano
Track: *Computational Science and Engineering*
Advisor: Prof. M. Verani, Coadvisors: Prof. N. Parolini, Prof. S. Berrone
Thesis: Topology optimization of self-assembling anisotropic materials
Thesis defense: 28/09/2016 (Milan) – Final mark: 110/110 *cum laude*

Master Degree in Mathematical Engineering Dec 2017
Politecnico di Torino
Double Degree program in the context of Alta Scuola Politecnica.
Final mark: 110/110 *cum laude*

Alta Scuola Politecnica (ASP) – XI cycle – `https://www.asp-poli.it/` 2014 - 2016
Politecnico di Milano and Politecnico di Torino
School of excellence founded by Politecnico di Milano and Politecnico di Torino, whose mission is to train high-profile graduates capable of working in a multidisciplinary and multicultural environment.

Bachelor Degree in Mathematical Engineering (L-8 Information Technology) Sep 2011 - Sep 2014
Politecnico di Milano
Advisor: M. A. Fuhrman
Final dissertation on: Stationary random sequences and Birkhoff's ergodic theorem
Thesis defense: 30/09/2014 (Milan) – Final mark: 110/110 *cum laude*

Diploma of Liceo Classico Sep 2006 - Jul 2011
Liceo Ginnasio Statale "A. Manzoni" (Lecco)
Final mark 100/100

RESEARCH VISITS

Harvard University Sep 2024
Computational Science & Engineering Laboratory Boston, Massachusetts (USA)
Host: Prof. Petros Koumoutsakos

Università degli Studi di Firenze Mar 2024
Dipartimento di Fisiologia e Dipartimento di Farmacologia Florence (Italy)
Hosts: Prof. Cecilia Ferrantini and Prof. Corrado Poggesi

Università degli Studi di Trento Feb 2024
Dipartimento di Matematica Trento (Italy)
Host: Dr. Simone Pezzuto

University of Graz Apr 2022
Institute of Mathematics and Scientific Computing Graz (Austria)
Host: Dr. Federica Caforio

Università degli Studi di Firenze Jul 2022
Dipartimento di Fisiologia e Dipartimento di Farmacologia Florence (Italy)
Hosts: Prof. Cecilia Ferrantini and Prof. Corrado Poggesi

Inria Saclay Île-de-France and École Polytechnique Dec 2019 - Feb 2020
M3DISIM and LMS (Laboratoire de Mécanique des Solides) Palaiseau (France)
Hosts: Prof. Dominique Chapelle and Prof. Philippe Moireau

Pennsylvania State University Aug 2019 - Sep 2019
Department of Mathematics State College, Pennsylvania (USA)
Host: Prof. Jinchao Xu

Inria Saclay Île-de-France and École Polytechnique Sep 2018 - Feb 2019
M3DISIM and LMS (Laboratoire de Mécanique des Solides) Palaiseau (France)
Hosts: Prof. Dominique Chapelle and Prof. Philippe Moireau

Honors and awards

Oden-Hughes Award 2024
Best paper published in CMAME (Computer Methods in Applied Mechanics and Engineering) in the years 2022-2023, for the paper [J22].

Best deal.II-based paper 2024
Best paper based on `deal.II` of the year 2023, for the paper [J22].

SIMAI Prize for Young Researchers in Industrial Mathematics 2024
Prize awarded by SIMAI (Italian Society of Applied and Industrial Mathematics) to young researchers (up to 35 years old) based on: (1) autonomy in the scientific production, (2) capability of developing lines of research of interest to applications of mathematics, (3) international recognition, (4) participation to projects relevant to Industrial Mathematics. The award consists of a money prize and a personal invitation to present the research work in one of the next meetings organized by SIMAI.

IJNMBE Best PhD Award in Biomedical Engineering 2022
Prize awarded for the best PhD Thesis related to Biomedical Engineering defended in 2020, 2021 or 2022. The award consists of a registration fee waiver, a travel grant and a money prize, sponsored by the International Journal for Numerical Methods in Biomedical Engineering (IJNMBE).

ECCOMAS Best PhD Thesis Award 2021
Prize awarded by ECCOMAS, the European Community on Computational Methods in Applied Sciences, for the best PhD Thesis in the field of Computational Methods in Applied Sciences and Engineering. The award is accompanied with a money prize and the winner awarded during the 8th ECCOMAS Congress (Oslo, Norway).

Best VPHi Thesis Award in *In Silico* Medicine 2021
Prize awarded by VPH Institute to reward individuals for outstanding achievements during their PhD thesis. The award is accompanied with a money prize and the winner is invited to give a plenary lecture at the 5th VPH Barcelona Summer School.

SIMAI best PhD Thesis 2021
Best Thesis on Computational Methods in Applied Sciences and Engineering (SIMAI nomination to the ECCOMAS PhD award).

VPH2020 Young Investigator Award 2020
Best talk in the conference VPH2020 among young researchers (PhD defended in 2016 and later). Voted by the Scientific Committee members.

GBMA PhD Award 2020
Prize awarded by AIMETA (Italian Association of Theoretical and Applied Mechanics, Biomechanics Group – GBMA) for the best Doctoral Thesis on Theoretical and Applied Biomechanics, defended in the period May 1st, 2019 – April 30th, 2020 in an Italian University or Research Centre.

Carlo Cercignani Prize 2017
Best thesis of the year 2016 in *Mathematical Engineering - Computational Science and Engineering* (Politecnico di Milano).

Best 1st-year students of Academic Year 2011/2012 2012
Winner of the scholarship.

Best Politecnico di Milano admission test score 2012
Rewarded by Politecnico's rector Prof. Giovanni Azzone for the score gained in the admission test (100/100), during the "Politest Top Schools" event.

Part II - Research

Research interests

My research focuses on the development of mathematical models and numerical methods for simulating complex problems, integrating physics-based modeling with Machine Learning. My primary application area is personalized medicine, particularly in the cardiac field. Specifically, I work on developing multi-physics and multi-scale mathematical models, and numerical methods for the approximation of differential problems. Additionally, my work explores the integration of Machine Learning with Scientific Computing, combining physics-based models with data-driven techniques, to accelerate the approximation of differential problems and support sensitivity analysis, uncertainty quantification, and the resolution of inverse problems.

Publications

Databases:

Scopus	https://www.scopus.com/authid/detail.uri?authorId=57202447315
Web of Science	https://www.researcherid.com/rid/V-4074-2017
Google Scholar	https://scholar.google.it/citations?user=9xq4ulgAAAAJ
ResearchGate	https://www.researchgate.net/profile/Francesco_Regazzoni
ORCID	https://orcid.org/0000-0002-4207-1400

In the author lists, * denotes an equal contribution. When alphabetical order is used, this is indicated in the author list.

Book Chapters

[B1] L. Cicci, S. Fresca, E. Zappon, S. Pagani, **F. Regazzoni**, L. Dede', A. Manzoni, A. Quarteroni. Chapter 21 - Reduced order modeling of the cardiac function across the scales. *Reduced Order Models for the Biomechanics of Living Organs* (2023)

Peer-reviewed Journals Papers

[J45] G. Ziarelli, S. Pagani, N. Parolini, **F. Regazzoni**, M. Verani. A model learning framework for inferring the dynamics of transmission rate depending on exogenous variables for epidemic forecasts. *Computer Methods in Applied Mechanics and Engineering* (2025) 437: 117796
https://doi.org/10.1016/j.cma.2025.117796

[J44] A. Quarteroni, P. Gervasio, **F. Regazzoni**. Combining physics-based and data-driven models: advancing the frontiers of research with Scientific Machine Learning. *Mathematical Models and Methods in Applied Sciences* (accepted)
https://doi.org/10.1142/S0218202525500125

[J43] **F. Regazzoni**. Stabilization of staggered time discretization schemes for 0D-3D fluid-structure interaction problems. *Numerische Mathematik* (2025) 157: 249–306
https://doi.org/10.1007/s00211-025-01452-z

[J42] A. Tonini, **F. Regazzoni**, M. Salvador, L. Dede', R. Scrofani, L. Fusini, C. Cogliati, G. Pontone, C. Vergara, A. Quarteroni. Two new calibration techniques of lumped-parameter mathematical models for the cardiovascular system. *Journal for Numerical Methods in Engineering* (2025) 126(1): e7648
http://dx.doi.org/10.1002/nme.7648

