

# PASQUALE CLAUDIO AFRICA

Post-Doctoral researcher

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elauksap



## EXPERIENCE

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Post-Doc

### Numerical modelling for the simulation of the cardiac function

📅 01 May 2020 – present

📍 Politecnico di Milano – Department of Mathematics

**Supported by:** iHeart – ERC 2016, advanced grant agreement n. 740132.

**Principal Investigator:** Prof. Alfio Quarteroni.

**Activity:** Development of an integrated model for the whole cardiac function. This project motivates the investigation of numerical schemes to tackle **multiphysics**, **multiscale**, and **multidomain** problems involved in the cardiac function. I am the main author, developer, and maintainer of **life<sup>x</sup>** (<https://lifex.gitlab.io/>), a C++ finite element library exploiting **high-performance computing** techniques for the efficient solution of large-scale PDEs with interface to a number of modern packages for scientific computing. I have either developed or supervised the development of a variety of space-time discretization, splitting and partitioning schemes, and matrix-based or **matrix-free** solvers for applications in cardiac computational modeling.

**Active collaborations and consultancy activity** with/for:

1. deal.II software development community (Prof. Wolfgang Bangerth, Colorado State University, Prof. Luca Heltai, SISSA, Dr. Peter Munch, TUM);
2. Johns Hopkins University (Prof. Natalia Trayanova, Dept. of Medicine);
3. MOXOFF S.p.A. (Dr. Nicoletta Caramia, Dr. Luca Azzolin, Dr. Abele Simona, Dr. Martin Gabriel, Dr. Stefano Brambilla);
4. University of Brescia (Prof. Paola Gervasio, Dept. of Mathematics);
5. University of Milan (Prof. Simone Scacchi, Dept. of Mathematics);
6. University of Pavia (Prof. Luca Pavarino, Dept. of Mathematics).

**Associations:** SIMAI (Italian Society of Applied and Industrial Mathematics), GNCS – INdAM (National Group for Numerical Analysis and Scientific Computing), CINECA

**Other:** Representative of research fellows in the Department Council.

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Post-Doc

### An integrated heart model for the simulation of the cardiac function

📅 16 Jan 2019 – 30 Apr 2020

📍 Politecnico di Milano – Department of Mathematics

**Supported by:** iHeart – ERC 2016, advanced grant agreement n. 740132.

**Principal Investigator:** Prof. Alfio Quarteroni.

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Visiting researcher

### High-performance computing techniques for the finite element library LifeV

📅 06 May 2019 – 09 May 2019

📍 École Polytechnique Fédérale de Lausanne – Mathematics Section

**Host:** Prof. Simone Deparis.

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Research fellow

### Development of high-performance computing algorithms for complex data analyses and simulations for monitoring and forecasting natural hazards

📅 23 Nov 2018 – 22 May 2019

📍 Politecnico di Milano – Department of Mathematics

**Supported by:** Accordo quadro ASI–PoliMi “Attività di Ricerca e Innovazione” n. 2018-5-HH.0, collaboration agreement between the Italian Space Agency and Politecnico di Milano.

Principal Investigator: Prof. Luca Formaggia.

## QUALIFICATIONS

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### Habilitation as Teacher in secondary schools

📅 Oct 2022

📍 Italian Ministry of University and Research

Subject area: **A-27** – Mathematics and Physics

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### 24 CFUs in anthropo-psycho-pedagogical disciplines

📅 Mar 2022

📍 Università Telematica Pegaso

**6 credits** Inclusive didactics (M-PED/03)

**6 credits** Educational and Learning Technology (M-PED/04)

**6 credits** General psychology (M-PSI/01)

**6 credits** General anthropology (M-DEA/01)

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## EDUCATION

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Ph.D.

### Mathematical Models and Methods in Engineering (awarded on 08 Feb 2019)

📅 01 Nov 2015 – 31 Oct 2018

📍 Politecnico di Milano – Department of Mathematics

**Thesis:** “Scalable adaptive simulation of organic thin-film transistors”.

**Supervisor:** Prof. Carlo de Falco.

**Activity:** **High-performance** numerical simulation of **multiphysics** and **multiscale** models of charge transport in organic semiconductor materials for electronics applications, in collaboration with the Center of Nano Science and Technology of the Italian Institute of Technology (CNST@IIT) and with the Department of Electronics, Information and Bioengineering (DEIB) of Politecnico di Milano.

