Lorenzo SALA, PhD

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Employment

- **Post doc** at Inria Saclay, Ile-de-France. 2020 - now.
  Mentor: I. Vignon-Clementel. *Project:* modelling of hemodynamics in the entire circulation for targeted surgical interventions in the liver.
- Collaboration as **consultant for Gspace LLC**. 2020-2021.
  Gspace LLC is a consulting company in computational modeling for smart solutions in engineering and life sciences.
  Project: modelling the structural reaction of mattress to body weight.
- **Research Associate** at Imperial College London. 2019 - 2020.
  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.

Qualifications

- **Qualified for the functions of "Maître de conférences"**. February, 2020.
- **PhD in Applied Mathematics** at the Université de Strasbourg. 2016 - 2019.
  Title: Mathematical modelling 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.
  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.

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

Funding

- Contribution to 2021 AIM Square[1] entitled *Mathematical modeling of the relationship between cardiovascular function and ballistocardiogram.*
- Young researchers scholarship for the **9e Biennale Française des Mathématiques Appliquées et Industrielles**.
  Fees and accommodation grant. 2019.
- Contribution to the grant **Mathematical Modelling, Simulation and Optimization for Societal Challenges with Scientific Computing: Eye2Brain project**. European Union's Horizon 2020 research and innovation programme. Grant agreement No 731063. C. Prud'homme. 2016-2018.
- Contribution to the grant **Prix Espoir IdEx** (*Initiative d'excellence*). M. Szopos. 2018.
- **PhD scholarship** administrated by the Doctoral School *Mathematics, Engineering and Computer Science* of the University of Strasbourg. 2016-2019.

Honours and awards

- **VPHi-InSilicoTrials PhD Thesis Award in In Silico Medicine for potential appliction in industrial R&D**.
  VPH2020 Conference. August 28, 2020, Paris, France.
- **Best PhD Thesis Award - Prize of the Research Commission of the University of Strasbourg**.
  June 26, 2020, Strasbourg, France.
- Oral presentations at 2018 and at 2019 **Annual Meeting of the Association for Research in Vision and Ophthalmology.** Selected among circa 1000 applicants. 2018, Honolulu (HI), USA; 2019, Vancouver, Canada.
- **Best Poster Award** - University of Strasbourg Doctorate School in Mathematics, Engineering and Computer Science. October 2, 2017, Strasbourg, France.

Invited talks

- *14th World Congress on Computational Mechanics: Multidisciplinary Alliance in Biosciences: Modeling, Computing, Technology and Clinical Applications.* (Online) Paris, France. 13/01/2021.
- *2021 Virtual Joint Mathematics Meetings.* Online. 08/01/2021.
- *VPH2020 Conference.* (Online) Paris, France. 28/08/2020.
- *Applied PDEs Seminar.* Imperial College London, UK. 29/11/2019.
- *European Numerical Mathematics and Advanced Applications Conference 2019.* Egmond aan Zee, The Netherlands. 30/09/2019.
- *6th International Conference on Computational and Mathematical Biomedical Engineering.* Sendai, Japan. 11/06/2019.
- *9e Biennale Française des Mathématiques Appliquées et Industrielles.* Guidel Plages (Morbihan), France. 14/05/2019.
- *Workshop Modeling the eye as a window on the body.* American Institute of Mathematics, San José (CA), USA. 17/10/2018.

[1] https://aimath.org/programs/squares/

- *13th World Congress on Computational Mechanics: Multidisciplinary Alliance in Biosciences: Modeling, Computing, Technology and Clinical Applications.* New York (NY), USA. 24/07/2018.
- *Workshop 5th Feel++ User Days.* IRMA, Strasbourg, France. 14/09/2017.
- *Séminaire Equations aux dérivées partielles.* IRMA, Strasbourg, France. 11/10/2016.

Presentations

- Poster at *44e Congrès National d'Analyse Numérique.* Centre Azureva, Cap d'Agde, France. 30/05/2018.
- *Workshop Mathematical Modelling, Simulation and Optimization for Societal Challenges with Scientific Computing (MSO4SC)*. Budapest, Hungary. 23/05/2017. *Presentation available on Youtube at* `https://www.youtube.com/watch?v=F4JIgA1PCcA&t=1s`
- Poster at *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.
- Poster at *Numerical methods for PDEs: recent developments in numerical methods for model reduction.* IHP, Paris, France. 08/11/2016.