[J41] R. Aróstica*, D. Nolte*, A. Brown*, A. Gebauer*, E. Karabelas*, J. Jilberto*, M. Salvador, M. Bucelli, R. Piersanti*, K. Osouli*, C. Augustin*, H. Finsberg*, L. Shi*, M. Hirschvogel*, M. Pfaller, P.C. Africa*, M. Gsell, A. Marsden, D. Nordsletten, **F. Regazzoni**, G. Plank, J. Sundnes, L. Dede', M. Peirlinck*, V. Vedula*, W. Wall, C. Bertoglio. A software benchmark for cardiac elastodynamics. *Computer Methods in Applied Mechanics and Engineering* (2025) 435: 117485
https://doi.org/10.1016/j.cma.2024.117485

[J40] M. Bucelli, **F. Regazzoni**, L. Dede', A. Quarteroni. Robust radial basis function interpolation based on geodesic distance for the numerical coupling of multiphysics problems. *SIAM Journal on Scientific Computing* (2024) 46(6)
https://doi.org/10.1137/24M1643888

[J39] **F. Regazzoni**. An optimally convergent Fictitious Domain method for interface problems. *Computer Methods in Applied Mechanics and Engineering* (2024) 431: 117327
https://doi.org/10.1016/j.cma.2024.117327

[J38] G. Montino Pelagi, **F. Regazzoni**, J.M. Huyghe, A. Baggiano, M. Alì, S. Bertoluzza, G. Valbusa, G. Pontone, C. Vergara. Modeling cardiac microcirculation for the simulation of coronary flow and 3D myocardial perfusion. *Biomechanics and Modeling in Mechanobiology* (2024) 23: 1863–1888
https://doi.org/10.1007/s10237-024-01873-z

[J37] E. Capuano, **F. Regazzoni**, M. Maines, S. Fornara, V. Locatelli, D. Catanzariti, S. Stella, F. Nobile, M.D. Greco, C. Vergara. Personalized Computational Electro-mechanics Simulations to Optimize Cardiac Resynchronization Therapy. *Biomechanics and Modeling in Mechanobiology* (2024) 23: 1977–2004
https://doi.org/10.1007/s10237-024-01878-8

[J36] F. Caforio, **F. Regazzoni**, S. Pagani, E. Karabelas, C. Augustin, G. Haase, G. Plank, A. Quarteroni. Physics-informed Neural Network Estimation of Material Properties in Soft Tissue Nonlinear Biomechanical Models. *Computational Mechanics* (2025) 75: 487–513
https://doi.org/10.1007/s00466-024-02516-x

[J35] E. Zappon, M. Salvador, R. Piersanti, **F. Regazzoni**, L. Dede', A. Quarteroni. An integrated heart-torso electromechanical model for the simulation of electrophysiological outputs accounting for myocardial deformation. *Computer Methods in Applied Mechanics and Engineering* (2024) 427: 117007
https://doi.org/10.1016/j.cma.2024.117077

[J34] A. Tonini, C. Vergara, **F. Regazzoni**, L. Dede', R. Scrofani, C. Cogliati, A. Quarteroni. A mathematical model to assess the effects of COVID-19 on the cardiocirculatory system. *Scientific Reports (Nature)* (2024) 14: 8304
https://doi.org/10.1038/s41598-024-58849-3

[J33] M. Salvador, M. Strocchi, **F. Regazzoni**, C.M. Augustin, L. Dede', S.A. Niederer, A. Quarteroni. Whole-heart electromechanical simulations using Latent Neural Ordinary Differential Equations. *npj Digital Medicine* (2024) 7: 90
https://doi.org/10.1038/s41746-024-01084-x

[J32] A. Zingaro, M. Bucelli, R. Piersanti, **F. Regazzoni**, L. Dede', A. Quarteroni. An electromechanics-driven fluid dynamics model for the simulation of the whole human heart. *Journal of Computational Physics* (2024) 504: 112885
https://doi.org/10.1016/j.jcp.2024.112885

[J31] N.A. Barnafi*, **F. Regazzoni***, D. Riccobelli*. Reconstructing relaxed configurations in elastic bodies: Mathematical formulations and numerical methods for cardiac modeling. *Computer Methods in Applied Mechanics and Engineering* (2024) 423(116845)
https://doi.org/10.1016/j.cma.2024.116845

[J30] G. Montino Pelagi, A. Baggiano, **F. Regazzoni**, L. Fusini, M. Alì, G. Pontone, G. Valbusa, C. Vergara. Personalized pressure conditions and calibration for a predictive computational model of coronary and myocardial blood flow. *Annals of Biomedical Engineering* (2024) 52: 1297–1312
https://doi.org/10.1007/s10439-024-03453-9

[J29] P.C. Africa, R. Piersanti, **F. Regazzoni**, M. Bucelli, M. Salvador, M. Fedele, S. Pagani, L. Dede', A. Quarteroni. lifex-ep: a robust and efficient software for cardiac electrophysiology simulations. *BMC Bioinformatics* (2023) 24: 389
https://doi.org/10.1186/s12859-023-05513-8

[J28] A. Zingaro, C. Vergara, L. Dede', **F. Regazzoni**, A. Quarteroni. A comprehensive mathematical model for cardiac perfusion. *Scientific Reports (Nature)* (2023) 13: 14220
https://doi.org/10.1038/s41598-023-41312-0

[J27] L. Ruffino, A. Santoro, S. Sparvieri, **F. Regazzoni**, D. Adebo, A. Quarteroni, C. Vergara, A. Corno. Computational analysis of cardiovascular effects of COVID-19 infection in children. *Journal of Pediatric Advance Research* (2023) 2(2): 1-10
http://dx.doi.org/10.46889/JPAR.2023.2204

[J26] F. Mazhar, C. Bartolucci, **F. Regazzoni**, M. Paci, L. Dede', A. Quarteroni, C. Corsi, S. Severi. A detailed mathematical model of the human atrial cardiomyocyte: integration of electrophysiology and cardiomechanics. *The Journal of Physiology* (2023) 602(18): 4543-4583
https://doi.org/10.1113/JP283974

[J25] **F. Regazzoni**, S. Pagani, M. Salvador, L. Dede', A. Quarteroni. Learning the intrinsic dynamics of spatio-temporal processes through Latent Dynamics Networks. *Nature Communications* (2024) 15: 1834
https://doi.org/10.1038/s41467-024-45323-x

[J24] M. Bucelli, **F. Regazzoni**, L. Dede', A. Quarteroni. Preserving the positivity of the deformation gradient determinant in intergrid interpolation by combining RBFs and SVD: application to cardiac electromechanics. *Computer Methods in Applied Mechanics and Engineering* (2023) 417(B): 116292
https://doi.org/10.1016/j.cma.2023.116292

[J23] A. Quarteroni, L. Dede', **F. Regazzoni**, C. Vergara. A mathematical model of the human heart suitable to address clinical problems. *Japan Journal of Industrial and Applied Mathematics* (2023) 40: 1547–1567
https://doi.org/10.1007/s13160-023-00579-6

[J22] M. Fedele, R. Piersanti, **F. Regazzoni**, M. Salvador, P.C. Africa, M. Bucelli, A. Zingaro, L. Dede', A. Quarteroni. A comprehensive and biophysically detailed computational model of the whole human heart electromechanics. *Computer Methods in Applied Mechanics and Engineering* (2023) 410: 115983
https://doi.org/10.1016/j.cma.2023.115983

[J21] M. Salvador, **F. Regazzoni**, L. Dede', A. Quarteroni. Fast and robust parameter estimation with uncertainty quantification for the cardiac function. *Computer Methods and Programs in Biomedicine* (2023) 231: 107402
https://doi.org/10.1016/j.cmpb.2023.107402

[J20] **F. Regazzoni**, S. Pagani, A. Quarteroni. Universal Solution Manifold Networks (USM-Nets): non-intrusive mesh-free surrogate models for problems in variable domains. *Journal of Biomedical Engineering* (2022) 144(12): 121004
https://doi.org/10.1115/1.4055285