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Master’s degree

### Mathematical Engineering (awarded on 30 Sep 2015, final grade: 110 / 110)

📅 Oct 2013 – Sep 2015

📍 Politecnico di Milano

**Thesis:** “Numerical modeling of organic thin-film transistors”.

**Supervisor:** Prof. Carlo de Falco.

**Other:** President of AIM (“Association of Mathematical Engineers”).

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Bachelor’s degree

### Mathematical Engineering (awarded on 22 Jul 2013, final grade: 108 / 110)

📅 Sep 2010 – Jul 2013

📍 Politecnico di Milano

**Thesis:** “Modeling and numerical simulation of charge transport in Organic Light-Emitting Transistor (OLET) devices”.

**Supervisor:** Prof. Stefano Micheletti.

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High school diploma

### Scientific studies (awarded on 05 Jul 2010, final grade: 100 / 100 cum laude)

📅 Sep 2005 – Jul 2010

📍 Liceo scientifico “L. Da Vinci” – Reggio Calabria (Italy)

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## SKILLS

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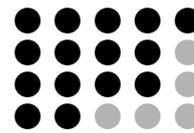
C++, C, MPI, OpenMP

MATLAB, GNU Octave

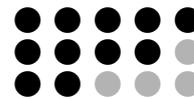
Python, R, CUDA



bash, git, Subversion  
CI/CD, Docker  
HPC tools (SLURM, TORQUE, Spack, LMod)  
Quantum computing (Qiskit, PyQUBO, QuTiP, Pulser)



L<sup>A</sup>T<sub>E</sub>X  
HTML  
PHP, CSS, SQL, JavaScript, jQuery



## SOFTWARE

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**life<sup>x</sup>** (<https://lifex.gitlab.io/>) (Sep 2019 – present): main author, developer and maintainer of a high-performance finite element library mainly focused on mathematical models and numerical methods for multi-physics, multi-scale and geometrically coupled problems, with a focus on cardiac applications. **life<sup>x</sup>** is written using the most modern programming techniques available in the C++17 standard and is based on the `deal.II` finite element core.

**pyfe<sup>x</sup>** (Sep 2019 – present): developer of a Python interface to **life<sup>x</sup>** for the development of model order reduction techniques, with interfaces to scientific packages for machine learning, inverse problems, sensitivity analysis and uncertainty quantification.

**deal.II** (<https://www.dealii.org/>) (Oct 2019 – present): contributor to the open-source high-performance C++ finite element library. Actively collaborated to bring support to simplex meshes into the library.

**mk** (<https://github.com/elauksap/mk>) (Feb 2020 – present): main author and maintainer of a tool for building environment modules, based on Lmod, for scientific computing libraries and packages, delivered as portable x86-64 Linux binaries.

**fdaPDE** (<https://github.com/fdaPDE/fdaPDE>) (Jul 2019 – present): supervisor of contributions to the open-source R package written in C++ for statistical analysis of functional and spatial data, based on regression with PDE regularization.

**orgDD++** (Jul 2018 – Oct 2018): main author and maintainer of a high-performance, parallel, scalable C++ software to simulate charge transport in Organic Thin-Film Transistors and Metal-Insulator-Semiconductor capacitors.

**bim++** (Jun 2017 – Oct 2019): author and maintainer of a high-performance, parallel, scalable C++ partial differential equation solver on non-conforming quadtree meshes with automatic estimator-driven mesh adaptation.

**Focus** (<https://github.com/elauksap/focus-beamertHEME>) (Jun 2018 – Nov 2019): main author and maintainer of a presentation theme for L<sup>A</sup>T<sub>E</sub>X Beamer that aims at a clean and minimalist design, so to minimize distractions and put the focus directly on the content. Published on the CTAN: <https://ctan.org/pkg/beamertHEME-focus>.

More available on my **GitHub** profile: <https://github.com/elauksap>.

