

CURRICULUM VITAE

LUCA FORMAGGIA

Last update: November 13, 2024

OFFICE ADDRESS

Dipartimento di Matematica
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BIBLIOMETRY DATA (SOURCE: SCOPUS)

N. of publications: 133

N. of citations: 4874

h-index: 34

EDUCATION

09/1978–04/1984 Undergraduate Studies in Mechanical Engineering at Università degli Studi di Padova (Italy)

10/1985–10/1986 Master of Science in *Finite Element Methods in Engineering Analysis and Design*, Institute for Numerical Methods in Engineering, University College of Swansea (UK). Supervisor: Prof. Ken Morgan

01/1987, 02/1989 Ph.D, Institute for Numerical Methods in Engineering, University College of Swansea (UK). Thesis title: *A finite element algorithm for modelling of compressible flow*. Supervisor: Prof. Ken Morgan

PROFESSIONAL CAREER

03/89–09/94 Senior researcher at the Computational Aeronautics office of Alenia Aeronautica SpA, Divisione Velivoli Difesa, Turin, Italy

09/94–04/98 Senior researcher at the Applied Mathematics unit of CRS4 (Centro di Ricerca, Sviluppo e Studi Superiori in Sardegna), Cagliari, Italy

05/98–08/2002 First Assistant to the Chair of Numerical Modelling and Scientific Computing of the Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland

09/2002-01/2006 Associate Professor of Numerical Analysis at Politecnico di Milano, Italy

02/2006 - Professor of Numerical Analysis at Politecnico di Milano, Italy

MAIN RESEARCH INTERESTS

- *Numerical Analysis of Partial Differential Equations*: Discretization techniques for multi-physics and multi-scale problems. Differential problems with interfaces. Reduced and hybrid-dimensional models.
 - *Computational Geophysics*. Numerical modelling of sedimentary basins and oil migration. Reservoir simulation. Flow in fractured porous media.
 - *Mathematical modelling and simulation of the cardiovascular system*. Reduced and multi-scale models. Coupled problems.
 - *Mesh adaptation for the finite element method*. Anisotropic error estimates. Mesh generation and adaptation.
 - *Numerical solution of fluid flow problems*. Fluid-structure interaction problems.
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MAIN SCIENTIFIC RESPONSIBILITIES

- 2024- Member of the Organising Committee and co-Chair of the 2025 edition of the SIAM Conference on Mathematical and Computational Issues in the Geosciences;
- 2024- Member of the Scientific Committee and responsible of the Numerical Analysis panel of the Conference Equadiff2026;
- 2023- Scientific Coordinator of the research line "Mathematics for sustainability" of the Department of Excellence 2023-27 project of the Department of Mathematics
- 2018- Scientific Responsible of the workpackage n.5 "Mathematical models and simulations" of the agreement between the Italian Space Agency and Politecnico di Milano n. 2018-5-HH.0;
- 2022- Member of the Scientific Board of Poliedra, a consortium of Politecnico di Milano;
- 2021- Member of the scientific evaluation panel for the Chilean Milenio Science Initiative;
- 2017-2022 Member of the Scientific Committee of AMIES (Agence pour les mathématiques en interaction avec l'entreprise et la société);
- 2012-2022 Scientific supervisor of the research agreement between Politecnico di Milano and Altran S.p.A.;
- 2021 co-Chair of the 2021 edition of the SIAM Conference on Mathematical and Computational Issues in the Geosciences;
- 2021 Member of the evaluation panel for CNR (Italian National Research Center) for the research projects on the topic "Industrial transition and resilience of post-COVID19 society";

- 2013-2015 Scientific supervisor of the research agreement between the Department of Mathematics of Politecnico di Milano and MOXOFF S.r.l.;
- 2009-2015 Scientific supervisor of the research agreement between the Department of Mathematics of Politecnico di Milano and ENI Spa;
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MAIN SERVICE AND INSTITUTIONAL ACTIVITIES

- 2023- Program Director of the Activity Group on Geosciences of the Society for Industrial and Applied Mathematics (SIAM);
- 2023- Member of the Italian commission for academic habilitation (ASN) for the scientific sector of Numerical Analysis (01/A5, now MATH/05);
- 2022 Member of the group of experts chosen by the Italian University Council (CUN) to elaborate the mission and scope (“declaratoria”) of the Italian Scientific Sector (SSD) denominated MAT/08, Numerical Analysis;
- 2018- Member of the Managing Board of the Cooperation Agreement between Politecnico di Milano and Eni S.p.A. The board, formed by Politecnico di Milano and ENI members, oversees all research activities between the institutions;
- 2017- President of SIMAI (Italian Society of Industrial and Applied Mathematics);
- 2017- Academic Advisor of the SIAM Student Chapter of Politecnico di Milano;
- 2006- Member of the Academic Board (Collegio di Dottorato) of the PhD Program “Mathematical Models and Methods in Engineering” (formerly “Ingegneria Matematica”) of Politecnico di Milano;
- 2021 Member of the panel of experts nominated by the Italian Ministry of Research (MUR) to elaborate the Italian National Research Plan (PNR) for the years 2021-2027, for the sector “Digitalization, Industry and Aerospace”;
- 2014-2017 Head of the MOX Laboratory of the Department of Mathematics of Politecnico di Milano, Italy;
- 2017-2018 Member of the Italian commission for academic habilitation (ASN) for the scientific sector of Numerical Analysis (01/A5);
- 2009-2017 Secretary of SIMAI (Italian Society of Industrial and Applied Mathematics).
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MAIN EDITORIAL ACTIVITIES

- 2022- Member of the Editorial Board of Computational Geosciences.
- 2012- Chief Editor of the SEMA-SIMAI Springer Series, a series that focus on applications of mathematics to social and industrial problems, including biology, medicine, engineering, environment and finance.
- 2017- Member of the Editorial Board of Communications in Applied and Industrial Mathematics
- 2011-2017 Member of the Editorial Board of the SIAM Journal of Scientific Computing (SISC)

2010-2020	Member of the Editorial Board of the International Journal for Numerical Methods in Biomedical Engineering
2010-2018	Member of the Advisory Board of the International Journal for Numerical Methods in Fluids

MAIN CONFERENCE ORGANIZATION

- Member of the Scientific Committee of the *First International Symposium on Modelling of Physiological Flows*, Lausanne, Switzerland, 1-3 September 2003
- Member of the Scientific Committee of the *Second International Symposium on Modelling of Physiological Flows*, Sesimbra, Portugal, 31/03-2/04 2005
- Member of the *International Advisory Committee* of the *First International Conference on Computational and Mathematical Biomedical Engineering*, Swansea, UK, June 29th-July 1st 2009
- Member of the Scientific Committee of the *4th International Symposium on Modelling of Physiological Flows*, Chia Laguna, Italy, June 2-3, 2010.
- Member of the Scientific Committee of *SIMAI 2012*, Torino, Italy, June 25-28, 2012
- Member of the Scientific Committee of the *SIAM Conference on the Mathematical and Computational Issues in the Geosciences (GS13)*, Padova, Italy, June 17-20, 2013
- Member of the International Program Committee of the *19th IMACS World Congress*, El Escorial-Maria Cristina, Spain August 26-30, 2013
- Member of the Scientific Committee of the *First Joint International Meeting RSME-SCM-SEMA-SIMAI-UMI*, Bilbao. June 30- July 4, 2014
- Member of the Scientific Committee of SimRace, Conference on numerical methods and High Performance Computing for industrial fluid flows IFPEN / Rueil-Malmaison - 8-10 December 2015
- Member of the Scientific Committee of the *Eccomas Conference X-DMS of Extended Discretization Methods*, Ferrara (Italy), 9-11 September 2015
- Head of the Organizing Committee of the *SIMAI 2016 Biannual Congress*, Milano (Italy), 13-16 September 2016
- Member of the Scientific Committee of the *Eccomas X-DMS 2017 Conference of Extended Discretization Methods*, Umea (Sweden), 19-21 June 2017
- Member of the Scientific Committee of the *SIAM Conference on Imaging Science*. Bologna, Italy, June 5-8 2018
- Member of the Scientific Committee of the *SIMAI Biannual Congress*, Rome, 2-6 July, 2018
- Member of the International Advisory Committee of the *6th Int. Conf. Computational and Mathematical Biomedical Engineering (CMBE19)*, Tohoku University, Katahira Campus, Sendai City, Japan, 10-12 June 2019
- Member of the Scientific Committee of the *Eccomas X-DMS 2019 Conference of Extended Discretization Methods for Partial Differential Equations on Complex and Evolving Domains*, Lugano (Switzerland), 3-5 July 2019