[J19] S. Stella, **F. Regazzoni**, C. Vergara, L. Dede', A. Quarteroni. A fast cardiac electromechanics model coupling the Eikonal and the nonlinear mechanics equations. *Mathematical Models and Methods in Applied Sciences* (2022) 32(8): 1531-1556
https://doi.org/10.1142/S021820252250035X

[J18] **F. Regazzoni**, M. Salvador, P.C. Africa, M. Fedele, L. Dede', A. Quarteroni. A cardiac electromechanical model coupled with a lumped-parameter model for closed-loop blood circulation. *Journal of Computational Physics* (2022) 457: 111083
https://doi.org/10.1016/j.jcp.2022.111083

[J17] **F. Regazzoni**, M. Salvador, L. Dede', A. Quarteroni. A machine learning method for real-time numerical simulations of cardiac electromechanics. *Computer Methods in Applied Mechanics and Engineering* (2022) 393: 114825
https://doi.org/10.1016/j.cma.2022.114825

[J16] R. Piersanti, **F. Regazzoni**, M. Salvador, A.F. Corno, C. Vergara, A. Quarteroni. 3D-0D closed-loop model for the simulation of cardiac biventricular electromechanics. *Computer Methods in Applied Mechanics and Engineering* (2022) 391: 114607
https://doi.org/10.1016/j.cma.2022.114607

[J15] M. Salvador, **F. Regazzoni**, S. Pagani, L. Dede', N. Trayanova, A. Quarteroni. The role of mechano-electric feedbacks and hemodynamic coupling in scar-related ventricular tachycardia. *Computers in Biology and Medicine* (2022) 142: 105203
https://doi.org/10.1016/j.compbiomed.2021.105203

[J14] **F. Regazzoni**, A. Quarteroni. Accelerating the convergence to a limit cycle in 3D cardiac electromechanical simulations through a data-driven 0D emulator. *Computers in Biology and Medicine* (2021) 135: 104641
https://doi.org/10.1016/j.compbiomed.2021.104641

[J13] **F. Regazzoni**, S. Pagani, A. Cosenza, A. Lombardi, A. Quarteroni. A physics-informed multi-fidelity approach for the estimation of differential equations parameters in low-data or large-noise regimes. *Rendiconti Lincei - Matematica e Applicazioni* (2021) 32(3): 437–470
https://doi.org/10.4171/RLM/943

[J12] **F. Regazzoni**, D. Chapelle, P. Moireau. Combining Data Assimilation and Machine Learning to build data-driven models for unknown long time dynamics - Applications in cardiovascular modeling. *International Journal for Numerical Methods in Biomedical Engineering* (2021) 37(7): e3471
https://doi.org/10.1002/cnm.3471

[J11] A. Quarteroni, L. Dede', **F. Regazzoni**. Modeling the cardiac electromechanical function: a mathematical journey. *Bulletin of the American Mathematical Society* (2022) 59: 371-403
https://doi.org/10.1090/bull/1738

[J10] L. Dede', **F. Regazzoni**, C. Vergara, P. Zunino, M. Guglielmo, R. Scrofani, L. Fusini, C. Cogliati, G. Pontone, A. Quarteroni. Modeling the cardiac response to hemodynamic changes associated with COVID-19: a computational study. *Mathematical Biosciences and Engineering* (2021) 18(4): 3364-3383
https://doi.org/10.3934/mbe.2021168

[J9] L. Dede', A. Quarteroni, **F. Regazzoni**. Mathematical and numerical models for the cardiac electromechanical function. *Rendiconti Lincei - Matematica e Applicazioni* (2022) 32(2): 233–272
https://doi.org/10.4171/rlm/935

[J8] **F. Regazzoni**, A. Quarteroni. An oscillation-free fully staggered algorithm for velocity-dependent active models of cardiac mechanics. *Computer Methods in Applied Mechanics and Engineering* (2021) 373: 113506
https://doi.org/10.1016/j.cma.2020.113506

[J7] **F. Regazzoni**, L. Dede', A. Quarteroni. Biophysically detailed mathematical models of multiscale cardiac active mechanics. *PLOS Computational Biology* (2020) 16(10): e1008294
https://doi.org/10.1371/journal.pcbi.1008294

[J6] **F. Regazzoni**, L. Dede', A. Quarteroni. Machine learning of multiscale active force generation models for the efficient simulation of cardiac electromechanics. *Computer Methods in Applied Mechanics and Engineering* (2020) 370: 113268
https://doi.org/10.1016/j.cma.2020.113268

[J5] **F. Regazzoni**, L. Dede', A. Quarteroni. Active force generation in cardiac muscle cells: mathematical modeling and numerical simulation of the actin-myosin interaction. *Vietnam Journal of Mathematics* (2020) 49: 87–118
https://doi.org/10.1007/s10013-020-00433-z

[J4] **F. Regazzoni**, L. Dede', A. Quarteroni. Machine learning for fast and reliable solution of time-dependent differential equations. *Journal of Computational Physics* (2019) 397: 108852
https://doi.org/10.1016/j.jcp.2019.07.050

[J3] **F. Regazzoni**, L. Dede', A. Quarteroni. Active contraction of cardiac cells: a reduced model for sarcomere dynamics with cooperative interactions. *Biomechanics and Modeling in Mechanobiology* (2018) 17: 1663-1686
https://doi.org/10.1007/s10237-018-1049-0

[J2] **F. Regazzoni**, N. Parolini, M. Verani. Topology optimization of multiple anisotropic materials, with application to self-assembling diblock copolymers. *Computer Methods in Applied Mechanics and Engineering* (2018) 338: 562-596
https://doi.org/10.1016/j.cma.2018.04.035

[J1] *(alphabetical order)* M. Bruggi, N. Parolini, **F. Regazzoni**, M. Verani. Topology optimization with a time-integral cost functional. *Finite Elements in Analysis & Design* (2018) 140: 11-22
https://doi.org/10.1016/j.finel.2017.10.011

Conference Proceedings

[C12] L. Dede', M. Bucelli, S. Pagani, R. Piersanti, **F. Regazzoni**, A. Tonini, A. Quarteroni. Advanced multiphysics and multiscale cardiac models: bridging numerical simulations with digital twins for human heart simulation. *Proceedings of the 8th International Conference on Computational and Mathematical Biomedical Engineering* (2024) 2

[C11] M. Salvador, **F. Regazzoni**, S. Pagani, L. Dede', A. Quarteroni. Electromechanical modeling of cardiac arrhythmias. *ARGESIM Report (Proceedings of MATHMOD Vienna)* (2022) 17: 13-14
https://doi.org/10.11128/arep.17.a17039

[C10] S. Pagani, **F. Regazzoni**, M. Salvador, D. Fraulin, F. Zacchei, A. Quarteroni. Physics-informed Neural Networks for parameter estimation in cardiac mechanics. *ARGESIM Report (Proceedings of MATHMOD Vienna)* (2022) 17: 61-62
https://doi.org/10.11128/arep.17.a17143

[C9] **F. Regazzoni**, M. Salvador, L. Dede', A. Quarteroni. Neural networks based real-time simulations of cardiac electromechanics. *ARGESIM Report (Proceedings of MATHMOD Vienna)* (2022) 17: 27-28
https://doi.org/10.11128/arep.17.a17074

[C8] **F. Regazzoni**, M. Salvador, L. Dede', A. Quarteroni. Machine learning based real-time simulation of the cardiac electromechanical function enabling global sensitivity analysis and bayesian parameter estimation. *Proceedings of the 7th International Conference on Computational and Mathematical Biomedical Engineering* (2022) 1

[C7] L. Dede', P.C. Africa, M. Bucelli, M. Fedele, R. Piersanti, A. Quarteroni, **F. Regazzoni**, M. Salvador, A. Zingaro. Multiphysics and multiscale models for the numerical simulation of the cardiac function. *Proceedings of the 7th International Conference on Computational and Mathematical Biomedical Engineering* (2022) 1

[C6] S. Pagani, **F. Regazzoni**, L. Dede', A. Quarteroni. Non-intrusive and mesh-free neural network models of parametrized differential equations with variable geometry. *Proceedings of the 7th International Conference on Computational and Mathematical Biomedical Engineering* (2022) 2