## PUBLICATIONS

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ORCID: <https://orcid.org/0000-0002-0706-8564>

### Preprints

- [1] **Pasquale Claudio Africa**, Roberto Piersanti, Marco Fedele, Luca Dede', and Alfio Quarteroni. "An open tool based on **life<sup>x</sup>** for myofibers generation in cardiac computational models". *Submitted to: BMC Bioinformatics* (Jan. 2022). arXiv: 2201.03303.
- [2] **Pasquale Claudio Africa**, Matteo Salvador, Paola Gervasio, Luca Dede', and Alfio Quarteroni. "A matrix-free high-order solver for the numerical solution of cardiac electrophysiology". *Submitted to: Journal of Computational Physics* (May 2022). arXiv: 2205.05136.
- [3] Michele Bucelli, Alberto Zingaro, **Pasquale Claudio Africa**, Ivan Fumagalli, Luca Dede', and Alfio Quarteroni. "A mathematical model that integrates cardiac electrophysiology, mechanics and fluid dynamics: application to the human left heart". *Submitted to: International Journal for Numerical Methods in Biomedical Engineering* (Aug. 2022). arXiv: 2208.05551.

- [4] Marco Fedele, Roberto Piersanti, Francesco Regazzoni, Matteo Salvador, **Pasquale Claudio Africa**, Michele Bucelli, Alberto Zingaro, Luca Dede', and Alfio Quarteroni. "A comprehensive and biophysically detailed computational model of the whole human heart electromechanics". *Submitted to: Computer Methods in Applied Mechanics and Engineering* (July 2022). arXiv: 2207.12460.

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## 🔗 Open-source software

- [1] **Pasquale Claudio Africa**. "life<sup>x</sup>-env". Version v2022.0. July 2022. DOI: 10.5281/zenodo.6947676. URL: <https://gitlab.com/lifex/lifex-env>.
- [2] **Pasquale Claudio Africa**. "life<sup>x</sup>: a flexible, high performance library for the numerical solution of complex finite element problems". Version v1.5.0. July 2022. DOI: 10.5281/zenodo.6941115. URL: <https://lifex.gitlab.io/>.
- [3] **Pasquale Claudio Africa**. "mk: environment modules for scientific computing software". Version v2022.0. July 2022. DOI: 10.5281/zenodo.6947699. URL: <https://github.com/elauksap/mk>.
- [4] **Pasquale Claudio Africa**, Roberto Piersanti, and Marco Fedele. "An open tool based on life<sup>x</sup> for myofibers generation in cardiac computational models". Version v1.4.0. Jan. 2022. DOI: 10.5281/zenodo.5810268.

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## 🕒 In preparation

- [1] **Pasquale Claudio Africa**, Simona Perotto, and Carlo de Falco. "Scalable recovery-based adaptive mesh refinement on quadtree meshes". *In preparation* (2022).