- Member of the Scientific Committee of NUMTA 2019, The 3rd International Conference and summer school on Numerical Computation: Theory and Algorithms. June 15-21, 2019, Le Castella Village, Italy
- Member of the Scientific Committee of the Workshop on Mathematical Modelling and Control for Healthcare and Biomedical Systems, Rome, Italy, September 8-10, 2020
- Member of the Scientific Committee of SIMAI2020, Biennial Congress of the Italian Society for Applied and Industrial Mathematics, 15-19 June 2020, Parma, Italy
- Member of the International Advisory Committee of the 7th International Conference on Computational and Mathematical Methods in Biomedical Engineering (CMBE21), 28-30 June 2021, Politecnico di Milano, Italy
- Chair of SIAM-GS21, SIAM Conference on Mathematical and Computational Issues in the Geosciences, 21-24 June 2021 (online), Politecnico di Milano, Italy
- Member of the Scientific Committee of SIMAI Biennial Congress 2023, 28th August- 3rd September 2023, Matera, Italy.
- Member of the Scientific Committee of HPCSIM 24: Frontiers of High-Performance Computing in Modeling and Simulation, July 4-5, Milano, Italy
- Member of the Scientific Committee of ECCOMASS2024, 3rd-7th June 2024, Lisbon, Portugal
- Chair of the SIAM Conference on Mathematical & Computational Issues in the Geosciences (GS25), October 14-17, 2025, Baton Rouge, Louisiana, US.
- Member of the Scientific Committee and coordinator of the Numerical Analysis Section of the Equadiff Conference 2026, Prague, Czech Republic

SPINOFF ACTIVITIES

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| 2010-present | Founder and member of the Board of MOXOFF (www.moxoff.com), a spinoff of the Department of Mathematics of Politecnico di Milano dedicated to developing numerical and statistical analysis tools for industries; |
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SUPERVISION ACTIVITY

Supervision of PhD Thesis

1. A. Bulgalho de Moura, *The Geometrical Multiscale Modelling of the Cardiovascular System: Coupling 3D FSI and 1D Models*, Mathematical Engineering, Politecnico di Milano, Italy, 2008
2. Sara Minisini, *Mathematical and numerical modeling of drug eluting stents*, Mathematical Engineering, Politecnico di Milano, Italy, 2009
3. Andrea Mola, *A model for the dynamics of high performance rowing boats*. Mathematical Engineering, Politecnico di Milano, Italy, 2009
4. Andrea Villa, *Three dimensional geophysical modeling: from physics to numerical simulation*, Applied Mathematics, Università degli studi di Milano, Italy, 2009
5. Anna Scotti, *Models for oil generation and primary migration*, Mathematical Engineering, Politecnico di Milano, Italy, 2009

6. Alessio Fumagalli, *Numerical modelling of flows in fractured media by the XFEM method*, Mathematical Models and Methods in Engineering, Politecnico di Milano, 2012
7. Matteo Pischiutta, *Mathematical and numerical modelling of the evolution of mixtures of sand in aeolian dunes*, Mathematical Models and Methods in Engineering, Politecnico di Milano, 2012
8. Nur Fadel, *HPC simulation of sedimentary basins*, Mathematical Models and Methods in Engineering, Politecnico di Milano, 2013
9. Alessandro Melani, *Adjoint-based parameter estimation in human vascular one dimensional models*, Mathematical Models and Methods in Engineering, Politecnico di Milano, 2013
10. Davide Baroli, *Multiscale models for heterogeneous Darcy's flows*, Mathematical Models and Methods in Engineering, Politecnico di Milano, 2015.
11. Stefano Zonca, *Unfitted numerical methods for fluid-structure interaction arising between an incompressible fluid and an immersed thick structure* Mathematical Models and Methods in Engineering, Politecnico di Milano, 2018.
12. Bianca Giovanardi, *Numerical modeling of hydro-mechanical coupling in deformable porous media: compaction and fractures*. Mathematical Models and Methods in Engineering, Politecnico di Milano, 2018.
13. Daquin Liu, *A numerical method for analyzing fault slip tendency under fluid injection with XFEM*, Mathematical Models and Methods in Engineering, Politecnico di Milano, 2018.
14. Florent Chave, *Hybrid High-Order methods for interface problems* in co-sharing with Prof. Di Pietro of University of Montpellier, France. PhD grantee of a Vinci France Italy Scholarship, 2018.
15. Ludovica Del Popolo Carciopolo. *Conservative multirate schemes for flow in heterogeneous porous media*. Mathematical Models and Methods in Engineering, Politecnico di Milano, 2020.
16. Federico Gatti. Mathematical Models and Methods in Engineering, *Effective Numerical Modelling of Hillslope Processes: Sediment Transport and Landslide Runout*, Politecnico di Milano, 2023.
17. Enrico Ballini. Mathematical Models and Methods in Engineering, *Flow and mechanics in fractured porous media: from high fidelity models to efficient reduced order solutions*, Politecnico di Milano, 2024.
18. Marco Fois. Mathematical Models and Methods in Engineering, *Particle Based Numerical Methods for Landslides: Run-out and Impact Analysis*, Politecnico di Milano, 2024.
19. Simone Brivio. Mathematical Models and Methods in Engineering, Politecnico di Milano, ongoing.

Reviewer/external examiner of the following PhD Thesis:

1. Li Yenjung *Hybrid Grids Methods for the Numerical Solution of the Navier-Stokes Equations Around Complex Three-Dimensional Configurations*, DIC, Aeronautics Department, Imperial College, London. Supervisor: D. Doorly. 1997.
2. Paul Metier, *Modelisation, analyse mathematique et applications numeriques de problemes d'interaction fluid-structure instationnaires*, Université Pierre et Marie Curie, Paris VI. Supervisor: Yvon Maday. 2003.

3. Emil Lovgren *Reduced basis modeling of hierarchical flow systems*, Department of Mathematical Sciences, Norwegian University of Science and Technology, Trondheim, Norway. Supervisor: E.M. Ronquist. 2005.
4. Nicole Poussineau, *Réduction variationnelle d'un couplage fluids-structure. application à l'hémodynamique*. Université Pierre et Marie Curie, Paris VI. Supervisor: Yvon Maday. 2007.
5. Carlo D'Angelo, *Multiscale modelling of metabolism and transport phenomena in living tissues*, EPFL, Lausanne, Switzerland. Supervisor: Alfio Quarteroni. 2007.
6. Angelo Casagrande, *Parallel Mesh Adaptive Techniques for Complex Flow Simulation*, Laboratoire d'ingénierie numérique, EPFL, Switzerland. Supervisor: Penelope Leyland. 2008.
7. Tormod, Bjontegaard, *A high order splitting method for time dependent domains*, Department of Mathematical Sciences, Norwegian University of Science and technology, Trondheim, Norway. Supervisor: E.M. Ronquist. 2008.
8. Anrea Lani, *An object-oriented and high-performance platform for aerothermodynamics simulation*, Von Karman Institute, Belgium. Supervisor: Herman Deconinck. 2008.
9. Adrien Loseille, *Adaptation de maillage anisotrope 3D multi-échelles et ciblée à une fonctionnelle pour la mécanique des fluides. Application à la prédiction haute-fidélité du bang sonique*, Université Pierre et Marie Curie et INRIA Roquencourt, Paris VI. Supervisor: Frederic Alauzet. 2008.
10. Joan Baiges, *The Fixed-Mesh ALE method applied to multiphysics problems using stabilized formulations*, Universitat Politècnica de Catalunya, Supervisor: Ramon Codina, 2010.
11. Riccardo Aramini, *Computational Inverse Scattering Via Qualitative Methods*, University of Trento, Supervisor: Andrea Massa and Michele Piana, 2011.
12. Anca Belme, *Aérodynamique instationnaire et méthode adjointe*, INRIA Sophia_Antipolis and University of Bordeaux, Supervisor: Alain Dervieux, 2011.
13. *Simulation Dynamique des systemes bateau-remeurs*, Francois, Rongere, University of Nantes, Supervisor: Jean Michel Kobus, 2011
14. Geraldine Olivier, *Anisotropic metric-based mesh adaptation for unsteady CFD simulations involving moving geometries*, Université Pierre et Marie Curie et INRIA Roquencourt, Paris VI. Supervisor: Frederic Alauzet. 2012.
15. Vincent Chabannes, *Vers la simulation des écoulements sanguins*, Université de Grenoble. Supervisor Christophe Prudhomme, 2013.
16. Radu Popescu, *Parallel algorithms and efficient implementation techniques for finite element approximations*, EPFL. Supervisor: Alfio Quarteroni, 2013.
17. Joubine Aghili, *Numerical resolution of partial differential equations with variable coefficients*. University of Montpellier, France, Supervisor: Daniele Di Pietro, 2016.
18. Maya Groza, *Modélisation et discretisation des écoulements diphasiques en milieux poreux avec réseaux de fractures discrètes*. University of Nice, France. Supervisor: Roland Masson, 2016.
19. Rita Riedlbeck, *Algorithmes adaptatifs pour la poro-mécanique et la poro -plasticité*. University of Montpellier, France. Supervisor: Daniele Di Pietro, 2017.