Teaching

- Undergraduate course **Mathématique I**. Lecture series and marking. *Review of the mathematics studied at high school for* 1^{st} *year undergraduate students in Biology.* Université de Strasbourg, A.Y. 2017-2018 and 2018-2019.
- Undergraduate course **Algorithme et Programmation en C++**. Exercise series, exam preparation and marking. *Practical (Computed-based) lessons on algorithms and coding in C++ for* 3^{rd} *year undergraduate students in Mathematics.* Université de Strasbourg, A.Y. 2018-2019.
- **Informal supervision**: L. Berti (U. Strasbourg), G. Bonifazi (U. Missouri), G. Chiaravalli (U. Missouri), N.M. Marazzi (U. Missouri), P. Ricka (U. Strasbourg), F. Stefanoni (Politecnico di Milano), A. Walczak (Imperial College).
- **Formal supervision**: L. Thiebaud (INRIA), T. Saigre (U. Strasbourg).

Peer-reviewed articles

- **Combining physiology-based modeling and evolutionary algorithms for personalized, non-invasive cardiovascular assessment based on electrocardiography and ballistocardiography** N.M. Marazzi, G. Guidoboni, M. Zaid, L. Sala et al. Frontiers of Physiology, 2021
- **Uncertainty propagation and sensitivity analysis: results from the Ocular Mathematical Virtual Simulator.** L. Sala et al. Mathematical Biosciences and Engineering, 2021.
- **Neurodegenerative disorders of the eye and of the brain: a perspective on their fluid-dynamical connections and the potential of mechanism-driven modeling.** G. Guidoboni, R. Sacco, M. Szopos, L. Sala et al. Frontiers in Neuroscience, 2020.
- **Using sensor signals in the early detection of heart failure: A case study.** L.A. Despins, G. Guidoboni, M. Skubic, L. Sala et al. Journal of Gerontological Nursing, 2020.
- **Mathematical assessment of the role of three factors entangled in the development of glaucoma by means of the Ocular Mathematical Virtual Simulator.** L. Sala et al. Numerical Mathematics and Advanced Applications ENUMATH, 2019.
- **A Theoretical Study of Aqueous Humor Secretion Based on a Continuum Model Coupling Electrochemical and Fluid-Dynamical Transmembrane Mechanisms.** L. Sala et al. Communications in Applied Mathematics and Computational Science, 2019.
- **Cardiovascular function and ballistocardiogram: a relationship interpreted via mathematical modeling**. G. Guidoboni, L. Sala et al. IEEE Transactions on Biomedical Engineering, 2019
- **Ocular mathematical virtual simulator: A hemodynamical and biomechanical study towards clinical applications**. L. Sala et al. Journal of Coupled Systems and Multiscale Dynamics, 2018
- **Multiscale nature of ocular physiology**. L. Sala, R. Sacco, G. Guidoboni. Journal for Modeling in Ophthalmology, 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*, 2017.
- **Electro-fluid dynamics of aqueous humor production: simulations and new directions**. A.G. Mauri, L. Sala et al. Journal for Modeling in Ophthalmology, 2016.

Peer-reviewed book chapter

- **Mathematical modeling of the cerebrospinal fluid flow and its interactions.** L. Sala, F. Salerni, M. Szopos. In *Mathematical Modeling of Ocular Fluid Dynamics: From Theory to Clinical Applications*, 2019.

Peer-reviewed conference proceedings

- **Influence of low perfusion pressure on the diastolic hemodynamics in central retinal vessels: a data-driven computational study.** N. Marazzi, L. Sala et al. IOVS, 2020.
- **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), 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 FranÃ§aise des MathÃ©matiques AppliquÃ©es et Industrielles (SMAI). 2019.
- **A web-based interface for ocular hemodynamics and biomechanics analysis via the Ocular Mathematical Virtual Simulator.** L. Sala et al. IOVS, 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, 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. IOVS, 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 IOVS, 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. IOVS, 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, 2018.
- **Patient-specific virtual simulator of tissue perfusion in the lamina cribrosa**. L. Sala et al. IOVS, 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. IOVS, 2016.