LUCA PEGOLOTTI

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Machine Learning **|** Computational Science **|** Mathematical Modeling of the Cardiovascular System

EDUCATION & CERTIFICATIONS

Stanford University, Stanford (USA)   January 2023 - *March 2023*
Ignite program, Stanford Graduate School of Business.
Ignite is a 2-month intensive program centered on entrepreneurship and business fundamentals. One of the goals of the program is the development of a startup in a team.

PhD: EPFL, École Polytechnique Fédérale de Lausanne, Lausanne (CH)   *March 2017 - December 2020*
PhD program in Applied Mathematics — advisor: Prof. Simone Deparis.
Thesis title: *Reduction techniques for PDEs built upon Reduced Basis and Domain Decomposition Methods with applications to hemodynamics.*

Stanford University, Stanford (USA)   *January 2020 - April 2020*
Visiting Student researcher in the Marsden Lab.
Program funded by a Swiss National Science Foundation scholarship.

M.Sc.: EPFL, Lausanne (CH)   *September 2014 - January 2017*
M.Sc. in Computational Science and Engineering.
Overall GPA: 5.5/6.0

B.Sc.: Politecnico di Milano, Milano (IT)   *September 2011 - September 2014*
B.Sc. in Mathematical Engineering.
Overall GPA: 27.4/30.0 - Final grade: 105/110

EXPERIENCE

Postdoctoral researcher at Stanford University, Stanford (USA)   *August 2021 - Present*
Advisor: Prof. Alison Marsden. My project focuses on the development of 1D reduced order models for cardiovascular simulations using deep learning (graph neural networks). I am also the main developer of the Vascular Model Repository website (www.vascularmodel.com).

Postdoctoral researcher at EPFL, Lausanne (CH)   *January 2021 - June 2021*
Advisor: Prof. Simone Deparis. The goal was to finalize projects started during my PhD and to facilitate the technology transfer (including the C++ code developed for my thesis) to the other members of the group.

Teaching assistant at EPFL, Lausanne (CH)   *February 2015 - December 2019*
Worked as a teaching assistant in: *i)* Analysis and Numerical Analysis courses for bachelor students and *ii)* courses in scientific programming and high-performance computing in C and C++ for master students.

President of the EPFL Chapter of SIAM, Lausanne (CH)   *September 2018 - September 2019*
Taken the role of president of the EPFL Chapter of SIAM (Society for Industrial and Applied

Mathematics), which aims at promoting interchanges between academia and industry through events specifically targeted to bachelor and master students.

Internship at Siemens AG, München (DE) *February 2016 - August 2016*
Worked in the Smart Embedded systems / Multicore group on the EMB^2 library (C++ library for parallel computations).
Tasks included: implementation of concurrent data structures and algorithms, use of the library to create test cases to demonstrate the improvement in performance.

PUBLICATIONS

Luca Pegolotti, Martin R. Pfaller, Natalia Rubio, Ke Ding, Rita Brugarolas, Eric Darve, and Alison L. Marsden. *Learning Reduced-Order Models for cardiovascular simulations with Graph Neural Networks. (2023) arXiv.* https://arxiv.org/abs/2303.07310v1

Erica L. Schwarz, Luca Pegolotti, Martin R. Pfaller, Alison L. Marsden. *Beyond CFD: Emerging methodologies for predictive simulation in cardiovascular health and disease. Biophysics Reviews* 4, no. 1 (2023): 011301.

Martin R. Pfaller, Jonathan Pham, Aekaansh Verma, Luca Pegolotti, Nathan M. Wilson, David W. Parker, Weighing Yang, and Alison L. Marsden. *Automated generation of 0D and 1D reduced-order models of patient-specific blood flow.* International Journal for Numerical Methods in Biomedical Engineering (2022): 2040-7939.