20. Yoann Robert, *Simulation numérique et modélisation d'écoulements tridimensionnels instationnaires à surface libre*. Application au système bateau-avirons-rameur. University Centrale Nantes, France. Supervisor: Michel Visonneau, 2017.
21. Alex Karkoulias, *Adaptive low and high-order hybridized methods for unsteady incompressible flow simulations*, Universitat Politècnica de Catalunya, Spain and Università di Pavia, Italy, Supervisor: Antonio Huerta, 2020.
22. Ilaria Fontana, *Interface Problems for Dam Modelling*, University of Montpellier, France, Supervisor: Daniele Di Pietro, 2022.
23. Jhabriel Varela, *A posteriori error estimation and modeling of unsaturated flow in fractured porous media*, University of Bergen, Norway, Supervisor: Jan Nordbotten, 2022.
24. Fabien Lespagnol, *Une nouvelle méthode numérique pour l'interaction fluide-structure de corps minces dans des écoulements tridimensionnels*, Sciences Mathématiques de Paris Centre, Supervisor: Miguel A. Fernandez, June 26, 2024

Supervision of Post-Docs:

Nur Fadel, Anna Scotti, Alessio Fumagalli, Stefano Zonca, Martin Prosi, Silvia Anicic, Antonio Montano, Stefania Ferrari, Andrea Mola, Mikel Landajuola, Wietze Boon, Elishan Braun

KEYNOTE AND PLENARY TALKS AT INTERNATIONAL CONFERENCES

1. *Implementation of a 3D explicit Euler solver on a Cray computer*. **Keynote Lecture**, Fourth International Symposium on Science and Engineering on Cray Supercomputers, 12-14 October 1988, Minneapolis Minnesota.
2. *Mesh generation and adaption strategies for Euler and Navier-Stokes equations*. **Keynote Lecture**. Workshop on Grid Adaptation in Computational PDE's: Theory and Applications, Edimbrough, July 1996.
3. *Some anisotropic mesh adaption strategies for the FEM*. **Keynote Lecture**. Chemnitz-FEM Symposium 2002, Chemnitz, Germania, 23-25 September 2002.
4. *Multiscale modelling of the cardiovascular system*. **Keynote Lecture**. Second International Symposium on Modelling of Physiological Flows, 31st March-2nd April 2005, Sesimbra, Portugal.
5. *Fluid-structure interaction problems in free surface flows: application to boat dynamics*. **Keynote Lecture**. ICFD06, Conference on Numerical Methods for Fluid Dynamics, University of Reading, 26-29 March 2007
6. *Numerical models for the evolution of geological basins and oil generation*. **Plenary Lecture** for the SIMAI 2010 conference, Cagliari, Italy, June 22nd 2010
7. *Numerical models for the simulation of the cardiovascular system*, **Plenary Lecture** at the INI/WIMCS meeting on Computational challenges in PDEs, Swansea, UK, April 4-8, 2011.
8. *The challenge of complexity in sedimentary and reservoir simulations*, **Keynote Lecture**, ACME-UK 2015. 23rd Conference on Computational Mechanics, 8-10 April 2015, Swansea, UK.
9. *Some numerical challenges of numerical simulations of subsurface flows*, **Plenary Lecture** at the first joint Brazil-Italy meeting in Mathematics, Rio de Janeiro, 29 August, 2nd September 2016

10. *Geometrical multiscale modeling of liquid packaging systems: an example of scientific cross-fertilization*, **Plenary Lecture** at the ECMI 2016 Conference. 13-17th June 2016. Santiago de Compostela, Spain.
11. *Darcy flow in fractured porous media: some mathematical and numerical aspects*, **Invited Lecture** at the Gordon Research Conference on Flow and Transport in Porous Media, July 31-August 5, 2016
12. *Some numerical techniques for problems with embedded domains and interfaces*, **Plenary Lecture** at the XDMS 2017 conference on eXtended Discretization MethodS for partial differential equations on complex and evolving domains. 19-21 June 2017, Umea, Sweden.
13. *Approximation of fractured porous media flow by mimetic finite differences*, **Invited Lecture** at POEMS 2017, Polytopal Element Methods in Mathematics and Engineering, 5-7 July 2017, University of Milano-Bicocca, Italy.
14. *Numerical model for fault reactivation based on a Nitsche method and XFEM*, **Invited Lecture** at the Oberwolfach Workshop on Reactive flow in deformable, complex media. 31st August 2018.
15. *Numerical modeling of flow in fractured porous media and fault reactivation*, **Plenary Lecture** at NUMTA2019, 3rd International Conference and Summer School on Numerical Computations: Theory and Algorithms, Capo Rizzuto, Italy, 2019.
16. *Numerical techniques for fluid-structure interaction problems with large displacements and applications in hemodynamics*, **Keynote Lecture** at the 3rd International Conference on Modern Mathematical Methods and High Performance Computing in Science & Technology, Inderprastha Engineering College, Ghaziabad, Uttar Pradesh, India, 2019.
17. *Hybrid-dimensional models for porous media flows some algorithms and preconditioning techniques* **Invited talk** at the Algorithmy 2020 Conference on Scientific Computing, September 10-15, 2020.
18. *Block preconditioners for Darcy problems in fractured media*, **Invited Talk** at INdAM Workshop on Polygonal methods for PDEs: theory and applications, online, May 17-19, 2021
19. *Some modeling and numerical issues for modeling underground flows*, **Invited Talk** at Frame 2022, Turin, Italy, 2022
20. *La matematica per l'innovazione digitale nei processi industriali*, **Invited Talk** at the 38th CAE Conference, Venice, Italy, 2022
21. *Simulation of Reactive Flow in Fractured Porous Media with Hybrid Dimensional Models and Polytopal Grids*, **Invited Talk** at the 14th international conference on large-scale scientific computations, Sozopol, Bulgaria, 2023
22. *Scalable adaptive techniques for simulation of fast landslides*, **Invited Talk** at HPCSIM: frontiers of high-performance computing in modeling and simulation, Padova, Italy, 2023.
23. *Some applications of model order reduction techniques to subsurface flows*. **Invited Talk** at the Workshop on Mathematical Models and Numerical Methods for Multiphysics Systems, Pittsburgh, May 1-3, 2024 ,
24. *A depth-averaged material point method for fast flow-like landslides and mudflows*, **Invited Talk** at the 16th World Congress on Computational Mechanics and 4th Pan American Congress on Computational Mechanics, Vancouver, July 21-26, 2024