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## 📄 Peer-reviewed articles

- [1] **Pasquale Claudio Africa**. "life<sup>x</sup>: A flexible, high performance library for the numerical solution of complex finite element problems". *SoftwareX* 20 (2022), p. 101252. DOI: 10.1016/j.softx.2022.101252.
- [2] Francesco Regazzoni, Matteo Salvador, **Pasquale Claudio Africa**, Marco Fedele, Luca Dede', and Alfio Quarteroni. "A cardiac electromechanics model coupled with a lumped-parameter model for closed-loop blood circulation". *Journal of Computational Physics* 457 (2022), p. 111083. DOI: 10.1016/j.jcp.2022.111083.
- [3] Christian Vergara, Simone Stella, Massimiliano Maines, **Pasquale Claudio Africa**, Domenico Catanzariti, Cristina Demattè, Maurizio Centonze, Fabio Nobile, Alfio Quarteroni, and Maurizio Del Greco. "Computational electrophysiology of the coronary sinus branches based on electro-anatomical mapping for the prediction of the latest activated region". *Medical & Biological Engineering & Computing* (2022). DOI: 10.1007/s11517-022-02610-3.
- [4] Alberto Zingaro, Ivan Fumagalli, Marco Fedele, **Pasquale Claudio Africa**, Luca Dede', Alfio Quarteroni, and Antonio Francesco Corno. "A geometric multiscale model for the numerical simulation of blood flow in the human left heart". *Discrete and Continuous Dynamical Systems - S* 15.8 (2022), pp. 2391–2427. DOI: 10.3934/dcdss.2022052.
- [5] Mara Sabina Bernardi, **Pasquale Claudio Africa**, Carlo de Falco, Luca Formaggia, Alessandra Menafoglio, and Simone Vantini. "On the use of interferometric synthetic aperture radar data for monitoring and forecasting natural hazards". *Mathematical Geosciences* 53.8 (2021), pp. 1781–1812. DOI: 10.1007/s11004-021-09948-8.
- [6] Roberto Piersanti, **Pasquale Claudio Africa**, Marco Fedele, Christian Vergara, Luca Dede', Antonio Francesco Corno, and Alfio Quarteroni. "Modeling cardiac muscle fibers in ventricular and atrial electrophysiology simulations". *Computer Methods in Applied Mechanics and Engineering* 373 (2021), p. 113468. DOI: 10.1016/j.cma.2020.113468.
- [7] Matteo Salvador, Marco Fedele, **Pasquale Claudio Africa**, Eric Sung, Luca Dede', Adityo Prakosa, Natalia Trayanova, Jonathan Chrispin, and Alfio Quarteroni. "Electromechanical modeling of human ventricles with ischemic cardiomyopathy: numerical simulations in sinus rhythm and under arrhythmia". *Computers in Biology and Medicine* 136 (2021), p. 104674. DOI: 10.1016/j.combiomed.2021.104674.

- [8] Simone Stella, Christian Vergara, Massimiliano Maines, Domenico Catanzariti, **Pasquale Claudio Africa**, Cristina Demattè, Maurizio Centonze, Fabio Nobile, Maurizio Del Greco, and Alfio Quarteroni. “Integration of activation maps of epicardial veins in computational cardiac electrophysiology”. *Computers in Biology and Medicine* 127 (2020), p. 104047. DOI: 10.1016/j.compbimed.2020.104047.
- [9] **Pasquale Claudio Africa**, Carlo de Falco, Francesco Maddalena, Mario Caironi, and Dario Natali. “Simultaneous extraction of density of states width, carrier mobility and injection barriers in organic semiconductors”. *Scientific Reports* 7 (2017), p. 3803. DOI: 10.1038/s41598-017-03882-8.

## Conference proceedings

- [10] **Pasquale Claudio Africa**, Dario Natali, Mario Caironi, and Carlo de Falco. “Automatic extraction of transport model parameters of an organic semiconductor material”. *SCEE 2018: Scientific Computing in Electrical Engineering. Journal of Mathematics in Industry*. Springer, 2020, p. 93. DOI: 10.1007/978-3-030-44101-2\_9.

## Ph.D. thesis

- [11] **Pasquale Claudio Africa**. “Scalable adaptive simulation of organic thin-film transistors”. Politecnico di Milano, Milano (MI), Italy, 2019. URL: <http://hdl.handle.net/10589/144819>.

## REVIEWS

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**Publons:** <https://publons.com/researcher/4660545/pasquale-claudio-africa/>

Reviewer for the following international journals.

- 2022 *Transactions on Mathematical Software*, ACM (1 peer review).
- 2022 *Journal of Open Source Software* (1 peer review).
- 2022 *Transactions on Biomedical Engineering*, IEEE (2 peer reviews).
- 2022 *Computers in Biology and Medicine*, Elsevier (1 peer review).
- 2022 *Medical and Biological Engineering and Computing*, Springer (1 peer review).
- 2021 *Computers in Biology and Medicine*, Elsevier (3 peer reviews).

