



Curriculum Vitae

Lorenzo Sala

l.sala@imperial.ac.uk

<https://lsala.github.io>

Office 6M22

Department of Mathematics

Imperial College London

London SW7 2AZ, UK

Scientific positions

- **Research Associate at Imperial College London.** 2019 - now.

Mentor: P. Degond.

Project: modelling sperm-mucus interactions across scales: apply advanced mathematical modelling and computational techniques to understand the motion of sperm cells through the heterogeneous environments they encounter during mammalian reproduction.

- **Engineer researcher at the Université de Strasbourg.** May - September 2016.

Mentors: G. Guidoboni, C. Prud'homme.

Project: Eye2Brain: study and implement innovative mathematical and physiological models to investigate the connection between the eye and the brain.

Education

- **PhD in Applied Mathematics at the Université de Strasbourg.** 2016 - 2019.

Title: Mathematical modeling and simulation of ocular blood flows and their interactions.

Advisors: C. Prud'Homme, G. Guidoboni, M. Szopos.

- **MSc in Computational Science and Engineering at Politecnico di Milano.** 2013 - 2016.

Principal subjects: High Performance Computing, Numerical Analysis for PDE, Computational Fluid Dynamics, Biomathematics, Solid State Electronics, Mechanical Statistics.

Master thesis: A Cellular Scale Model of Aqueous Humour Production.

Advisors: R. Sacco, A.G. Mauri, G. Guidoboni.

- **BSc in Mathematical Engineering at Politecnico di Milano.** 2010 - 2013.

Principal subjects: Informatics, Numerical Mathematics, Calculus, Biomathematics, Physics, Electronics, Operative Research, Statistics.

Honors and awards

- **05/19: 9e Biennale Française des Mathématiques Appliquées et Industrielles young researchers scholarship.** May 13 - 17, 2019, Guidel Plages (Morbihan), France.

- **05/19: Oral presentation at 2019 Annual Meeting of the Association for Research in Vision and Ophthalmology.** April 28 - May 2, 2019, Vancouver, Canada.

Title: A web-based interface for ocular hemodynamics and biomechanics analysis via the Ocular Mathematical Virtual Simulator.

Authors: L. Sala, C. Prud'homme, G. Guidoboni, M. Szopos, A.C. Verticchio Vercellin, B.A. Siesky, A. Harris.

- **05/18: Oral presentation at 2018 Annual Meeting of the Association for Research in Vision and Ophthalmology.** April 29 - May 3, 2018, Honolulu (HI), USA.

Title: Analysis of IOP and CSF alterations on ocular biomechanics and lamina cribrosa hemodynamics.

Authors: L. Sala, C. Prud'homme, G. Guidoboni, M. Szopos, B.A. Siesky, A. Harris.

- **10/17: Best Poster Award - University of Strasbourg Doctorate School in Mathematics, Engineering and Computer Science.** October 2, 2017, Strasbourg, France.
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Peer-reviewed articles

- **Mathematical assessment of the role of three factors entangled in the development of glaucoma by means of the Ocular Mathematical Virtual Simulator.**

L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS, A. HARRIS.

Submitted.

- **A Theoretical Study of Aqueous Humor Secretion Based on a Continuum Model Coupling Electrochemical and Fluid-Dynamical Transmembrane Mechanisms.**
L. SALA, A.G. MAURI, R. SACCO, D. MESSENIO, G. GUIDOBONI, A. HARRIS.
Communications in Applied Mathematics and Computational Science, 14(1), pp.65-103. 2019.
 - **Cardiovascular function and ballistocardiogram: a relationship interpreted via mathematical modeling.**
G. GUIDOBONI, L. SALA, M. ENAYATI, R. SACCO, M. SZOPOS, J.M. KELLER, M. POPESCU, L. DESPINS, V. HUXLEY, M. SKUBIC.
IEEE Transactions on Biomedical Engineering. 2019
 - **Ocular mathematical virtual simulator: A hemodynamical and biomechanical study towards clinical applications.**
L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
Journal of Coupled Systems and Multiscale Dynamics, 6(3), pp.241-247. 2018
 - **Multiscale nature of ocular physiology.**
L. SALA, R. SACCO, G. GUIDOBONI.
Journal for Modeling in Ophthalmology, 2(1), pp.12-18. 2018.
 - **Hi-POD solution of parametrized fluid dynamics problems: preliminary results.**
D. BAROLI, C.M. COVA, S. PEROTTO, L. SALA, A. VENEZIANI.
In Model Reduction of Parametrized Systems (pp. 235-254). Springer, Cham. 2017.
 - **Electro-fluid dynamics of aqueous humor production: simulations and new directions.**
A.G. MAURI, L. SALA, P. AIROLDI, G. NOVIELLI, R. SACCO, S. CASSANI, G. GUIDOBONI, B.A. SIESKY, A. HARRIS.
Journal for Modeling in Ophthalmology, 1(2), pp.48-58. 2016.
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Peer-reviewed book chapters