PARTICIPATION/COORDINATION OF RESEARCH PROJECT

Supported by National or European research financing bodies

- 10/93-09/95 Participation to: E.U. BRITE AER20031 *ECARP: European Computational Aerodynamics Project*. Coordinated by British Aerospace. Subject: mesh adaptation of the Euler Equations.
- 06/96-05/98 Participation to: E.U. ESPRIT PCI-II *PCECOWATER* Subject: development of parallel solvers for free surface flows with environmental applications.
- 06/97-05/98 Participation to: E.U. EU-1063, HPPC-SEA *VIVA: The Virtual Vascular Project*. Subject: Development of a Navier-Stokes solver.
- 02/00-01/02 Participation to: E.U. BRPR-CT97-0591 *IdeMAS: Industrial Demonstrator of Accurate and Efficient Multidimensional Upwind and Multigrid Algorithms for Aerodynamic Simulations on Unstructured Grids*. Coordinated by Prof. Deconinck, Von Karman Institute for Fluid Dynamics, Belgium.
- 09/00-08/02 Participation to: FNS (Fond National Suisse) project *Multimodels and multidomains methods for fluid structure interaction problems*. Principal coordinator: Prof. A. Quarteroni.
- 09/00-08/03 Participation to: FNS (Fond National Suisse) project *Mathematical Modelling and Numerical Simulation of Fluid Flow and Mass Transport Processes in Heterogeneous Media*. Principal coordinator: Prof. A. Quarteroni.
- 09/98-08/00 Participation to: FNS (Fond National Suisse) project *Domain Decomposition and Adaptive Methods: Analysis, Development and Applications*. Principal coordinator: Prof. A. Quarteroni.
- 01/02-06/03 Participation to: E.U./OFES BRPR-CT97-0591. Continuation of *IdeMAS:Industrial Demonstrator of Accurate and Efficient Multidimensional Upwind and Multigrid Algorithms for Aerodynamic Simulations on Unstructured Grids*, Coordinator: Prof. Deconinck, Von Karman Institute for Fluid Dynamics, Belgium.
- 01/02-12/05 **Co-responsible** of: FNS (Fond National Suisse) project *Techniques hybrides et adaptives pour la simulation complexe*, with P. Leyland, EPFL Lausanne.
- 01/01-12/02 Participation to: Project MCB: *Multiscale Computing in Biofluidynamics* funded by Politecnico di Milano. Principal Investigator: Prof. A. Quarteroni.
- 01/00-09/00 **Co-responsible** of the CTI (Commission Technologie et Industrie) project *ChronoDial* on the development of a mathematical model of biochemical exchanges in peritoneal dialysis. Principal Investigator: Prof. A. Quarteroni.
- 09/01-03/03 Participation to: CNR Progetto Agenzia 2000. *Modelling Fluid Structure Interaction in the arterial System*. Coordinator: Prof. A. Quarteroni.
- 01/02-12/05 Participant and **local coordinator** of E.U. HPRNCT-2002-002670 *HaeMOdel: Modelling the Cardiovascular System*. P.I.: Prof. A. Quarteroni. The project involved 6 European University and was coordinated by Politecnico di Milano.
- 01/03-12/04 Participation to: MURST Cofin 2003 *Numerical simulation of the cardiovascular system and Error estimation and mesh adaptivity for finite elements*. Coordinated by Prof. Quarteroni.

- 01/04-12/05 Participation to: MURST Cofin 2004 *Multiscale models and methods*. Coordinated by Prof. F. Brezzi, CNR-IMATI, Pavia, Italy.
- 06/04-05/05 Participation to: INDAM (Italian Institute for High Mathematics) project *Integrazione di sistemi complessi in biomedicina: modelli, rappresentazioni, simulazioni*. Coordinator: Alfio Quarteroni.
- 02/06-01/08 Participation to: MIUR PRIN05 project *Numerical models in fluid dynamics with application to the cardiovascular system and to the environment*. Coordinator: A. Quarteroni.
- 03/04-02/06 Participation to: *Interazione Fluido Struttura: comportamento aeroelastico con metodologie sperimentali e numeriche*, financed by Politecnico di Milano. Coordinator: Prof. G. Diana.
- 03/05-02/07 *Co-responsible of: Modellistica Matematica di Materiali Microstrutturati per Dispositivi a Rilascio di Farmaco*, project financed by Fondazione Cariplo, Italy. Participants: MOX, LaBS (Politecnico di Milano), Department of Chemistry (University of Bologna). P.I.: Prof. A. Quarteroni.
- 10/08-9/10 Participation to: MIUR PRIN07. *Mathematical and numerical modelling for cardiovascular and fluid dynamics applications*. Coordinator: Alfio Quarteroni.
- 06/06-05/11 Participation to: *Nanobiotechnology models and methods for local drug delivery from nano/micro structured materials*. Project financed by the Italian Institute of Technology (IIT). Coordinator: Alfio Quarteroni.
- 01/09-12/13 **Coordination of the Politecnico unit** of *MathCard* ERC advanced grant. Grantee: Prof. A. Quarteroni.
- 10/11-10/12 Participation to MIUR PRIN09. *Numerical methods for scientific computing and advanced applications*. P.I.: Alfio Quarteroni.
- 03/14-03/17 **Coordination (P.I.)** of MIUR PRIN12. *Mathematical and numerical modelling of the cardiovascular system and clinical applications*.
- 2016 **Coordinator** of the IHP Trimester on Numerical Methods for PDEs, Institute Henry Poincaré, Paris, France, 5 September-16 December 2016. With D. di Pietro and A. Ern. Financed by Institute Henry Poincaré and CNRS France.
- 02/17-02/18 **Principal Investigator** of INdAM-GNCS project “Modellazione numerica di fenomeni idro/geomeccanici per la simulazione di eventi sismici”.
- 2018-present **Responsible** of Work Package n.5: Data analysis and mathematical tools for environmental risk assessment for a research project between Agenzia Spaziale Italiana and Politecnico di Milano.
- 2022-2023 **Scientific Advisor** of MSCA Grant n.101031434. — Deep Learning Enhanced Numerical Simulations of Mixed-dimensional Models for Subsurface Flows — MiDiROM - H2020 MSCA-IF-2020
- 2023- Member of the Spoke 6 “Multiscale Modelling and Engineering Applications” of the National Center on HPC, Big Data and Quantum Computing, financed by the Italian Ministry of Research under the PNRR European Project “Next Generation EU”.

Financed by Industries (with coordinating role)

- 2004-05 **Scientific Coordinator**, with S. Micheletti of the project *Glow1D* and *Glow2D*. Financed by Federal Mogul Inc. Subject: numerical models for the simulation of a diesel engine glow plug. Development of an original finite element code for the related electro-thermal interaction problem.
- 2005-07 Participation to *Steam2D*. Project financed by Eni S.p.A. on the mathematical and numerical modelling of sedimentary basins. Coordinators: Alfio Quarteroni and Fausto Saleri.
- 2007-09 **Scientific Coordinator**, with A. Quarteroni, of *Steam3D* and *Pmod+*, two research projects financed by Eni S.p.A. on the mathematical and numerical modelling of sedimentary basins and oil generation and primary migration. Development of original numerical methods and software.
- 2003-08 **Scientific Coordinator** of the projects *Kime* and *Rowing*. Financed by Filippi Lido S.r.L. Subject: Development of a dynamics model competition rowing boats.
- 2008-10 **Scientific Coordinator**, with Piercesare Secchi, of the project *Microseepage*. Financed by Eni S.p.A. Responsible of the work package: models of transport of hydrocarbons in sands.
- 2008-10 **Scientific Coordinator**, with Stefano Micheletti, of the project *Eni-Imaging*, financed by Eni S.p.A. Subject: novel numerical methods to support seismic imaging.
- 2008-10 **Scientific Coordinator**, with G. Arioli, of the project *RUM*, financed by Altran Italia. Subject: Development of tools for the management of uncertainties in the design of oil pipes.
- 2009-11 **Scientific Coordinator**, with N. Parolini, of the MOX research activity within the project EnergIT, financed by Regione Lombardia, Italy, on the development of green data centers.
- 2013-2014 **Scientific Coordinator** of a research project in collaboration with Nolan group SpA on the development of numerical tools for bettering the comfort of a motorcycle helmet, crash analysis and vibro-acoustics.
- 2013-2015 **Scientific Coordinator** of the project KAFRES upscaling on the development of upscaling techniques for fractured reservoirs. Financed by Eni spa.
- 2013-2014 **Scientific Coordinator** of the project SIMBA-GE on the development and implementation on GPUs of numerical techniques for the simulation of oil generation and expulsion in source rocks. Financed by Eni spa.
- 2014 **Scientific Coordinator** of the project KAFRES gridding on the development of mesh generation techniques for fractured reservoirs. Financed by Eni spa.
- 2014-2015 **Scientific Coordinator** with S. Micheletti of the project GEOMECH on fault reactivation and induced seismicity. Financed by Eni spa.
- 2021-present **Scientific Coordinator** of GEOCHRON, a research contract between Politecnico di Milano and Eni SpA on the development of numerical tools for geological restoration.
- 2021-22 **Local Coordinator** of the seed-funds project ENI-Metamateriali, in collaboration with the Department of Mechanics and the Department of Physics of Politecnico di Milano. A research contract between Politecnico di Milano and Eni SpA on the analysis of the behavior of an innovative material for radiative thermal insulation.

2024- **Scientific coordinator** for the Department of Mathematics of the project "Sviluppo di modelli e algoritmi per il monitoraggio satellitare delle infrastrutture di distribuzione", financed by SNAM SpA.