[C5] R. Piersanti, **F. Regazzoni**, M. Salvador, L. Dede', C. Vergara, A. Quarteroni. A physiologically detailed 3D-0D closed-loop model for the simulation of cardiac electromechanics. *Proceedings of the 7th International Conference on Computational and Mathematical Biomedical Engineering* (2022) 2

[C4] M. Fedele, R. Piersanti, **F. Regazzoni**, M. Salvador, P.C. Africa, M. Bucelli, L. Dede', A. Quarteroni. An electromechanical model of the entire human heart coupled with a lumped parameters model of the circulatory system. *Proceedings of the 7th International Conference on Computational and Mathematical Biomedical Engineering* (2022) 2

[C3] F. Mazhar, **F. Regazzoni**, C. Bartolucci, C. Corsi, L. Dede', A. Quarteroni, S. Severi. A Novel Human Atrial Electromechanical Cardiomyocyte Model with Mechano-Calcium Feedback Effect. *CINC Proceedings* (2022) http://dx.doi.org/10.22489/CinC.2022.195

[C2] F. Mazhar, **F. Regazzoni**, C. Bartolucci, C. Corsi, L. Dede', A. Quarteroni, S. Severi. Electro-Mechanical Coupling in Human Atrial Cardiomyocytes: Model Development and Analysis of Inotropic Interventions. *Computing in Cardiology Proceedings* (2021) https://dx.doi.org/10.23919/CinC53138.2021.9662766

[C1] *(alphabetical order)* M. Bruggi, N. Parolini, **F. Regazzoni**, M. Verani. Finite element approximation of a time-dependent topology optimization problem. *Proceedings of ECCOMAS* (2016) 2067: 3711-3723 https://doi.org/10.7712/100016.2067.7766

Under review

[R4] L. Zhang, S. Pagani, J. Zhang, **F. Regazzoni**. Shape-informed surrogate models based on signed distance function domain encoding.

[R3] **F. Regazzoni**, C. Poggesi, C. Ferrantini. Elucidating the cellular determinants of the end-systolic pressure-volume relationship of the heart via computational modelling.

[R2] A. Quarteroni, P. Gervasio, **F. Regazzoni**. Scientific Machine Learning for differential problems: integrating physics-based and data-driven approaches.

[R1] F. Giardini, C. Olianti, G.A. Marchal, F. Campos, J. Steyer, J. Madl, R. Piersanti, G. Arecchi, I.P. Vanaja, V. Biasci, G. Nesi, L. Loew, E. Cerbai, S. Chelko, **F. Regazzoni**, A. Loewe, M. Bishop, M. Mongillo, P. Kohl, T. Zaglia, C.M. Johnston, L. Sacconi. Cardiac fibrosis affects electrical conduction and arrhythmogenesis in a pacing-rate-dependent manner.

FUNDING

Total funds as Principal Investigator: 1.6 M€
Total funds as Co-Investigator: 700 K€

Principal Investigator – 1.3 M€ 2025–2028
FIS 2023 Starting Grant - Fondo Italiano per la Scienza, Italian Ministry of Education, University and Research (MUR)
Project title: *SYNERGIZE: Synergizing Numerical Methods and Machine Learning for a new generation of computational models*

Participant – 2.5 K€ 2025–2026
Research Project GNCS - INdAM
Project title: *Modellistica matematica e numerica per il cuore umano*

Fellowship Winner – 7.3 K€ 2024–2025
INdAM Fellowship funding research stays abroad
Project title: *An uncertainty-aware machine learning approach to direct and inverse problems based on differential equations*

Participant – 2.5 K€ 2024–2025
Research Project GNCS - INdAM
Project title: *Modelli matematici e metodi numerici per la costruzione di gemelli digitali cardiaci*

Participant – 299.4 K€ 2024–2026
Horizon Europe - Centres of Excellence for exascale HPC applications
Project title: *Dealii-X: an Exascale Framework for Digital Twins of the Human Body*

Principal Investigator – 224.9 K€ 2023–2025
PRIN 2022 PNRR - Italian Ministry of Education, University and Research (MUR)
Project title: *SIDDMs: shape-informed data-driven models for parametrized PDEs, with application to computational cardiology*

Participant – 2.3 K€ 2023–2024
Research Project GNCS - INdAM
Project title: *Modelli matematici e metodi numerici per la medicina computazionale in patologie cardiovascolari*

Participant (co-investigator) – 395.4 K€ 2023–2025
MAECI - Ministero degli Affari Esteri e della Cooperazione Internazionale
Project title: *DESTRO - Dextrous, strong yet soft robots*

Principal Investigator – 2.4 K€ 2022–2023
Research Project GNCS - INdAM
Project title: *Development of synergies between Scientific Computing and Machine Learning for biomedical applications*

Membership in scientific societies

Current or former member of the following societies.

- **EMS** – European Mathematical Society
- **UMI** – Unione Matematica Italiana (Italian Mathematical Union)
- **SIMAI** – Società Italiana di Matematica Applicata e Industriale (Italian Society of Applied and Industrial Mathematics)
- **GNCS** – Gruppo Nazionale per il Calcolo Scientifico (National Group for Scientific Computing), INdAM – Istituto Nazionale di Alta Matematica
- **IACM** – International Association for Computational Mechanics
- **ESB** – European Society of Biomechanics
- **VPHi** – Virtual Physiological Human Institute

Scientific collaborations

International Research centers and Universities

- Harvard University, Cambridge, USA (Prof. Petros Koumoutsakos). Topic: Scientific Machine Learning and surrogate modeling of time-dependent PDEs.
- Inria Saclay Île-de-France and École Polytechnique (Prof. Dominique Chapelle and Prof. Philippe Moireau). Topic: data-driven and semi-physical modeling of multiscale in time physical processes.
- Johns Hopkins University (Baltimore, USA), Department of Biomedical Engineering (Prof. Natalia Trayanova). Topic: mathematical modeling and Scientific Machine Learning for problems in cardiac electrophysiology and electromechanics.
- Alma Mater Studiorum, Universitá di Bologna (Prof. Stefano Severi, Dr. Chiara Bartolucci). Topic: mathematical modeling of cardiomyocytes.
- Karl-Franzens-Universität Graz and Medical University of Graz, Austria (Prof. Gernot Plank, Dr. Federica Caforio). Topic: Scientific Machine Learning methods for the solution of inverse problems in cardiac mechanics.
- Imperial College, London, UK (Prof. Steven Niederer, Dr. Marina Strocchi). Topic: neural network based surrogate models for the solution of inverse problems in cardiac electromechanics.
- Universitá degli studi di Firenze, Dipartimento di Fisiologia (Prof. Raffaele Coppini, Prof. Cecilia Ferrantini, Prof. Corrado Poggesi) and CNR (Prof. Leonardo Sacconi). Topic: mathematical methods for the analysis of microscopic data; mathematical modeling and numerical methods for mechanistic understanding of drugs action on the cardiac function.

Hospitals and clinical collaborators

- Texas Medical Center (Huston, USA), Children's Heart Institute (Prof. Dilachew Adebo, Prof. Antonio F. Corno, Prof. Uppu C Santosh). Topic: effect of COVID-19 infection on the cardiovascular system in pediatric patients.
- Lariboisière Hospital (Paris, France), Anesthesia and Intensive Care Department (M.D. Jona Joachim, M.D. Fabrice Vallée). Topic: data-driven and semi-physical modeling of pharmacodynamics during anesthesia.
- Centro Cardiologico Monzino IRCSS (Milan), Cardiovascular Imaging Department (Prof. Gianluca Pontone, M.D. Laura Fusini, M.D. Marco Guglielmo). Topic: development of mathematical models and numerical methods for the non-invasive assessment of cardiac perfusion.
- IRCCS Ca' Granda Ospedale Maggiore Policlinico (Milan), Cardiac Surgery Department (M.D. Roberto Scrofani). Topic: effect of COVID-19 infection on the cardiovascular system.
- Ospedale Luigi Sacco (Milan), Internal Medicine Department, Pathophysiology section (Prof. Chiara Cogliati). Topic: pathophysiology of COVID-19 infection and its impact on the cardiovascular system.