- **Mathematical modeling of the cerebrospinal fluid flow and its interactions.**
L. SALA, F. SALERNI, M. SZOPOS.
Chapter in the book Mathematical Modeling of Ocular Fluid Dynamics: From Theory to Clinical Applications.
Editors: G. Guidoboni, A. Harris, R. Sacco.
Springer-Birkhauser (New York). *Book series:* Modeling and Simulation in Science, Engineering, and Technology
Expected release date: November, 2019.
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Peer-reviewed conference proceedings

- **Case study exemplar of detecting severe diastolic dysfunction using ballistocardiogram.**
L.A. DESPINS, G. GUIDOBONI, M. SKUBIC, L. SALA, M. ENAYATI, J. KELLER, M. POPESCU.
Innovation in Aging, 3(Supplement_1), pp.S88-S89. 2019.
- **An operator splitting method for the time discretization of a multi-scale model in ophthalmology.**
L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
In 9e Biennale Française des Mathématiques Appliquées et Industrielles (SMAI). 2019.
- **A web-based interface for ocular hemodynamics and biomechanics analysis via the Ocular Mathematical Virtual Simulator.**
L. SALA, G. GUIDOBONI, C. PRUD'HOMME, M. SZOPOS, A. C. VERTICCHIO VERCELLIN, B. A. SIESKY, A. HARRIS.
Investigative Ophthalmology & Visual Science, 60(9), pp. 4277-4277. 2019.
- **Towards a full model for ocular biomechanics, fluid dynamics, and hemodynamics.**
L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
Journal for Modeling in Ophthalmology, 2(2), pp.7-13. 2018.
- **Analysis of IOP and CSF alterations on ocular biomechanics and lamina cribrosa hemodynamics.**
L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS, B.A. SIESKY, A. HARRIS.
Investigative Ophthalmology & Visual Science, 59(9), pp.4475-4475. 2018.
- **A theoretical study of the role of conformational properties of transepithelial ion pumps on aqueous humor production.**
R. SACCO, L. SALA, A.G. MAURI, D. MESSENIO, G. GUIDOBONI, B.A. SIESKY, A. HARRIS
Investigative Ophthalmology & Visual Science, 59 (9), 1656-1656. 2018.
- **A theoretical study of the role of conformational properties of transepithelial ion pumps on aqueous humor production.**
R. SACCO, A.G. MAURI, L. SALA, S. CASSANI, B.A. SIESKY, G. GUIDOBONI, A. HARRIS.
Investigative Ophthalmology & Visual Science, 59(9), pp.1656-1656. 2018.
- **Unconditionally stable operator splitting method for a multiscale application in ophthalmology.**
G. GUIDOBONI, C. PRUD'HOMME, L. SALA, M. SZOPOS.
In 44e Congrès National d'Analyse Numérique. May, 2018.
- **Patient-specific virtual simulator of tissue perfusion in the lamina cribrosa.**
L. SALA, C. PRUD'HOMME, D. PRADA, F. SALERNI, C. TROPHIME, V. CHABANNES, M. SZOPOS, R. REPETTO, S. BERTOLUZZA, R. SACCO, A. HARRIS.
Investigative Ophthalmology & Visual Science, 58(8), pp. 727. 2017.

- **The role of HCO_3^- and NA/K ATPase in the regulation of aqueous humor production: a mathematical model.**
R. SACCO, A.G. MAURI, L. SALA, S. CASSANI, B.A. SIESKY, G. GUIDOBONI, A. HARRIS.
Investigative Ophthalmology & Visual Science, 57(12). 2016.
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Patents

- **Cardiovascular function and ballistocardiogram.** US provisional patent application No.62/735,716. Filed on 09/24/2018.
Inventor: G. Guidoboni
Authors: G. Guidoboni, L. Sala
Assignee: The Curators of the University of Missouri
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Presentations