MAIN TEACHING ACTIVITY

Politecnico di Milano

<i>A. Y(s).</i>	<i>Course Title</i>
2002-03,03-04, 04-05, 06-07, 07-08	Calcolo Numerico, B.Sc Aeronautical Engineering
2003-04	Calcolo Numerico, B.Sc Mechanical Engineering
2004-05, 06-07	Metodi Analitici e Numerici per l'Ingegneria. BSc Mechanical Engineering
2005-06, 06-07, 07-08, 08-09, 09-10, 10-11, 11-12, 12-13, 13-14	Programmazione Avanzata per il Calcolo Scientifico, MSc Mathematical Engineering
2007-08, 08-09, 09-10, 10-11, 11-12, 12-13, 13-14	Modellistica Numerical per Problemi Differenziali, MSc Aerospace Engineering
2014-15,16-17,17-18, 19-20, 20-21, 21-22, 22-23, 23-24, 24-25	Advanced Programming for Scientific Computing. MSc Mathematical Engineering
2014-15, 16-17	Numerical Modelling of Differential Problems, MSc Aerospace Engineering
2017-18,18-19,19-20,20-21, 21-22	Calcolo Numerico. BSc Environmental Engineering
2022-23, 23-24, 24-25	Advanced Methods for Scientific Computing, MSc on High Performance Computing

EPFL

<i>A. Y(s).</i>	<i>Course Title</i>
1998-99, 99-2000	Exercise session of the course <i>Analyse Numerique</i> for engineering students
1998-99, 99-2000, 2000-0, 01-02	Course on <i>Scientific Computing</i> at the "Master Course on Mathematical Engineering, EPFL e École Polytechnique de Paris.
1999-2000	Exercise session of the course <i>Mathematical Modelling</i> for students of engineering and physics
2000-01	Exercise sessions for the course <i>Mathematical Modelling of the Cardiovascular System</i> for students of Mathematics
2000-01, 01-02	Numerical Analysis for Civil Engineers and Physics, EPFL and University of Lausanne

MAIN PUBLICATIONS

REFEREED JOURNALS

- [1] Alessandro Palumbo, Eleonora Arnone, Luca Formaggia, and Laura M. Sangalli. Functional principal component analysis for incomplete space–time data. *Environ. Ecol. Stat.*, 31(2):555–582, March 2024.
- [2] Federico Gatti, Carlo de Falco, Simona Perotto, Luca Formaggia, and Manuel Pastor. A scalable well-balanced numerical scheme for the modeling of two-phase shallow granular landslide consolidation. *J. Comput. Phys.*, 501:112798, March 2024.
- [3] Federico Gatti, Carlo de Falco, Simona Perotto, and Luca Formaggia. A scalable well-balanced numerical scheme for the simulation of fast landslides with efficient time stepping. *Appl. Math. Comput.*, 468:128525, May 2024.
- [4] Marco Fois, Carlo de Falco, and Luca Formaggia. A semi-conservative depth-averaged material point method for fast flow-like landslides and mudflows. *Commun. Nonlinear Sci.*, 138:108202, November 2024.
- [5] Enrico Ballini, Luca Formaggia, Alessio Fumagalli, Eirik Keilegavlen, and Anna Scotti. A hybrid upwind scheme for two-phase flow in fractured porous media. *Comput. Method. Appl. M.*, 432:117437, December 2024.
- [6] Federico Gatti, Marco Fois, Carlo de Falco, Simona Perotto, and Luca Formaggia. Parallel simulations for fast-moving landslides: Space-time mesh adaptation and sharp tracking of the wetting front. *Int. J. Numer. Meth. Fl.*, 95(8):1286–1309, March 2023.
- [7] Alessio Fumagalli, Lorenzo Panzeri, Luca Formaggia, Anna Scotti, and Diego Arosio. A mixed-dimensional model for direct current simulations in the presence of a thin high-resistivity liner. *Int. J. Numer. Meth. Eng.*, 125(6), December 2023.
- [8] Samuel Burbulla, Luca Formaggia, Christian Rohde, and Anna Scotti. Modeling fracture propagation in poro-elastic media combining phase-field and discrete fracture models. *Comput. Method. Appl. M.*, 403:115699, January 2023.
- [9] Eleonora Arnone, Carlo De Falco, Luca Formaggia, Giorgio Meretti, and Laura M. Sangalli. Computationally efficient techniques for spatial regression with differential regularization. *Int. J. Comput. Math.*, 100(10):1971–1991, August 2023.
- [10] Luca Formaggia, Paola Gervasio, Yvon Maday, and Hoang Xuan Phu. Mathematical modelling and scientific computing: an effective way to understand reality. *Vietnam J. Math.*, 50(4):829–832, October 2022. Preface to two special issues dedicated to Alfio Quarteroni on the occasion of his 70th birthday.
- [11] Luca Formaggia, Federico Gatti, and Stefano Zonca. An XFEM/DG approach for fluid-structure interaction problems with contact. *Appl. Math-czech.*, (66):183–211, 2021.
- [12] L. Formaggia, A. Fumagalli, and A. Scotti. A multi-layer reactive transport model for fractured porous media. *Math. Eng.*, 4(1):1–32, 2021.
- [13] Mara S. Bernardi, Pasquale C. 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. *Math. Geosci.*, 53:1781–1812, 2021.
- [14] Paola F. Antonietti, Jacopo De Ponti, Luca Formaggia, and Anna Scotti. Preconditioning techniques for the numerical solution of flow in fractured porous media. *J. Sci. Comput.*, 86(1):1–32, 2021.
- [15] D. Cerroni, L. Formaggia, and A. Scotti. A control problem approach to Coulomb’s friction. *J. Comput. Appl. Math.*, 385:113196, 2020.

- [16] Ludovica Delpopolo Carciopolo, Luca Formaggia, Anna Scotti, and Hadi Hajibeygi. Conservative multirate multiscale simulation of multiphase flow in heterogeneous porous media. *J. Comput. Phys.*, 404(109134), March 2020.
- [17] Ludovica Delpopolo Carciopolo, Matteo Cusini, Luca Formaggia, and Hadi Hajibeygi. Adaptive multilevel space-time-stepping scheme for transport in heterogeneous porous media (ADM-LTS). *J. Comput. Phys. X*, 6:100052, 2020.
- [18] F. Chave, D. A. Di Pietro, and L. Formaggia. A Hybrid High-Order method for passive transport in fractured porous media. *GEM - International Journal on Geomathematics*, 10(12):1–12, 2019.
- [19] S. Zonca, C. Vergara, and L. Formaggia. An unfitted formulation for the interaction of an incompressible fluid with a thick structure via an XFEM/DG approach. *SIAM J. Sci. Comput.*, 40(1):59–84, 2018.
- [20] Mikel Landajuela, Christian Vergara, Antonello Gerbi, Luca Dedé, Luca Formaggia, and Alfio Quarteroni. Numerical approximation of the electromechanical coupling in the left ventricle with inclusion of the Purkinje network. *Int. J. Numer. Meth. Bio.*, 34(7):1–24, 2018.
- [21] Luca Formaggia, Christian Vergara, and Stefano Zonca. Unfitted extended finite elements for composite grids. *Computers and Mathematics with Applications*, 76(4):893–904, 2018.
- [22] L. Formaggia, A. Scotti, and F. Sottocasa. Analysis of a mimetic finite difference approximation of flows in fractured porous media. *ESAIM Math. Model. Numer. Anal.*, 52(2):595–630, 2018.
- [23] Florent Chave, Daniele A. Di Pietro, and Luca Formaggia. A Hybrid High-Order method for Darcy flows in fractured porous media. *SIAM J. Sci. Comput.*, 40(2):A1063–A1094, 2018.
- [24] Ludovica Delpopolo Carciopolo, Luca Bonaventura, Anna Scotti, and Luca Formaggia. A conservative implicit multirate method for hyperbolic problems. *Computat. Geosci.*, 23(4):647–664, 2018.
- [25] Christian Vergara, Davide Le Van, Maurizio Quadrio, Luca Formaggia, and Maurizio Domanin. Large eddy simulations of blood dynamics in abdominal aortic aneurysms. *Med. Eng. Phys.*, 47:38–46, 2017.
- [26] Bianca Giovanardi, Anna Scotti, and Luca Formaggia. A hybrid XFEM–Phase field (Xfield) method for crack propagation in brittle elastic materials. *Comput. Method. Appl. M.*, 320:396–420, 2017.
- [27] Alessio Fumagalli, Stefano Zonca, and Luca Formaggia. Advances in computation of local problems for a flow-based upscaling in fractured reservoirs. *Math. Comput. Simulat.*, 137:299–324, 2017.
- [28] P. Zunino, J. Tambaca, E. Cutri, S. Canic, L. Formaggia, and F. Migliavacca. Integrated stent models based on dimension reduction: review and future perspectives. *Ann. Biomed. Eng.*, 44(2):604–617, 2016.
- [29] Alberto Ferroni, Luca Formaggia, and Alessio Fumagalli. Numerical analysis of Darcy problems on surfaces. *ESAIM Math. Model. Numer. Anal.*, 50(6):1615–1630, 2016.
- [30] Franco Dassi, Luca Formaggia, and Stefano Zonca. Degenerate tetrahedra removal. *Appl. Numer. Math.*, 110:1–13, 2016.
- [31] Paola F. Antonietti, Luca Formaggia, Anna Scotti, Marco Verani, and Nicola Verzotti. Mimetic finite difference approximation of flows in fractured porous media. *ESAIM Math. Model. Numer. Anal.*, 50(3):809–832, 2016.