- IRCCS Ospedale San Raffaele (Milan), Department of Cardiac Arrhythmology and Electrophysiology (M.D. Giovanni Peretto). Topic: diagnosis and treatment of cardiac arrhythmias and myocarditis through mathematical models.

Part III - Teaching

Teaching activities

PhD courses

- **Lecturer** 2023-2024, I sem.
  Foundations and Applications of Machine Learning in Scientific Computing, Politecnico di Torino. 21 hours.

MSc courses

- **Teaching assistant** 2024-2025, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 48 hours, 10 CFUs.
- **Lecturer** 2024-2025, I sem.
  Computational Methods for Building Eng., Building Eng., Politecnico di Milano. 60 hours, 6 CFUs.
- **Teaching assistant** 2023-2024, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 48 hours, 10 CFUs.
- **Teaching assistant** 2022-2023, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 48 hours, 10 CFUs.
- **Teaching assistant** 2022-2023, I sem.
  Numerical Analysis for Machine Learning, Mathematical Eng., Politecnico di Milano. 33 hours, 10 CFUs.
- **Teaching assistant** 2021-2022, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 48 hours, 10 CFUs.
- **Course projects tutor** 2021-2022, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 20 hours, 10 CFUs.
- **Teaching assistant** 2021-2022, I sem.
  Numerical Analysis for Machine Learning, Mathematical Eng., Politecnico di Milano. 33 hours, 10 CFUs.
- **Teaching assistant** 2020-2021, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 48 hours, 10 CFUs.
- **Course projects tutor** 2020-2021, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 20 hours, 10 CFUs.
- **Teaching assistant** 2020-2021, I sem.
  Numerical Analysis for Machine Learning, Mathematical Eng., Politecnico di Milano. 33 hours, 10 CFUs.
- **Teaching assistant** 2019-2020, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 48 hours, 10 CFUs.
- **Course projects tutor** 2019-2020, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 20 hours, 10 CFUs.
- **Course projects tutor** 2018-2019, II sem.
  Numerical Analysis for Partial Differential Equations, Mathematical Eng., Politecnico di Milano. 20 hours, 10 CFUs.
- **Teaching assistant** 2017-2018, I sem.
  Numerical Methods for Partial Differential Equations, Civil Eng., Politecnico di Milano. 48 hours, 12 CFUs.

BSc courses

- **Lecturer** 2024-2025, II sem.
  Numerical Methods, Biomedical Eng., Politecnico di Milano. 20 hours, 5 CFUs.
- **Lecturer** 2023-2024, II sem.
  Numerical Methods, Biomedical Eng., Politecnico di Milano. 20 hours, 5 CFUs.
- **Lecturer** 2022-2023, II sem.
  Numerical Methods, Biomedical Eng., Politecnico di Milano. 20 hours, 5 CFUs.

- **Teaching assistant** 2020-2021, II sem.
  Numerical Methods, Biomedical Eng., Politecnico di Milano. 20 hours, 5 CFUs.
- **Teaching assistant** 2017-2018, II sem.
  Applied Numerical Analysis, Aerospace Eng., Politecnico di Milano. 48 hours, 10 CFUs.
- **Teaching assistant** 2016-2017, II sem.
  Applied Numerical Analysis, Aerospace Eng., Politecnico di Milano. 48 hours, 10 CFUs.

STUDENT ADVISING

PhD Theses (Co-advisor)

- (in progress). Andrea Tonini. Mathematical Models and Methods in Engineering (Politecnico di Milano).
- (in progress). Irena Radišić. Mathematical Models and Methods in Engineering (Politecnico di Milano).

MSc Theses (Advisor)

- (in progress). Arianna Cagali. Mathematical Engineering (Politecnico di Milano).
- (in progress). Gregorio Casella. Mathematical Engineering (Politecnico di Milano). Title: *Distributed overlapping-grid simulations of fluid-structure interaction problems with a Fictitious Domain approach*.
- 2024. Carlo Guastamacchia. Mechanical Engineering (Politecnico di Milano). Title: *A computational study on the impact of myofiber architecture on murine heart electromechanics*.
- 2024. Andrea Bosisio. Computer Science and Engineering (Politecnico di Milano). Title: *On the Synthesis of Seismic Broadband Waveforms with Conditional Diffusion Models*. Carried out with ETH Zurich.
- 2024. Luca Muscarnera. High Performance Computing Engineering (Politecnico di Milano). Title: *A Diffusion Based High Performance Algorithm for Continuous and Discrete Global Optimization*.
- 2022. Manfred Nesti. Mathematical Engineering (Politecnico di Milano). Title: *A multi-physics oxygenation model: from biological derivation to the numerical simulation of real-life scenarios*.
- 2022. Simone Polito. Mathematical Engineering (Politecnico di Milano). Title: *Physics-Informed Neural Networks for the inverse problem of Diffuse Optical Tomography*.

MSc Theses (Co-advisor)

- (in progress). Lorenzo Carella. Mathematical Engineering (Politecnico di Milano). Title: *On the time extrapolation capability of 2nd-Order Latent Dynamics Networks*.
- (in progress). Simone Celora. Mathematical Engineering (Politecnico di Milano). Title: *A Study of Hypertension by means of Cardiovascular Computational Models*.
- (in progress). Ettore Modina. Mathematical Engineering (Politecnico di Milano). Title: *Hybrid Learning for Digital Twin Modeling of a Satellite Thermal System*.
- 2024. Ilaria Bonfanti. Mathematical Engineering (Politecnico di Milano). Title: *Politecnico di Milano*.
- 2024. Vanessa Locatelli. Mathematical Engineering (Politecnico di Milano). Title: *Personalized 3D electromechanical model to assess virtual scenarios of biventricular pacing*.
- 2023. Ilaria de Vittori. Mathematical Engineering (Politecnico di Milano). Title: *Numerical modeling of the cerebrospinal fluid flow in brain ventricles*.
- 2023. Irena Radišić. Mathematical Engineering (Politecnico di Milano). Title: *Fully coupled multiscale models of cardiac electromechanics*.
- 2023. Francesco Songia. Mathematical Engineering (Politecnico di Milano). Title: *Aortic wall shear stress quantification from 4D flow data with Physics-Informed Neural Networks*.
- 2023. Davide Carrara. Mathematical Engineering (Politecnico di Milano). Title: *A neural network approach for reconstruction of cardiac electroanatomical maps*.
- 2022. Silvia Fornara. Biomedical Engineering (Politecnico di Milano). Title: *Optimization study of cardiac resynchronization therapy by means of a calibrated electromechanics computational model*.
- 2022. Alessandro Pirozzi. Mathematical Engineering (Politecnico di Milano). Title: *Gaussian process emulators to accelerate sensitivity analysis and Bayesian parameter estimation: application to cardiovascular modeling*.
- 2021. Andrea De Gobbis. Mathematical Engineering (Politecnico di Milano). Title: *Physics Informed Neural Networks for parameter estimation in cardiac electrophysiology*.