- **The Ocular Mathematical Virtual Simulator: modelisation and simulation.** L. SALA.
Applied PDEs Seminar. Imperial College London, UK. 29/11/2019.
 - **From medicine to mathematics and back: an application in ophthalmology.** L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
European Numerical Mathematics and Advanced Applications Conference 2019. Egmond aan Zee, The Netherlands. 30/09/2019.
 - **The Ocular Mathematical Virtual Simulator: towards uncertainty quantification.** L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
6th International Conference on Computational and Mathematical Biomedical Engineering. Sendai, Japan. 11/06/2019.
 - **An operator splitting method for the time discretization of a multi-scale model in ophthalmology.** L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
9e Biennale Française des Mathématiques Appliquées et Industrielles. Guidel Plages (Morbihan), France. 14/05/2019.
 - **Mathematical modeling and simulation of ocular blood flow and their interactions.** L. SALA
Workshop Modeling the eye as a window on the body. American Institute of Mathematics, San José (CA), USA. 17/10/2018.
 - **Ocular Mathematical Virtual Simulator: A Hemodynamical and Biomechanical Study towards Clinical Applications.** L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
13th World Congress on Computational Mechanics: Multidisciplinary Alliance in Biosciences: Modeling, Computing, Technology and Clinical Applications. New York (NY), USA. 24/07/2018.
 - **Unconditionally stable operator splitting method for a multiscale application in ophthalmology.** L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
44e Congrès National d'Analyse Numérique. Centre Azureva, Cap d'Agde, France. 30/05/2018.
 - **Towards a full model for ocular biomechanics, fluid dynamics and hemodynamics.** L. SALA, C. PRUD'HOMME, G. GUIDOBONI, M. SZOPOS.
ESB-ITA VII Annual Meeting. Roma, Italy. 28/09/2017.
 - **Multiphysic modeling of the Eye using Feel++.** L. SALA
Workshop 5th Feel++ User Days. IRMA, Strasbourg, France. 14/09/2017.
 - **HDG Method and Toolbox in Feel++.** R. HILD, L. SALA
Workshop 5th Feel++ User Days. IRMA, Strasbourg, France. 13/09/2017.
 - **Demo tissue perfusion in the eye** L. SALA
Workshop Mathematical Modelling, Simulation and Optimization for Societal Challenges with Scientific Computing (MSO4SC). Budapest, Hungary. 23/05/2017.
 - **Patient-specific virtual simulator of tissue perfusion in the lamina cribrosa** L. SALA, C. PRUD'HOMME, D. PRADA, F. SALERNI, C. TROPHIME, V. CHABANNES, M. SZOPOS, R. REPETTO, S. BERTOLUZZA, R. SACCO, A. HARRIS, G. GUIDOBONI.
2017 Annual Meeting of the Association for Research in Vision and Ophthalmology. Poster session "Imaging: Macula Retina, Blood Flow, OCT Angiography". Baltimore(MD), USA. 07/05/2017.
 - **Hi-POD reduction techniques for parametrized fluid dynamics problems.** L. SALA, D.BAROLI, C.M. COVA, S. PEROTTO, A. VENEZIANI.
Numerical methods for PDEs: recent developments in numerical methods for model reduction. IHP, Paris, France. 08/11/2016.
 - **Hi-POD reduction techniques for parametrized fluid dynamics problems.** L. SALA
Séminaire Equations aux dérivées partielles". IRMA, Strasbourg, France. 11/10/2016.
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Teaching

- Undergraduate course **Mathématique I.**
Review of the mathematics studied at high school for 1st year undergraduate students in Biology.
Université de Strasbourg, A.Y. 2017-2018 and 2018-2019.

- Undergraduate course **Algorithme et Programmation en C++**.
Practical (Computed-based) lessons on algorithms and coding in C++ for 3rd year undergraduate students in Mathematics. Université de Strasbourg, A.Y. 2018-2019.
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Work and studies experiences

- **Semaine d'étude maths-entreprise.**
One week work on the industrial project "Modeling Simulation and Optimisation of Storage areas" proposed by the Port Autonome de Strasbourg. Université de Strasbourg, Strasbourg, France. November, 2018.
- **Visit Eye Glick Institute.** A. HARRIS, B.A. SIESKY, A. VERTICCHIO VERCELLIN.
Direct collaboration with ophthalmologists in clinic and research center. Study of measurement instruments and their outcomes in ocular diseases. Eye Glick Institute, Indianapolis (IN), USA. February, 2018.
- **Training Scientific Communication and Research Culture.** P. MONTGOMERY.
Doctoral course to improve English scientific communication skills. Université de Strasbourg, Strasbourg, France. November 2017 - January 2018.
- **VivaBrain Summer School.** N. PASSAT, H TALBOT, V. WOLFF, J.-P. ARMSPACH, J. JOMIER, S. SALMON.
Cerebral MR Angiography: acquisition, processing, simulation ESIEE-Paris, Noisy-le-Grand (Campus Paris-Est) France. June, 2017.
- **PhD course Life2Math** R. SACCO, G. GUIDOBONI, R.S. EISENBERG, A.G. MAURI, M.L. COSTANTINO, M.T. RAIMONDI, C. GIORDANO, A. HARRIS.
A mathematical shuttle from molecules to neurons to functions and back. Politecnico di Milano, Milano, Italy. November, 2016.
- **Centre d'Été Mathématique de Recherche Avancée en Calcul Scientifique (CEMRACS)**
Numerical challenges in parallel scientific computing. CIRM, Luminy, Marseille, France. July-August 2016.
- **Master student stage.** A.G. MAURI
Interdisciplinary work between semiconductor device models and biomathematics. Micron Technology, Vimercate(MB), Italy. September-December 2015.
- **Ski teacher** SCUOLA MAESTRI DI SCI MONTE BIANCO
Ski teacher for any levels and any age acknowledged internationally. Courmayeur (AO), Italy. From 2013.