- [32] A. Agosti, B. Giovanardi, L. Formaggia, and A. Scotti. A numerical procedure for geochemical compaction in the presence of discontinuous reactions. *Adv. Water Resour.*, 94:332–344, 2016.
- [33] Nicola Giuliani, Andrea Mola, Luca Heltai, and Luca Formaggia. FEM SUPG stabilisation of mixed isoparametric BEMs: application to linearised free surface flows. *Eng. Anal. Boundary Elem.*, 59:8–22, 2015.
- [34] Bianca Giovanardi, Anna Scotti, Luca Formaggia, and Paolo Ruffo. A general framework for the simulation of geochemical compaction. *Computat. Geosci.*, 19(5):1027–1046, 2015.
- [35] Franco Dassi, Simona Perotto, and Luca Formaggia. A priori anisotropic mesh adaptation on implicitly defined surfaces. *SIAM J. Sci. Comput.*, 37(6):A2758–A2782, 2015.
- [36] D. Bonomi, C. Vergara, E. Faggiano, M. Stevanella, C. Conti, A. Redaelli, G. Puppini, G. Faggian, L. Formaggia, and G. B. Luciani. Influence of the aortic valve leaflets on the fluid-dynamics in aorta in presence of a normally functioning bicuspid valve. *Biomech. Model. Mechanobiol.*, 14(6):1349–1361, 2015.
- [37] A. Agosti, L. Formaggia, and A. Scotti. Analysis of a model for precipitation and dissolution coupled with a Darcy flux. *J. Math. Anal. Appl.*, 431(2):752–781, July 2015.
- [38] Stefano Morlacchi, Claudio Chiastra, Elena Cutrì, Paolo Zunino, Francesco Burzotta, Luca Formaggia, Gabriele Dubini, and Francesco Migliavacca. Stent deformation, physical stress, and drug elution obtained with provisional stenting, conventional culotte and tryton-based culotte to treat bifurcations: a virtual simulation study. *EuroIntervention*, 9(12):1441–1453, 2014.
- [39] L. Formaggia, A. Fumagalli, A. Scotti, and P. Ruffo. A reduced model for Darcy’s problem in networks of fractures. *ESAIM Math. Model. Numer. Anal.*, 48(4):1089–1116, 2014.
- [40] F. Dassi, S. Perotto, L. Formaggia, and P. Ruffo. Efficient geometric reconstruction of complex geological structures. *Mathematics and Computers in Simulations*, 106:163–184, 2014.
- [41] L. Cattaneo, L. Formaggia, G. F. Iori, A. Scotti, and P. Zunino. Stabilized extended finite elements for the approximation of saddle point problems with unfitted interfaces. *Calcolo*, 52(2):123–152, February 2014.
- [42] Elena Cutrì, Luca Formaggia, Paolo Zunino, Stefano Morlacchi, Claudio Chiastra, and Francesco Migliavacca. Drug delivery patterns for different stenting techniques in coronary bifurcations: a comparative computational study. *Biomechanics and modeling in mechanobiology*, 12(4):657–669, 2013.
- [43] L. Tamellini, L. Formaggia, E. Miglio, and A. Scotti. An Uzawa iterative scheme for the simulation of floating bodies. *Computers and Fluids*, 68:148–158, 2012.
- [44] L. Formaggia and C. Vergara. Prescription of general defective boundary conditions in fluid-dynamics. *Milan J. Math.*, 80(2):333–350, 2012.
- [45] L. Formaggia, A. Quarteroni, and C. Vergara. On the physical consistency between three-dimensional and one-dimensional models in haemodynamics. *J. Comput. Phys.*, 244:97–112, 2012.
- [46] L. Formaggia, A. Guadagnini, I. Imperiali, V. Lever, G. M. Porta, M. Riva, A. Scotti, and L. Tamellini. Global sensitivity analysis through polynomial chaos expansion of a basin-scale geochemical compaction model. *Computat. Geosci.*, 17(1):25–42, 2012.
- [47] A. Casagrande, P. Leyland, and L. Formaggia. Parallel mesh adaptive techniques for complex flow simulation: geometry conservation. *Modelling and Simulation in Engineering*, 43:1–13, 2012.

- [48] J. Alastruey, T. Passerini, L. Formaggia, and J. Peiró. Physical determinants of the arterial pulse waveform: theoretical analysis and estimation using the 1-D formulation. *J. Eng. Math.*, 77(1):1–19, 2012.
- [49] M. Pischiotta, L. Formaggia, and F. Nobile. Mathematical modelling for the evolution of aeolian dunes formed by a mixture of sands: entrainment-deposition formulation. *Commun. Appl. Ind. Math.*, 2(2):1–21, 2011.
- [50] L. Formaggia and A. Scotti. Positivity and conservation properties of some integration schemes for mass action kinetics. *SIAM J. Numer. Anal.*, 49:1267–1288, 2011.
- [51] L. Formaggia and A. Villa. Implicit tracking for multi-fluid simulations. *J. Comput. Phys.*, 229:5788–5802, 2010.
- [52] L. Formaggia, A. Veneziani, and C. Vergara. Flow rate boundary problems for an incompressible fluid in deformable domains: formulations and solution methods. *Comput. Method. Appl. M.*, 199(9-12):677–688, 2010.
- [53] L. Formaggia, S. Minisini, and P. Zunino. Stent a rilascio di farmaco: una storia di successo per la matematica applicata. *La Matematica nella Società e nella Cultura (Rivista della Unione Matematica Italiana)*, III:181–200, 2010.
- [54] L. Formaggia, S. Minisini, and P. Zunino. Modeling erosion controlled drug release and transport phenomena in the arterial tissue. *Math. Models Method Appl. Sci.*, 20(10):1759–1786, 2010.
- [55] A. F. Corno, C. Vergara, C. Subramanian, R. A. Johnson, T. Passerini, A. Veneziani, L. Formaggia, N. Alphonso, A. Quarteroni, and J. C. Jarvis. Assisted Fontan procedure: animal and in vitro models and computational fluid dynamics study. *Interactive CardioVascular and Thoracic Surgery*, 10(5):679–684, 2010.
- [56] T. Passerini, M. R. de Luca, L. Formaggia, A. Quarteroni, and A. Veneziani. A 3D/1D geometrical multiscale model of cerebral vasculature. *J. Eng. Math.*, 64(4):319–330, 2009.
- [57] L. Formaggia, E. Miglio, A. Mola, and A. Montano. A model for the dynamics of rowing boats. *Int. J. Numer. Meth. Fl.*, 61(2):119–143, 2009.
- [58] R. Balossino, G. Pennati, F. Migliavacca, L. Formaggia, A. Veneziani, M. Tuveri, and G. Dubini. Computational models to predict stenosis growth in carotid arteries: which is the role of boundary conditions? *Comput Method Biomech Biomed Engin*, 12(1):113–123, 2009.
- [59] L. Formaggia, A. Veneziani, and C. Vergara. A new approach to the numerical solution of defective boundary problems in incompressible fluid dynamics. *SIAM J. Numer. Anal.*, 46(6):2769–2794, 2008.
- [60] L. Formaggia, E. Miglio, A. Mola, and N. Parolini. Fluid-structure interaction problems in free-surface flows: application to boat dynamics. *Int. J. Numer. Meth. Fl.*, 56(8):965–978, 2008.
- [61] J. Peiró, L. Formaggia, M. Gazzola, A. Radaelli, and V. Rigamonti. Shape reconstruction from medical images and quality mesh generation via implicit surfaces. *Int. J. Numer. Methods Fluids*, 53:1339–1360, 2007.
- [62] F. Migliavacca, F. Gervaso, G. Dubini, M. Prosi, P. Zunino, S. Minisini, L. Formaggia, and G. Dubini. Expansion and drug elution model of a coronary stent. *Computer Methods in Biomechanical and Biomedical Engineering.*, 10(1):63–73, 2007.
- [63] L. Formaggia, A. Moura, and F. Nobile. On the stability of the coupling of 3D and 1D fluid-structure interaction models for blood flow simulations. *ESAIM Math. Model. Numer. Anal.*, 41(4):743–769, 2007.