Part IV - Dissemination

Talks and seminars

Invited seminars

- Jan 14, 2025. PAV-IA Inaugural Lecture. Università di Pavia. Pavia, Italy. *Integrating physics-based models with machine learning for fast and accurate simulations*.
- Sep 24, 2024. Johns Hopkins University, Computational Cardiology Lab. Baltimore, USA. *Integrating physics-based models and Scientific Machine Learning in Computational Cardiology*.
- Sep 06, 2024. Harvard University, CSELab (Computational Science & Engineering Laboratory). Cambridge, USA. *Bridging Machine Learning methods with physics-based models in Computational Cardiology*.
- May 17, 2024. Inaugural Lecture for the seminar series "DARE U: DAssault REsearch Universe". Dassault Systèmes. Paris, France (online). *Bridging Scientific Machine Learning methods with physics-based models*.
- Mar 27, 2024. Università degli studi di Firenze. Florence, Italy. *Mathematical and numerical modeling of the human heart: linking the sarcomere scale with the organ scale function*.
- Feb 05, 2024. Università di Trento. Trento, Italy. *Augmenting physics-based models by means of Scientific Machine Learning methods in Computational Cardiology*.
- Oct 04, 2023. SofTMech Seminars. Glasgow, UK (online). *The regulation of cardiac active force generation: from micro-scale mechanisms to organ-scale simulations*.
- Sep 11, 2023. AI Seminars 2023, Spoke 4, FAIR. Politecnico di Milano. Milan, Italy. *Machine Learning augmentation of physics-based models in medicine*.
- Sep 22, 2022. Center of Advanced Mathematical Sciences (CAMS), American University of Beirut. Beirut, Lebanon (online). *A virtual heart: mathematical and numerical models of the cardiac electromechanical function*.
- Jul 04, 2022. Università degli studi di Firenze. Florence, Italy. *A novel in silico model of sarcomeres with cooperative thin filament regulation: from microscale dynamics to macroscale simulations*.
- Apr 25, 2022. University of Graz. Graz, Austria. *Regulatory mechanisms in cardiac active mechanics: from microscale models to multiscale numerical methods*.
- Jan 08, 2021. Università di Bologna. Bologna, Italy (online). *Biophysically detailed mathematical models of microscale active force generation in the cardiac tissue*.
- Aug 27, 2019. Pennsylvania State University, Department of Mathematics. State College, USA. *Machine learning for fast and reliable solutions of time dependent differential equations*.
- Feb 21, 2019. Inria Saclay Île-de-France. Palaiseau, France. *Blending Data Assimilation and Machine Learning for data-driven modeling of multiscale problems*.

Plenary lectures in conferences

- Jul 10–12, 2024. Plenary lecture at GIMC SIMAI YOUNG Conference 2024. Naples, Italy. *Research highlights for the SIMAI Young Researcher Award 2024*.
- Sep 29–30, 2022. Plenary lecture at GIMC SIMAI YOUNG Conference 2022. Pavia, Italy. *Automatic discovery of low-dimensional dynamics underpinning time-dependent PDEs by means of Neural Networks*.

Invited lectures in workshop

- Aug 04–08, 2025. Mathematical and Scientific Machine Learning (MSML 2025). Naples, Italy. *TBA*.
- May 19–23, 2025. Hidden structures in dynamical systems, optimization, and machine learning. L'Aquila, Italy. *Discovering compact latent structures in PDE solution manifolds*.
- Apr 28–30, 2025. Machine Learning and PDEs. Erlangen, Germany. *Discovering the hidden low-dimensional dynamics of time-dependent PDEs with latent dynamics networks*.
- Mar 24–26, 2025. Annual Meeting of EMS activity group on Scientific Machine Learning (first edition). Milan, Italy. *TBA*.
- Apr 15–19, 2024. Keynot Lecture at INdAM Workshop on Mathematical and Numerical Modeling of the Cardiovascular System. Rome, Italy. *Accelerating cardiac simulations: numerical methods and scientific machine learning*.

- Dec 04–07, 2023. Special Semester on Mathematical Methods in Medicine – Workshop on ML and AI for medical applications. Linz, Austria. *Augmenting physics-based models by means of Scientific Machine Learning methods in Computational Cardiology*.
- Oct 25–26, 2022. Workshop on Mathematics for the Health Sciences. Beirut, Lebanon (online). *Regulatory mechanisms in cardiac active mechanics: from microscale models to multiscale numerical methods*.
- Jun 08, 2021. Lecture for the GBMA PhD Award, in the context of the GBMA, GIMC GMA *Giovani alla ricerca* Workshop. Online. *Mathematical Modeling and Machine Learning for the Numerical Simulation of Cardiac Electromechanics*.

Lectures in international schools

- Jul 09, 2023. Lecture in the ESB23 (European Society of Biomechanics) pre-courses. Maastricht, the Netherlands. *AI-based and hybrid modelling*.
- Jun 07, 2021. Plenary lecture for the Best VPHi Thesis Award in *In Silico* Medicine (in the context of the 5th VPH Summer School). Barcelona, Spain (online). *Mathematical Modeling and Machine Learning for the Numerical Simulation of Cardiac Electromechanics*.

Invited talks in conferences

- Jun 03–07, 2024. ECCOMAS 2024 Congress. Lisbon, Portugal. *Bridging Scientific Machine Learning methods with physics-based models in Computational Cardiology*.
- Feb 27 – Mar 01, 2024. SIAM Conference on Uncertainty Quantification. Trieste, Italy. *Non-Intrusive Mesh-Free Surrogate Models in Variable Shape Domains*.
- Aug 20–25, 2023. ICIAM Conference. Tokyo, Japan (online). *Automatic discovery of low-dimensional dynamics underpinning time-dependent PDEs for inverse problems resolution*.
- Jul 31 – Aug 04, 2023. Workshop "Mathematical mechanical biology: old school and new school, methods and applications" at Isaac Newton Institute for Mathematical Sciences. Cambridge, UK. *A Biophysically Detailed Computational Model of the Four Chamber Human Heart Electromechanics*.
- May 30 – Jun 01, 2023. Math 2 Product (M2P), ECCOMAS Thematic Conference. Taormina, Italy. *A Biophysically Detailed Computational Model of the Four Chamber Human Heart Electromechanics*.
- Jul 31 – Aug 05, 2022. 15th World Congress of Computational Mechanics (WCCM). Yokohama, Japan (online). *Stabilizing numerical oscillations in cardiac active mechanics: an oscillations-free and accurate fully partitioned scheme*.
- Jul 10–14, 2022. 9th World Congress of Biomechanics. Taipei, Taiwan (online). *Bayesian parameter calibration for multiscale cardiovascular models enabled by Artificial Neural Networks*.
- Jun 27–29, 2022. 7th International Conference on Computational and Mathematical Biomedical Engineering (CMBE22). Milan, Italy. *Machine learning based real-time simulation of the cardiac electromechanical function enabling global sensitivity analysis and Bayesian parameter estimation*.
- Jun 04–11, 2022. ECCOMAS Congress 2022. Oslo, Norway. *Efficient identification of biomechanical properties in cardiac models based on physics-informed neural networks*.
- Nov 09–12, 2021. XLII Ibero-Latin-American Congress on Computational Methods in Engineering (CILAMCE-2021). Rio de Janeiro, Brazil (online). *Machine Learning enhanced cardiac models for computationally efficient multiscale simulations, sensitivity analysis and parameter estimation*.
- Sep 26–29, 2021. IACM Conference on Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering & Technology. San Diego, USA (online). *Data-driven reduced order modeling for fast and reliable solution of differential equations, with application to multiscale cardiac modeling*.
- Jun 27–30, 2021. 4th International Conference on Uncertainty Quantification in Computational Sciences and Engineering (ECCOMAS Thematic Conference). Athens, Greece (online). *Data-driven model order reduction for fast and reliable solution of differential equations: application to multiscale cardiac modeling*.
- Sep 02–07, 2019. UMI Congress 2019. Pavia, Italy. *An Artificial Neural Network based approach to Model Order Reduction of time-dependent models*.
- Jul 15–19, 2019. ICIAM Conference 2019. Valencia, Spain. *Machine learning of active force generation models for the efficient multiscale simulation of the cardiac function*.
- Jul 02–06, 2018. EUROMECH Conference ESMC 2018. Bologna, Italy. *A reduced model for active contraction in cardiac cells: towards computational efficiency in heart simulation*.
- May 10, 2018. MediolaNUM, University of Milano Bicocca. Milan, Italy. *Towards computational efficiency in heart simulation: a reduced model of active contraction of the cardiac tissue*.