## CONFERENCES AND SEMINARS

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ICIAM 2023 – International Congress on Industrial and Applied Mathematics

Invited talk (title to be announced)

 20 – 25 Aug 2023

 Tokyo (Japan)

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MCF 2022 – Modeling the Cardiac Function

- Member of the Organizing Committee
- Invited talk: “**life<sup>x</sup>: a friendly, high-performance framework for complex cardiac simulations**”

 30 Sep – 02 Oct 2022

 Cetraro (Italy)

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CMBE 2022 – Computational and mathematical Biomedical Engineering

Invited talk (with L. Dede’): “**Multiphysics and multiscale models for the numerical simulation of the cardiac function**”

 27 – 29 Jun 2022

 Milano (Italy)

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ECCOMAS 2022 – 8th European Congress on Computational Methods in Applied Sciences and Engineering

- Member of the Organizing Committee of mini-symposium MS123: “**Physics-based and data-driven methods for computational cardiology**”

• **Contributed talk:** “A matrix-free solver for high-order discretization in cardiac electrophysiology” in mini-symposium MS92: “Higher order finite element methods for challenging mathematical problems in engineering and applied sciences”

📅 05 Jun – 09 Jun 2022

📍 Oslo (Norway)

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Università di Pavia

**Invited talk:** “life<sup>x</sup>: a high-performance simulator of the cardiac function”

📅 14 Dec 2021

📍 Pavia (Italy)

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MNCM – Young Researcher Workshop on Mathematical and Numerical Cardiac Modeling

**Chairperson**

📅 14 Dec 2021

📍 Pavia (Italy)

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SIMAI 2020+21 – Italian Society of Applied and Industrial Mathematics

• **Member of the Organizing Committee of mini-symposium MS49/MS50:** “Clinical Data Integration in Numerical Models”

• **Invited talk:** “Matrix-Free methods for high-order discretization in cardiac electrophysiology” in mini-symposium MS09: “Effective solvers for innovative discretizations of partial differential equations and applications”

📅 30 Aug – 02 Sep 2021

📍 Parma (Italy)

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MCF 2021 – Modeling the Cardiac Function

• **Organizer of satellite workshop:** “life<sup>x</sup>: overview and hands-on tutorial”

• **Invited talk:** “life<sup>x</sup>: a new high-performance library for integrated heart simulations”

📅 01 – 03 Jul 2021

📍 Online

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deal.II workshop 2021

**Invited talk:** “deal.II user experience in life<sup>x</sup>: porting existing code to simplex meshes”

📅 13 – 15 Jan 2021

📍 Online

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MCF 2020 – Modeling the Cardiac Function

• **Informal talk:** “Introducing the novel life<sup>x</sup> software library for cardiac simulations”

• **Chairperson**

📅 31 Aug – 02 Sep 2020

📍 Online

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MCF 2019 – Modeling the Cardiac Function – RISM

**Attendee**

📅 22 – 24 Jul 2019

📍 Varese (Italy)

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SIMAI 2018 – Italian Society of Applied and Industrial Mathematics

**Contributed talk:** “Scalable recovery-based adaptation on quadtree meshes”

in mini-symposium: “Recent advances in nonconforming and polygonal methods for partial differential equations”

📅 02 – 06 Jul 2018

📍 Rome (Italy)

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MediolaNum 2018 – Young Numerical Analysts in Milan

**Invited talk: “Scalable adaptive refinement on quadtree meshes”**

📅 10 May 2018

📍 Milan (Italy)

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IWCN 2017 – International Workshop on Computational Nanotechnology

**Contributed talk: “Model parameter estimation and adaptive numerical simulation for organic thin-film transistors”**

📅 05 – 09 Jun 2017

📍 Windermere (Cumbria, UK)

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SimOEP 2016 – Simulation of Organic Electronics and Photovoltaics

**Contributed talk: “Simultaneous extraction of DOS width and injection barrier in OTFTs”**

📅 14 – 16 Sep 2016

📍 Winterthur (Zürich, Switzerland)

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## TEACHING

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### Seminar lectures

**Tools for scientific research software development and distribution** (01 Mar 2022 – 10 Jun 2022): organizer (with Prof. L. Formaggia in the frame of the “Passion in Action” program of Politecnico di Milano) of a cycle of 8 seminars open to all Engineering students (~40 students). Speaker of “Introduction to Makefiles” (09 Mar, **2 hours**) and “Version control systems: git” (13 Apr, **2 hours**).

**Binding C++ and Python: introduction to pybind11** (28 May 2021): Advanced Programming for Scientific Computing, M.Sc. in Mathematical and Nuclear Engineering (**3 hours**, ~60 students, blended course).