- [64] L. Formaggia, S. Micheletti, R. Sacco, and A. Veneziani. Mathematical modelling and numerical simulation of a glow-plug. *Appl. Numer. Math.*, 57(10):1125–1144, October 2007.
- [65] D. Amadori, S. Ferrari, and L. Formaggia. Derivation and analysis of a fluid-dynamical model in thin and long elastic vessels. *Netw. Heterog. Media*, 2:99–125, 2007.
- [66] G. Selvaggi, S. Anicic, and L. Formaggia. Mathematical explanation of the buckling of the vessels after twisting of the microanastomosis. *Microsurgery*, 26(7):524–528, 2006.
- [67] L. Formaggia, D. Lamponi, A. Veneziani, and M. Tuveri. Numerical modeling of 1D arterial networks coupled with a lumped parameters description of the heart. *Comput. Methods Biomech. Biomed. Engin.*, 9(5):273–288, 2006.
- [68] G. Selvaggi, M. Salgarello, E. Farallo, S. Anicic, and L. Formaggia. Effect of torsion on microvenous anastomotic patency in rat model and early thrombotic phenomenon. *Microsurgery* 24:416-417, 2004. (Letter to editors).
- [69] L. Formaggia and F. Nobile. Stability analysis of second order time accurate schemes for ALE-FEM. *Comput. Method. Appl. M.*, 193:4097–4116, 2004.
- [70] L. Formaggia, S. Micheletti, and S. Perotto. Anisotropic mesh adaption in computational fluid dynamics: application to advection-diffusion-reaction and the Stokes problems. *Appl. Numer. Math.*, 51:511–533, 2004.
- [71] S. J. Sherwin, L. Formaggia, J. Peiró, and V. Franke. Computational modelling of 1D blood flow with variable mechanical properties and its application to the simulation of wave propagation in the human arterial system. *Int. J. Numer. Methods Fluids*, 43(6-7):673–700, 2003.
- [72] B. V. R. Kumar, A. Quarteroni, L. Formaggia, and D. Lamponi. On parallel computation of blood flow in human arterial network based on 1-D modelling. *Computing*, 71(4):321–351, 2003.
- [73] L. Formaggia and S. Perotto. Anisotropic error estimates for elliptic problems. *Numer. Math.*, 94:67–92, 2003.
- [74] L. Formaggia, D. Lamponi, and A. Quarteroni. One dimensional models for blood flow in arteries. *J. Eng. Math.*, 47(3/4):251–276, 2003.
- [75] S. Deparis, M. A. Fernandez, L. Formaggia, and F. Nobile. Modified fixed point algorithm in fluid-structure interaction. *Cr. Mecanique*, 331(8):525–530, 2003.
- [76] S. Deparis, M. A. Fernández, and L. Formaggia. Acceleration of a fixed point algorithm for fluid-structure interaction using transpiration conditions. *ESAIM Math. Model. Numer. Anal.*, 37(4):601–616, 2003.
- [77] L. Formaggia, J.-F. Gerbeau, F. Nobile, and A. Quarteroni. Numerical treatment of defective boundary conditions for the Navier–Stokes equations. *SIAM J. Numer. Anal.*, 40(1):376–401, 2002.
- [78] L. Formaggia, S. Perotto, and P. Zunino. An anisotropic a-posteriori error estimate for a convection-diffusion problem. *Computing and Visualisation in Science*, 4:99–104, 2001.
- [79] L. Formaggia and S. Perotto. New anisotropic a priori estimates. *Numer. Math.*, 89(4):641–667, 2001.
- [80] L. Formaggia, J. F. Gerbeau, F. Nobile, and A. Quarteroni. On the coupling of 3D and 1D Navier-Stokes equations for flow problems in compliant vessels. *Comput. Methods Appl. Mech. Eng.*, 191(6-7):561–582, 2001.

- [81] Cristina Manzi, Francesca Rapetti, and Luca Formaggia. Function approximation on triangular grids: Some numerical results using adaptive techniques. *Appl. Numer. Math.*, 32(4):389–399, 2000.
- [82] L. Formaggia, F. Nobile, A. Quarteroni, and A. Veneziani. Multiscale modelling of the circulatory system: a preliminary analysis. *Comput. Vis. Sci.*, 2(2-3):75–83, 1999.
- [83] L. Formaggia and F. Nobile. A stability analysis for the arbitrary Lagrangian Eulerian formulation with finite elements. *East-West J. Numer. Math.*, 7(2):105–132, 1999.
- [84] G. Abdoulaev, S. Cadeddu, G. Delussu, M. Donizelli, L. Formaggia, A. Giachetti, E. Gobetti, A. Leone, C. Manzi, P. Pili, A. Scheinine, M. Tuveri, A. Varone, A. Veneziani, G. Zanetti, and A. Zorcolo. ViVa: the virtual vascular project. *IEEE Trans. Inf. Technol. Biomed.*, 2(4):268–274, 1998.
- [85] L. Paglieri, D. Ambrosi, L. Formaggia, A. Quarteroni, and A. L. Scheinine. Parallel computation for shallow water flow: A domain decomposition approach. *Parallel Comput.*, 23(9):1261–1277, 1997.
- [86] L. Formaggia, A. Scheinine, and A. Quarteroni. A numerical investigation of Schwarz domain decomposition techniques for elliptic problems on unstructured grids. *Mathematics and Computers in Simulations*, 44:313–330, 1997.
- [87] Vittorio Selmin and Luca Formaggia. Unified construction of finite element and finite volume discretizations for compressible flows. *Int. J. Numer. Methods Eng.*, 39(1):1–32, 1996.
- [88] A. Quarteroni, D. Ambrosi, L. Formaggia, G. Fotia, M. Manzini, M. Mulas, and L. Stolcis. Computational fluid dynamics at CRS4, Italy. *IEEE Computational Science and Engineering*, 3(3):4–8, 1996.
- [89] V. Selmin and L. Formaggia. Simulation of hypersonic flows on unstructured grids. *Int. J. Numer. Methods Eng.*, 34(2):569–606, 1992.
- [90] J. Peraire, J. Peiro, L. Formaggia, K. Morgan, and O. C. Zienkiewicz. Finite element Euler computations in three dimensions. *Int. J. Numer. Methods Eng.*, 26(10):2135–2159, 1988.
- [91] L. Formaggia, J. Peraire, and K. Morgan. Simulation of a store separation using the finite element method. *Appl. Math. Model.*, 12(2):175–181, 1988.

CHAPTERS IN BOOKS AND PUBLISHED LECTURE NOTES

- [1] Domenico Notaro, Laura Cattaneo, Luca Formaggia, Anna Scotti, and Paolo Zunino. *A mixed finite element method for modeling the fluid exchange between microcirculation and tissue interstitium*, pages 3–25. Springer International Publishing, Cham, 2016.
- [2] L. Formaggia and A. Veneziani. *Modeling cardiovascular system and mechanical circulatory support*, chapter Coupling models of the cardiovascular system, pages 115–131. CNR, Rome, Italy, 2007.
- [3] Lorenzo Panzeri, Monica Papini, Luca Formaggia, Anna Scotti, Alessio Fumagalli, Diego Arosio, and Laura Longoni. Lab and modelling tests to develop a geoelectric monitoring system for municipal solid waste landfills. In *EGU22, the 24th EGU General Assembly*, Copernicus GmbH, March 2022.