Contributed talks in conferences

- Jan 30–31, 2025. COLIBRI Focus Workshop on Computational Medicine. Graz, Austria. *Improving computational efficiency in cardiac simulation: stress-free configuration recovery and multiphysics coupling*.
- Jun 18–21, 2024. Scientific Machine Learning, Emerging topics. Trieste, Italy. *Latent Dynamics Networks (LDNets): learning the intrinsic dynamics of spatio-temporal processes*.
- Jan 17–19, 2024. Mathematics for Artificial Intelligence and Machine Learning. Milan, Italy. *Scientific Machine Learning augmentation of physics-based models in Computational Cardiology*.
- Oct 19–20, 2023. BUILding a DIgital Twin: requirements, methods, and applications. Rome, Italy. *Automatic discovery of low-dimensional dynamics underpinning time-dependent PDEs by means of Latent Dynamics Networks*.
- Jul 09–12, 2023. 28th Congress of the ESB (European Society of Biomechanics). Maastricht, the Netherlands. *Regulatory mechanisms in cardiac active mechanics: from microscale models to multiscale numerical methods*.
- Sep 30 – Oct 02, 2022. Modeling the Cardiac Function – Theory, Numerical Methods, Clinical Applications. Cetraro, Italy. *Stabilization of staggered schemes for 3D cardiac mechanics coupled with 0D blood dynamics*.
- Jul 27–29, 2022. 10th Vienna International Conference on Mathematical Modelling. Vienna, Austria. *Neural networks based real-time simulations of cardiac electromechanics*.
- Feb 14–15, 2022. COLIBRI Focus Workshop – Mathematical Modeling and Machine Learning in Computational Medicine. Graz, Austria. *A Machine Learning Method for Real-time Numerical Simulations of Cardiac Electromechanics*.
- Aug 22–27, 2021. 25th International Congress of Theoretical and Applied Mechanics. Milan, Italy (online). *An oscillation-free fully staggered algorithm for the numerical simulation of cardiac active mechanics*.
- Jul 11–14, 2021. 26th Congress of the European Society of Biomechanics. Milan, Italy (online). *Stabilization for segregated algorithms in cardiac active mechanics*.
- Jul 01–03, 2021. Modeling the Cardiac Function – Theory, Numerical Methods, Clinical Applications. Milan, Italy (online). *An oscillation-free segregated algorithm for the numerical simulation of cardiac active mechanics*.
- Jan 11–15, 2021. WCCM-ECCOMAS Congress 2020. Paris, France (online). *Data-driven model order reduction for fast and reliable solution of differential equations: application to multiscale cardiac modeling*.
- Aug 31 – Sep 02, 2020. Modeling the Cardiac Function – Theory, Numerical Methods, Clinical Applications. Milan, Italy (online). *A Biophysically-detailed Human Cardiomyocytes Model: towards Computationally Efficient Simulation*.
- Aug 24–28, 2020. VPH2020: Virtual Physiological Human Conference 2020 Edition. Paris, France (online). *A biophysically-detailed model of cardiomyocytes: towards computationally efficient simulations*.
- Jul 22–24, 2019. RISM Congress 2019, Modelling the Cardiac Function. Varese, Italy. *Multiscale numerical simulation of the cardiac function: exploiting machine learning for modeling active force generation*.
- Jun 11–15, 2018. ECCOMAS Conference ECCM-ECFD 2018. Glasgow, UK. *A reduced model of active contraction of the cardiac muscle tissue*.
- Apr 16–19, 2018. INdAM Workshop on Mathematical and Numerical Modeling of the Cardiovascular System. Rome, Italy. *Active contraction of cardiac cells: a reduced model of force generation*.
- May 15–19, 2017. INdAM Workshop on Innovative Mathematical Models and Methods for Industrial Applications. Rome, Italy. *Multiscale topology optimization for self-assembling anisotropic materials*.

Posters

- Sep 02–06, 2023. EMC2023: European Muscle Conference. Florence, Italy. *A novel computational model of cardiac electromechanics: linking sarcomere-level mechanisms with organ-level function*.
- Aug 24–28, 2020. VPH2020: Virtual Physiological Human Conference 2020 Edition. Paris, France (online). *Combining Data Assimilation and Machine Learning to build data-driven models for unknown long time dynamics*.

ORGANIZATION OF CONFERENCES AND SCIENTIFIC EVENTS

Scientific Committee member — Sep 17–19, 2025
ECCOMAS Young Investigator Conference 2025 — Pescara, Italy

Minisymposium organizer — Sep 17–19, 2025
ECCOMAS Young Investigator Conference 2025 — Pescara, Italy
MS title: *Computational Cardiology: Mathematical Modeling, Numerical Methods and Simulation*
Organizers: R. Piersanti (Politecnico di Milano, Italy), N. Biasi (Università di Pisa, Italy), M. Bucelli (Politecnico di Milano, Italy), F. Regazzoni (Politecnico di Milano, Italy), F. Renzi (Politecnico di Milano, Italy)

Organizing Committee member Mar 24–26, 2025
Annual Meeting of EMS activity group on Scientific Machine Learning (first edition) Milan, Italy
Organizers: P. Antonietti, S. Pagani, F. Regazzoni, M. Verani, P. Zunino (Politecnico di Milano)

Organizing Committee member Nov 07–08, 2024
Mathematics for our Health (M4H) Milan, Italy
Organizers: S. Fresca, C. Masci, S. Pagani, F. Regazzoni, D. Riccobelli, A. Signori (Politecnico di Milano)

Minisymposium organizer Jun 24–26, 2024
Computational and Mathematical Biomedical Engineering - CMBE24 Arlington, USA
MS title: *Innovative computational models and methods for the cardiac function*
Organizers: L. Dede' (Politecnico di Milano, Italy), S. Pagani (Politecnico di Milano, Italy), F. Regazzoni (Politecnico di Milano, Italy), C. Vergara (Politecnico di Milano, Italy)

Organizing Committee member Jun 18–21, 2024
Scientific Machine Learning, emerging topics Trieste, Italy
Organizers: M. D'Elia (Pasteur Labs and Stanford University), G. Rozza (SISSA), M. Strazzullo (Politecnico di Torino), D. Torlo (Università di Roma, La Sapienza), F. Pichi (SISSA), N. Tonicello (SISSA), P. Africa (SISSA), M. Girfoglio (SISSA), S. Pagani (Politecnico di Milano), F. Regazzoni (Politecnico di Milano)

Minisymposium organizer Jun 03–07, 2024
European Community on Computational Methods in Applied Sciences Congress (ECCOMAS) Lisbon, Portugal
MS title: *Computational Cardiology: Modeling and Simulating the Heart*
Organizers: M. Bucelli (Politecnico di Milano, Italy), S. Pagani (Politecnico di Milano, Italy), R. Piersanti (Politecnico di Milano, Italy), F. Regazzoni (Politecnico di Milano, Italy), M. Schuster (RWTH Aachen, Germany), E. Zappon (Politecnico di Milano, Italy), A. Zingaro (ELEM Biotech, Spain)

Minisymposium organizer Feb 27 – Mar 01, 2024
SIAM Conference on Uncertainty Quantification Trieste, Italy
MS title: *Algorithms and methods for PDEs in parametric or uncertain domains*
Organizers: F. Bonizzoni (Politecnico di Milano, Italy), S. Pagani (Politecnico di Milano, Italy), S. Pezzuto (Università di Trento, Italy), F. Regazzoni (Politecnico di Milano, Italy)

Minisymposium organizer Aug 28 – Sep 01, 2023
The bi-annual congress of the Italian Society of Applied and Industrial Mathematics (SIMAI) Matera, Italy
MS title: *Scientific computing and data science in biomedicine*
Organizers: F. Caforio (University of Graz, Austria), E. Karabelas (University of Graz, Austria), F. Regazzoni (Politecnico di Milano, Italy), S. Pagani (Politecnico di Milano, Italy), E. Zappon (Politecnico di Milano, Italy)

Minisymposium organizer Aug 20–25, 2023
International Congress on Industrial and Applied Mathematics (ICIAM) Tokyo, Japan
MS title: *Differential Equations meet Data: Scientific Machine Learning for Cardiovascular Applications*
Organizers: F. Regazzoni (Politecnico di Milano, Italy), S. Pagani (Politecnico di Milano, Italy), Francisco Sahli Costabal (Pontificia Universidad Católica de Chile), Simone Pezzuto (Università di Trento)

Minisymposium organizer May 30 – Jun 01, 2023
Math 2 Product (M2P) Conference Taormina, Italy
MS title: *Computational Medicine: Data-driven and physics-based tools for clinical applications*
Organizers: F. Caforio (University of Graz, Austria), S. Pagani (Politecnico di Milano, Italy), F. Regazzoni (Politecnico di Milano, Italy), M. Strocchi (King's College London, United Kingdom), E. Karabelas (University of Graz, Austria)

Minisymposium organizer Jun 05–09, 2022
European Community on Computational Methods in Applied Sciences Congress (ECCOMAS) Oslo, Norway
MS title: *Physics-based and data-driven methods for Computational Cardiology*
Organizers: P. C. Africa, M. Fedele, I. Fumagalli, S. Pagani, F. Regazzoni (Politecnico di Milano, Italy)

