# GIACOMO ROSILHO DE SOUZA

Applied Mathematician (PhD) | Researcher | Simulation Engineer

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## Summary

Applied mathematician expert in **physic-based simulations**, **numerical methods, mathematical models**, **stochastic processes,** and **optimization**. Model-based design of numerical strategies. Implement and test algorithms in **Python, C++,** and **MATLAB**. Exceptional **communication** skills acquired through presenting at international conferences and collaborations. Independent researcher. Author of several papers in top-tier journals, full list.

## Selected Achievements

### C++ Multi-scale Stochastic Differential Equations

Designed and implemented fast **Monte Carlo** integration methods achieving speed-up factors of 10.

### C++ Discontinuous Finite Elements

Optimized nonlinear **finite element** simulation code, achieving speed-up of 5.

### Python Parallel computing

Developed and implemented the first **parallel-in-time** solver. Tested accuracy and stability on **HPC** machines on over 1000 processors.

## Skills

Simulation Engineering:

Numerical methods · Numerical integration · Runge-Kutta methods · Exponential methods · Finite elements · Finite differences · Stabilization methods · Numerical linear algebra · High-performance computing · Boundary element methods · Parallel computing · Nonlinear multi-grid methods · Large-scale simulations · Mixed-precision methods · Tau-leap methods · Monte Carlo simulations · Optimization methods · Spectral deferred corrections

Mathematics:

Dynamic Systems · Differential equations · Calculus · Linear Algebra · Stochastic Calculus · Optimization · Probability · Statistics

Software Engineering: Python · C++ · MATLAB · Git · CMake · Linux/Unix · Docker · Conda

Data Analysis and libraries: Pandas · SQL · NumPy · Seaborn · Matplotlib · Scikit-learn · Dash · Machine learning · JAX · Flax

Managerial: Public speaking · Led report writing · Scientific writing · LaTeX · Supervision of talents · Communication

## Experience

### USI - Università della Svizzera italiana — Lugano, Switzerland

Simulation Engineer — 11/2021 - 12/2024

- Contributed to 2 **European** high-performance computing (HPC) **projects. Collaborated** with **remote** teams.
- Developed **parallel** and **multi-scale** solvers for large complex systems of nonlinear **PDE**s, reducing computational time by 50% on 1000 processors (Python).
- Research on stabilized **optimization** methods (Python).
- **Code optimization** for numerical solvers (Python/C++).
- Lecturer, rated 9/10 by MSc students. Supervisor for 3 MSc thesis students.

### EPFL - Swiss Federal Technology Institute of Lausanne — Lausanne, Switzerland

Research Scientist — 06/2020 - 08/2021

- Research in **stochastic** differential equations and **mixed-precision** methods for GPUs, improving computational efficiency by 75% (C++).
- Lecturer for the MSc course "Numerical integration of dynamical systems".

PhD Student — 09/2015 - 05/2020

- Enhanced **stochastic** differential equations solvers and **finite element** methods, achieving speed-up factors of 10 (C++).
- **Supervisor** for 5 BSc and MSc students in research projects.

### CSCS - Swiss National Supercomputing Centre — Lugano, Switzerland

Computational scientist intern — 09/2013 - 01/2014

Migrated an astrophysics simulation code from CPUs to GPUs (Fortran).

- **Code optimization**, algorithms, and data structures, achieving a 10x speed-up.
- Results presented at international conferences.

## Selected Publication

Submitted SIAM Journal on Scientific Computing — doi.org/10.48550/arXiv.2405.19994

High-order parallel-in-time method for the monodomain equation in cardiac electrophysiology

**Parallel**-in-time method inspired from iterative **numerical linear algebra** techniques such as **multigrid** methods and the **nonlinear** full approximation scheme (**FAS**).

## Certifications

IBM Data Science Professional Certificate — data analysis, data cleaning, data visualization, dashboards, supervised/unsupervised machine learning, data science libraries.

## Education

EPFL

PhD in Applied Mathematics 09/2015 - 05/2020

EPFL

MSc in Mathematical Engineering | GPA: **5.75** / 6 09/2012 - 06/2014

EPFL

BSc in Mathematics | GPA: **5.45** / 6 09/2009 - 06/2012

## Honors and Awards

Prize in Numerical Analysis

Received international Butcher Prize for excellent **communication skills** and **research quality**.

Teaching award at EPFL, 2 times

Prize for excellent quality and commitment in teaching, for **detailed** course material and delivering **clear** lectures to students.

## Languages

English Fluent

French Fluent

Italian Native

Portuguese Native

Spanish Fluent

## Interests

Fermentation

Soy sauce, miso, beer, cheese, kefir, tempeh, kvass, ....

DIY

Building furniture for home, forging, gardening.

## Find me online

LinkedIn
linkedin.com/in/grosilho

Personal website
grosilho.ch

GitHub
github.com/grosilho

Google Scholar
scholar.google.com/citations?user=88Aul6QAAAAJ&hl=en&oi=ao