- [4] Luca Formaggia and Paolo Zunino. Hybrid-dimensional models for blood flow and mass transport: Sequential and embedded 3D-1D models. In *Modeling of Mass Transport Processes in Biological Media*, pages 509–536. Elsevier, 2022.
- [5] Alessio Fumagalli, Anna Scotti, and Luca Formaggia. Performances of the mixed virtual element method on complex grids for underground flow. In *Polyhedral Methods in Geosciences*, SEMA-SIMAI Springer Series, pages 299–329. Springer Nature, 2021.
- [6] Luca Formaggia and Christian Vergara. Defective boundary conditions for PDEs with applications in haemodynamics. In *Numerical Methods for PDEs*, pages 285–312. Springer, 2018.
- [7] B. Giovanardi, L. Formaggia, A. Scotti, and P. Zunino. Unfitted FEM for modelling the interaction of multiple fractures in a poroelastic medium. In S. P. A. Bordas, E. N. Burman, M. G. Larson, and M. A. Olshanskii, editors, *Geometrically Unfitted Finite Element Methods and Applications*, volume 121, pages 331–352. Springer, Cham, 2017.
- [8] A. Quarteroni and L. Formaggia. Domain decomposition (DD) methods. In *Encyclopedia of Solid Earth Geophysics*. Springer, 2010.
- [9] L. Formaggia, A. Mola, N. Parolini, and M. Pischiutta. A three-dimensional model for the dynamics and hydrodynamics of rowing boats. In *Proc. IMechE, Part P: J. Sports Engineering and Technology*, volume 224 (P1), pages 51–61, 2010.
- [10] L. Formaggia, A. Quarteroni, and A. Veneziani. Multiscale models of the vascular system. In L. Formaggia, A. Quarteroni, and A. Veneziani, editors, *Cardiovascular Mathematics. Modelling and simulation of the circulatory system.*, volume 1 of *Modeling, Simulation & Applications*, chapter 11, pages 403–455. Springer, 2009.
- [11] L. Formaggia, K. Perktold, and A. Quarteroni. Basic mathematical models and motivations. In L. Formaggia, A. Quarteroni, and A. Veneziani, editors, *Cardiovascular Mathematics. Modelling and simulation of the circulatory system.*, volume 1 of *Modeling, Simulation and Applications*, chapter 2, pages 47–67. Springer, 2009.
- [12] L. Formaggia, E. Miglio, A. Mola, and A. Scotti. Numerical simulation of the dynamics of boats by a variational inequality approach. In G. Buttazzo and A. Frediani, editors, *Variational analysis and aerospace engineering*, pages 213–227. Springer, 2009. Proceedings of the 47th workshop of the International school of mathematics "Guido Stampacchia, Erice, Italy, 8th-16th September, 2007.
- [13] M. A. Fernandez, L. Formaggia, J.-F. Gerbeau, and L. Formaggia. The derivations of the equation for fluids and structure. In L. Formaggia, A. Quarteroni, and A. Veneziani, editors, *Cardiovascular Mathematics. Modelling and simulation of the circulatory system.*, volume 1 of *Modeling, Simulation & Applications*, chapter 3, pages 77–124. Springer, 2009.
- [14] L. Formaggia, A. Quarteroni, and A. Veneziani. The circulatory system: from case studies to mathematical modelling. In A. Quarteroni, L. Formaggia, and A. Veneziani, editors, *Complex systems in Biomedicine*, pages 243–281. Springer-Verlag, Berlin, 2006.
- [15] L. Formaggia, m. Sala, and f. Saleri. Domain decomposition techniques. In A. M. Bruaset and A. Tveito, editors, *Numerical Solution of Partial Differential Equations on Parallel Computers*, volume 51 of *Lecture Notes in Computational Science and Engineering*, chapter 4, pages 135–162. Springer, New York, 2006.
- [16] L. Formaggia and A. Veneziani. Geometrical multiscale models for the cardiovascular system. In T. A. Kowalewski, editor, *Blood Flow Modelling and Diagnostics*, volume 6, pages 309–360. Institute of Fundamental Technological Research, Warsaw, Poland, 2005.

- [17] A. Quarteroni and L. Formaggia. Mathematical modelling and numerical simulation of the cardiovascular system. In N. Ayache, editor, *Computational Models for the Human Body*, Handbook of Numerical Analysis (P.G Ciarlet Ed.), pages 3–129. Elsevier, Amsterdam, 2004.
- [18] J. Peiro, S. J. Sherwin, K. H. Parker, V. Franke, L. Formaggia, D. Lamponi, and A. Quarteroni. Numerical simulation of the arterial pulse propagation using one-dimensional models. In M. W. Collins et Al, editor, *Wall-Fluid Interactions in Physiological Flows*, pages 1–36. WIT Press, Southampton, 2004.
- [19] L. Formaggia and A. Veneziani. One dimensional models for blood flow in the human vascular system. In M. L. Riethmuller and P. Corieri, editors, *Biological Fluid Dynamics*, Lecture Series 2003-07, chapter 8/1, pages 1–45. VKI, Rhode-St-Genese, Belgium, May 2003.
- [20] L. Formaggia and A. Veneziani. Geometrical multiscale models for the cardiovascular system: from lumped parameters to 3D simulations. In M. L. Riethmuller and P. Corieri, editors, *Biological Fluid Dynamics*, Lecture Series 2003-07, chapter 8/2, pages 1–65. VKI, Rhode-St-Genese, Belgium, May 2003.
- [21] L. Formaggia and S. Perotto. Anisotropic error estimation for finite element methods. In N. P. Weatherill and H. Deconinck, editors, *Von Karman Institute Lecture Series 2000-05*, pages 1–26. VKI, Rhode-Saint Genése, Belgium, March 2000. 31st Computational Fluid Dynamics Lecture Series.
- [22] L. Formaggia. Data structures for unstructures mesh generation. In N. P. Weatherill and H. Deconinck, editors, *Von Karman Institute Lecture Series 2000-05, 31st Computational Fluid Dynamics*, pages 1–32. VKI, Rhode-Saint Genése, Belgium, March 2000.
- [23] V. Selmin and L. Formaggia. Mesh adaptation on 2-D unstructured meshes. In David P. et al. Hills, editor, *Computational mesh adaptation. ECARP - European computational aerodynamics research project.*, volume 69 of *Notes Numer. Fluid Mech*, pages 187–202. Vieweg, Braunschweig, 1999.
- [24] L. Formaggia. Data structures for unstructured mesh generation. In J. F. Thompson, B. K. Soni, and N.P. Weatherill, editors, *Handbook of Grid Generation*, chapter 14, pages 1–22. CRC Press, Boca Raton, Florida, 1999.
- [25] O. C. Zienkiewicz, K. Morgan, J. Peraire, J. Peiró, and L. Formaggia. Finite elements in fluid mechanics: compressible flow, shallow water equations and transport. In T. E. Tezduyar and T. J. R. Hughes, editors, *Recent developments in computational fluid dynamics*, volume 95, pages 193–206. ASME, 1988.

BOOKS

- [1] L. Formaggia, F. Saleri, and A. Veneziani. *Solving numerical PDEs: problems, applications, exercises*. UNITEXT. Springer, 2012.
- [2] L. Formaggia, F. Saleri, and A. Veneziani. *Applicazioni ed esercizi di modellistica numerica per problemi differenziali*, volume 17 of *UNITEXT*. Springer Italia, Milan, 2005.

EDITED BOOKS

- [1] A. Quarteroni, L. Formaggia, and A. Veneziani, editors. *Complex systems in biomedicine*. Springer-Verlag Italia, Milan, 2006.

- [2] S. Perotto and L. Formaggia, editors. *New Challenges in Grid Generation and Adaptivity for Scientific Computing*, volume 5 of *SEMA-SIMAI Springer Series*. Springer, 2015. ISBN 978-3-319-06052-1.
- [3] Alessio Fumagalli, Inga Berre, Luca Formaggia, Eirik Keilegavlen, and Anna Scotti, editors. *Numerical methods for processes in fractured porous media*. Lecture Notes in Geosystems Mathematics and Computing. Springer International, 2019.
- [4] L. Formaggia, A. Quarteroni, and A. Veneziani, editors. *Cardiovascular Mathematics. Modelling and Simulation of the Circulatory System*, volume 1 of *Modeling, Simulation & Applications*. Springer, 2009.
- [5] Daniele Antonio Di Pietro, Luca Formaggia, and Roland Masson, editors. *Polyhedral Methods in Geosciences*, volume 27 of *SEMA-SIMAI Springer Series*. Springer Nature, 2021.
- [6] D. Di Pietro, A. Ern, and L. Formaggia, editors. *Numerical methods for PDEs: State-of-the-art numerical techniques*, volume 15 of *SEMA-SIMAI Springer Series*. Springer International Publishing, 2018. Book.