Organizing Committee member May 27, 2022
MOX20, Celebrations for the 20th anniversary of MOX Milan, Italy
Organizers: I. Mazzieri, A. Menafoglio, F. Regazzoni, D. Riccobelli, M. Verani (Politecnico di Milano, Italy)

Part V - Outreach

National or international patents

Approved

Office:	UIBM - Ufficio Italiano Brevetti e Marchi
Application n.:	102020000015619 (Date: 29/06/2020)
Inventors:	Dede' Luca, Quarteroni Alfio, Regazzoni Francesco
Title:	*Metodo implementato mediante computer per la generazione di un modello matematico a complessità computazionale ridotta*

Pending

Office:	World Intellectual Property Organization
Application n.:	WO 2022/003509 A1 (Date: 06/01/2022)
Inventors:	Dede' Luca, Quarteroni Alfio, Regazzoni Francesco
Title:	*Computer-implemented method for the generation of a mathematical model with reduced computational complexity*

Working groups for Technology Transfer

- 2021–2024. Member of the *Working Group Data & Artificial Intelligence* in Assolombarda, the association of companies operating in the Metropolitan City of Milan and in the provinces of Lodi, Monza and Brianza, Pavia.
- 2024. *Linee guida per le Imprese sull'approccio all'Intelligenza Artificiale* (Guidelines for Enterprises on the approach to Artificial Intelligence), Dispensa n° 05/2024. Guidelines written on behalf of Assolombarda, the association of companies operating in the Metropolitan City of Milan and in the provinces of Lodi, Monza and Brianza, Pavia.
- 2023. *Intelligenza Artificiale per l'industria* (Artificial Intelligence for Industry), Dispensa n° 01/2023. Booklet written on behalf of Assolombarda, the association of companies operating in the Metropolitan City of Milan and in the provinces of Lodi, Monza and Brianza, Pavia.

Software contributions

My GitHub profile (https://github.com/FrancescoRegazzoni) contains some software codes that I made publicly available. A list of the libraries I contributed to is reported below.

Main developer
model-learning – http://model-learning.rtfd.io/
Open source MATLAB library for Machine Learning and data-driven discovery of differential equations and for Model Order Reduction of time-dependent problems.

Main developer
cardioemulator – http://cardioemulator.rtfd.io/
Open source PYTHON library that allows to construct zero-dimensional emulators of the cardiac electromechanical function.

Contributor
life^x – https://lifex.gitlab.io
High-performance Finite Element library mainly focused on mathematical models and numerical methods for cardiac applications, written in C++ (C++17 standard) and based on the deal.II finite element core.

Contributor
LifeV – https://bitbucket.org/lifev-dev/lifev-release/wiki/Home
Open source C++ library for the numerical solution of PDEs with the Finite Element Method (FEM), with a focus on applications in life sciences.

Divulgation activities

- Participation in the podcast "Il cuore matematico: Alfio Quarteroni racconta iHeart".

- "Un glossario per l'intelligenza artificiale: da Algoritmo a Unsupervised Learning" (A glossary for artificial intelligence: from Algorithm to Unsupervised Learning). Article on www.agendadigitale.eu.
- "IA in ambito industriale: i domini di applicazione" (AI in Industry: application domains). Article on www.agendadigitale.eu.
- "Intelligenza artificiale: i concetti chiave per comprenderla meglio" (Artificial Intelligence: key concepts to better understand it). Article on www.agendadigitale.eu.
- "A twin heart". Interview by F. Pietrangeli on *Frontiere – Journey into the research world*.
- MEETmeTONIGHT – "Faccia a Faccia con la Ricerca" (Face to face with Research).
- "The role of artificial intelligence and machine learning in the iHEART project". Interview by S. Moraca on iHEART YouTube Channel.

Part VI - Service

Reviewer activity

Reviewer for Funding Agencies

- French National Research Agency (*ANR, Agence Nationale de la Recherche*)
- German Research Foundation (*DFG, Deutsche Forschungsgemeinschaft*)
- Icelandic Research Fund
- National Science Centre Poland

Review Editor

- Frontiers in Physiology (Section *Computational Physiology and Medicine*)

Reviewer for International Journals

Computer Methods in Applied Mechanics and Engineering (4 papers), International J. for Numerical Methods in Biomedical Engineering (3 papers), Mathematical Biosciences and Engineering (2 papers), Mathematics (2 papers), Applied Mathematics and Computation (2 papers), Frontiers in Physiology (2 papers), Journal of Computational Physics (1 paper), Nature Machine Intelligence (1 paper), npj Computational Materials (1 paper), Computer Methods in Biomechanics and Biomedical Engineering (1 paper), Nature Communications Biology (1 paper), Journal of Computational Physics: X (1 paper), Computers and Fluids (1 paper), Computers in Biology and Medicine (1 paper), The Journal of Physiology (1 paper), Journal of Theoretical Biology (1 paper), Biocybernetics and Biomedical Engineering (1 paper), Zeitschrift für Angewandte Mathematik und Mechanik (1 paper), Mathematics in Action (1 paper), Computational Methods in Applied Mathematics (1 paper), Acta Biomaterialia (1 paper), ASME Journal of Biomechanical Engineering (1 paper)

Committees

Hiring committees for research and teaching positions

- Jan 2025. Committee member for the award of teaching support positions for the course *Numerical Analysis for Partial Differential Equations* (provvedimento Rep. N. 19708/2024 - prot. n. 314575 del 18 dicembre 2024). *Politecnico di Milano*.
- Jan 2025. Committee member for the award of one research fellow positions - SSD MATH-05/A - Analisi Numerica (procedure ASSEGNI DMAT28 2024). *Politecnico di Milano*.
- Sep 2024. Committee member for the award of one research fellow positions - SSD MAT/08 - Analisi Numerica (procedure 2024_ASSEGNI_DCMC 76). *Politecnico di Milano*.
- Sep 2024. Committee member for the award of one research fellow positions - SSD MAT/08 - Analisi Numerica (procedure ASSEGNI DMAT18 2024). *Politecnico di Milano*.
- Dec 2023. Committee member for the award of teaching support positions for the course *Numerical Analysis for Partial Differential Equations* (provvedimento Rep. N. 14142/2023 - prot. n. 271637 del 20 novembre 2023). *Politecnico di Milano*.
- Dec 2023. Committee member for the award of two research fellow positions - SSD MAT/08 - Analisi Numerica (procedure ASSEGNI DMAT10 2023). *Politecnico di Milano*.

- Nov 2023. Committee member for the award of one research fellow positions - SSD MAT/08 - Analisi Numerica (procedure ASSEGNI_DMAT11_2023). *Politecnico di Milano*.
- Dec 2022. Committee member for the award of teaching support positions for the course *Numerical Analysis for Partial Differential Equations* (provvedimento Rep. N. 12059/2022 prot. n. 268665 del 21 novembre 2022). *Politecnico di Milano*.

Master Degrees Committees

- Dec 2024. Master Degree in Mechanical Engineering, *Politecnico di Milano*.
- Jul 2024. Master Degree in Mathematical Engineering, *Politecnico di Milano*.
- Apr 2024. Master Degree in Mathematical Engineering, *Politecnico di Milano*.
- Jul 2023. Master Degree in Mathematical Engineering, *Politecnico di Milano*.
- May 2023. Master Degree in Biomedical Engineering, *Politecnico di Milano*.
- Dec 2022. Master Degree in Aerospace Engineering, *Politecnico di Milano*.
- Oct 2022. Master Degree in Mathematical Engineering, *Politecnico di Milano*.
- Jul 2022. Master Degree in Mathematical Engineering, *Politecnico di Milano*.

OTHER SERVICE ACTIVITIES

- 2023 – to date: Member of the working table on communication at MOX, Department of Mathematics, *Politecnico di Milano*.
- 2023 – to date: Contact person for International Mobility at Department of Mathematics, *Politecnico di Milano*.

In compliance with the Italian legislative Decree no. 196 dated 30/06/2003, I hereby authorize you to use and process my personal details contained in this document.