Jean Bonnemain, Matthias Zeller, Luca Pegolotti, Lucas Liaudet, and Simone Deparis. *Deep neural network implementation for evaluation of left ventricular systolic function in patients under left ventricular assist device.* Frontiers in Cardiovascular Medicine 8 (2021): 752088.

Luca Pegolotti, Martin Pfaller, Alison L. Marsden, and Simone Deparis. *Model order reduction of flow based on a modular geometrical approximation of blood vessels.* Computer Methods in Applied Mechanics and Engineering 380 (2021): 113762.

Jean Bonnemain, Luca Pegolotti, Lucas Liaudet, and Simone Deparis. *Implementation and calibration of a deep neural network to predict parameters of left ventricular systolic function based on pulmonary and systemic arterial pressure signals.* Frontiers in Physiology 11 (2020): 1086.

Niccolò Dal Santo, Simone Deparis, and Luca Pegolotti. *Data driven approximation of parametrized PDEs by Reduced Basis and Neural Networks.* Journal of Computational Physics (2020): 109550.

Simone Deparis, Antonio Iubatti, and Luca Pegolotti. *Coupling non-conforming discretizations of PDEs by spectral approximation of the Lagrange multiplier space.* ESAIM: Mathematical Modelling and Numerical Analysis 53.5 (2019): 1667-1694.

Simone Deparis, Michel O. Deville, Filippo Menghini, Luca Pegolotti, Alfio Quarteroni. *Application of the Rosenbrock methods to the solution of unsteady 3D incompressible Navier-Stokes equations. Computers & Fluids* 179 (2019): 112-122.

Luca Pegolotti, Luca Dede, and Alfio Quarteroni. *Isogeometric Analysis of the electrophysiology in the human heart: Numerical simulation of the bidomain equations on the atria.* Computer Methods in Applied Mechanics and Engineering 343 (2019): 52-73.

Conferences & Workshops

Mathematical and Scientific Machine Learning, Providence (USA)   June 2023
Title: *Learning reduced-order models for cardiovascular simulations with graph neural networks.*

Math 2 Product, Taormina (ITA)   June 2023
Title: *Learning reduced-order models for cardiovascular simulations with graph neural networks.*

Invited speaker at ETH, Zurich (CH)   May 2023
Title: *Leveraging graph neural networks for efficient reduced-order blood flow simulations.*

Int. Symp. on Computer Methods in Biomechanics and Biomedical Eng., Paris (FR)   May 2023
Title: *Learning reduced-order models for cardiovascular simulations with graph neural networks.*

Society of Engineering Science Meeting 2022, College Station (USA)   October *2022*
Title: *Learning reduced-order models for cardiovascular simulations with graph neural networks.*

World Congress in Computational Mechanics IX, online conference   *August 2022*
Title: *Data-driven reduced-order models for cardiovascular simulations.*

Coupled Problems, Sitges (ES)   *June 2019*
Title: *Coupling non-conforming discretizations of PDEs by means of spectral Lagrange multipliers.*

Finite Elements in Fluids, Chicago (USA)   *April 2019*
Title: *Efficient Reduced coupling of non-conforming discretizations of PDEs.*

World Congress in Computational Mechanics XIII, New York (USA)   *July 2018*
Title: *Efficient reduced coupling of PDEs based on weak transmission conditions.*

Awards & Achievements

Captain of the Vascular Model Repository Team, which was awarded the <u>Significant Achievement Award in the DataWorks! Challenge by FASEB.</u>

Awarded the Doc.Mobility scholarship by the Swiss National Science Foundation. The scholarship funded the research carried out at Stanford University during my PhD.

Computer skills

Programming languages	C, C++, Python, MATLAB, Javascript
Software	Microsoft VS Code, version control systems (Git), PyTorch, Tensorflow
Operating systems	Unix based systems (Mac OS/Linux), Windows
GitHub profile	https://github.com/lucapegolotti

Languages

Italian	Mother tongue
English	Advanced (C2/C1)
French	Intermediate (B2)
Mandarin	Basic (HSK 2)