**Introduction to modern parallel computing in C++ using MPI and OpenMP** (18, 19 May 2022): Advanced Programming for Scientific Computing, M.Sc. in Mathematical and Nuclear Engineering (**5 hours**, ~90 students, blended course).

**Introduction to modern parallel computing in C++ using MPI and OpenMP** (10, 13 May 2021): Advanced Programming for Scientific Computing, M.Sc. in Mathematical and Nuclear Engineering (**5 hours**, ~60 students, blended course).

**Introduction to CMake** (24 Jun 2019): Ph.D. course in Mathematical Models and Methods in Engineering and M.Sc. in Mathematical Engineering (**2 hours**, ~10 students).

**Introduction to git and HPC tools** (23 May 2019): Ph.D. course in Mathematical Models and Methods in Engineering and M.Sc. in Mathematical Engineering (**2 hours**, ~20 students).

**Parameter estimation and numerical simulation for OTFTs** (14 Mar 2018): Ph.D. course in Organic Electronics and applications (**2 hours**, ~20 students).

**Introduction to L<sup>A</sup>T<sub>E</sub>X** (2013/2014, 2014/2015): M.Sc. and B.Sc. students from Politecnico di Milano (2 hours / year × 2 years = **4 hours**, ~80 students / year).

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### Teaching assistant

**Advanced Programming for Scientific Computing** (2021/2022): M.Sc. in Mathematical and Nuclear Engineering (**40 hours**, ~90 students, blended course).

**Advanced Programming for Scientific Computing** (2020/2021): M.Sc. in Mathematical and Nuclear Engineering (**40 hours**, ~60 students, blended course).

**Numerical Analysis** (2020/2021): B.Sc. in Biomedical Engineering (**20 hours**, ~120 students, blended course).

**Advanced Programming for Scientific Computing** (2019/2020): M.Sc. in Mathematical and Nuclear Engineering (**40 hours**, ~60 students, online course).

**Fundamentals of Numerical Analysis** (2016/2017): M.Sc. and B.Sc. in Electronic Engineering (**24 hours**, ~60 students).

**Elements of Mathematics** (2016/2017): B.Sc. in Architectural Design (**18 hours**, ~160 students).

**Numerical Analysis** (2015/2016, 2016/2017): M.Sc. and B.Sc. in Environmental and Civil Engineering (32 hours / year × 2 years = **64 hours**, ~40 students / year).

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## Tutoring

**Advanced Methods for Scientific Computing** (2022/2023): M.Sc. in High Performance Computing Engineering (**20 hours**, ~35 students).

**Scientific Computing Tools for Advanced Mathematical Modelling** (2021/2022): M.Sc. in Mathematical Engineering (**20 hours**, ~30 students, blended course).

**Advanced Programming for Scientific Computing** (2015/2016, 2016/2017, 2017/2018, 2018/2019): M.Sc. in Mathematical and Nuclear Engineering (20 hours /year  $\times$  4 years = **80 hours**, ~ 40  $\div$  60 students / year).

## STUDENTS

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List of students (co-)supervised.

### M.Sc. theses in Mathematical Engineering

1. F. Botta (2022/2023) (in progress).
2. F. Mantegazza (2021/2022): “GPU-accelerated matrix-free solvers for the efficient solution of cardiac electrophysiology in `lifex`” (with P. Gervasio, M. Salvador, A. Quarteroni).
3. M. Nesti (2021/2022): “A multi-physics oxygenation model: from biological derivation to the numerical simulation of real-life scenarios” (with F. Regazzoni, I. Fumagalli).
4. T. V. Avramova (2017/2018): “A scalable positivity preserving solution scheme for coupled nonlinear advection-diffusion-reaction problems” (with C. de Falco).

### M.Sc. theses in Computer Science Engineering

1. A. Palummo (2021/2022) (in progress): “`fdapDE`: bringing the expressive power of PDEs into statistics” (with L. Sangalli, E. Arnone).

### B.Sc. theses in Mathematical Engineering

1. Riccardo Griffo (2018/2019): “Drift–Diffusion model for organic electronic devices” (with C. de Falco).

### Projects for the course “Advanced Programming for Scientific Computing” at Politecnico di Milano

1. D. Gurrieri (2022/2023): “Computation of persistent homology on metric graphs” (with P. Zunino).
2. A. Arcardini, M. Cesaratto (2021/2022): “A multilevel Monte Carlo method in `lifex` for the estimation of conduction velocities in cardiac electrophysiology”.
3. T. Babini and M. Nesti (2021/2022): “Implementation and validation of an oxygen exchange model coupled with multiple physics in `lifex`” (with F. Regazzoni, I. Fumagalli).
4. F. Botta, M. Calafà (2021/2022): “`DUBeat`: a C++ library for high order discontinuous Galerkin methods and applications to cardiac electrophysiology” (with P. Antonietti, C. Vergara).
5. L. Caivano, M. Precuzzi (2021/2022): “A non-Newtonian model for computational fluid dynamics simulations of blood flow” (with M. Fedele, I. Fumagalli, F. Regazzoni).
6. A. Dall’Olio, F. Zacchei (2021/2022): “Implementation of the INTERNODES domain-decomposition technique in `lifex`” (with P. Gervasio).
7. L. Galvan, C. B. Leimer (2021/2022): “A 1D finite element solver for the Eikonal equation” (with C. Vergara, M. Fedele, R. Piersanti).
8. F. Mantegazza (2021/2022): “Implementation of a matrix-free solver for PDEs in `lifex`”.
9. E. G. O. Eriksson, A. F. M. Seger (2020/2021): “Time- and space-adaptive strategies in `lifex`”.
10. R. Invernizzi (2020/2021): “Isogeometric Analysis with `deal.II`” (with L. Dede’).
11. A. Bossi and A. Cordone (2019/2020): “Simulating the sinoatrial node action potential in `lifex`”.
12. G. Gualtieri and G. Marziali (2019/2020): “Implementation of a parallel solver for the cardiac bidomain model in `lifex`”.
13. F. Filippini (2018/2019): “Extending the estimator-driven mesh adaptation in `bim++` from quadtree to octree meshes” (with C. de Falco).

14. T. V. Avramova (2017/2018): “A scalable positivity preserving solution scheme for coupled nonlinear advection-diffusion-reaction problems” (with C. de Falco).
15. A. Chiesa (2017/2018): “Implementation of a solver for charge transport in organic Metal-Insulator-Semiconductor capacitors in `bim++`” (with C. de Falco).
16. C. Giannetti (2017/2018): “`tmesh_3d`: a `bim++` interface to a `p4est` mesh of octrees” (with C. de Falco).
17. A. Parini (2016/2017): “Octree mesh adaptation in `bim++`” (with C. de Falco).

### Projects for the course “Numerical Analysis for Partial Differential Equations” at Politecnico di Milano

1. D. Cerrone, F. De Pas, S. M. Vanegas (2021/2022): “Fast marching method for the Eikonal model of the cardiac electrophysiology” (joint with the course “Advanced Programming for Scientific Computing”, with C. Vergara, S. Stella).
2. C. Lanella, V. Locatelli (2021/2022): “Comparison between monodomain and eikonal electrophysiology models” (with C. Vergara, S. Stella).
3. P. Motta, E. Pastorino, F. Tombari (2021/2022): “Study of the numerical dispersion of Spectral Element Methods in electrophysiology” (with P. Gervasio, M. Salvador).
4. M. Bagnara (2019/2020): “The inverse potential problem of electrocardiography regularized with optimal control and applied to data simulated through a monodomain model” (with C. Vergara).

### Projects for the course “Scientific Computing Tools for Advanced Mathematical Modelling” at Politecnico di Milano

1. L. De Giorgi, R. Sala (2021/2022): “An adaptive time scheme for cardiac electrophysiology”.
2. L. Burgio, E. Garbin, R. Valentino (2021/2022): “Comparison of numerical accuracy between tetrahedral and hexahedral meshes in cardiac applications”.
3. E. Gjyli, G. Mazzilli, B. Viti (2021/2022): “Implementation of a GUI for `lifex` parameter files using Tkinter”.

## LANGUAGES

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Italian  
English  
French

