

# LU Liu-Di

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🌐 <https://liudi-lu.github.io>

## Research interests

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🔗 numerical analysis, scientific computing, domain decomposition, PDE-constrained optimization, optimal control, coupling problems, mathematics modelling, mathematical biology, model order reduction.





## Research experience

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- 📄 **Post-doctorat contract** October 2025 –  
Centre for Mathematical Sciences, Lund University, Sweden  
*Project:* Coupling methods for in climate problems  
*Keywords:* waveform relaxation, global climate model, heterogeneous heat transfer  
*Collaborators:* Philipp Birken (Lund University), Niklas Kotarsky (Lund University), Valentina Schüller (Lund University)
- 📄 **Post-doctorat contract** October 2021 – June 2025  
Section of Mathematics, University of Geneva, Switzerland  
*Project:* Domain decomposition methods for PDE-constrained optimization problems  
*Keywords:* elliptic optimal control, parabolic optimal control, convergence analysis, time parallelization, Dirichlet–Neumann method, Neumann–Neumann method, Optimized Schwarz method  
*Collaborators:* Bastien Chaudet-Dumas (HEIG-VD), Pierre–Henri Cocquet (Université de Pau), Martin J. Gander (University of Geneva), Si-Wei Liao (Lanzhou University), Tommaso Vanzan (Politecnico di Torino), Tingting Wu (Nanjing University of Aeronautics and Astronautics)
- 👤 **Instructor contract** October 2018 – September 2021  
Sorbonne Université, France  
192 hours of teaching task
- 📄 **Doctoral contract** October 2018 – September 2021  
Laboratoire Jacques-Louis Lions, Sorbonne Université, France  
*Project:* Modelling and optimization problems in microalgae production  
*Keywords:* microalgae, photobioreactor, raceway pond, Saint–Venant model, Han model, optimal control, nonlinear adaptive control, resource allocation, permutation, topography, photoinhibition, sensitivity analysis, parameter calibration  
*Collaborators:* Olivier Bernard (INRIA Sophia Antipolis), Joel Ignacio Fierro Ulloa (INRIA Sophia Antipolis), Nan Pan (École Polytechnique), Jacques Sainte-Marie (INRIA Paris), Julien Salomon (INRIA Paris)
- 📄 **Research Internship** March 2018 – September 2018  
INRIA Paris, team ANGE, France  
*Project:* Model order reduction for Burgers’ equation  
*Keyword:* reduced basis, Burgers’ equation, characteristic equation, Proper Orthogonal Decomposition (POD), Empirical Interpolation Method (EIM), Greedy algorithm, *a posteriori* estimation  
*Supervisors:* Julien Salomon (INRIA Paris), Jacques Sainte-Marie (INRIA Paris)





## Education

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-  **Sorbonne Université (Université Pierre et Marie Curie), Paris, France** 2018 – 2021  
 Ph.D. degree in Applied mathematics  
 Defended September 29th 2021 at Laboratory Jacques-Louis Lions, UMR 7598, Paris  
*Title:* Lagrangian approaches for modelling and optimization of hydrodynamic-photosynthesis coupling  
*Supervisors:*  
 Julien Salomon Senior Researcher at INRIA Paris
- Jury:*
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|-------------------|------------------|---|
| Referees          | Benoît Chachuat  | Professor at Imperial College London        |
|                   | Yannick Privat   | Professor at University of Strasbourg       |
| President of Jury | Florence Hubert  | Professor at Aix-Marseille University       |
| Examiners         | Céline Grandmont | Senior Researcher at INRIA Paris            |
|                   | Camille Pouchol  | Associate Professor at University of Paris  |
|                   | Magali Ribot     | Professor at University of Orléans          |
| Invited           | Martin J. Gander | Professor at University of Geneva           |
|                   | Olivier Bernard  | Senior Researcher at INRIA Sophia Antipolis |
-  **Sorbonne Université (Université Pierre et Marie Curie), Paris, France** 2016 – 2018  
 Master degree in Mathematics and applications
-  **Université Claude Bernard Lyon 1, Lyon, France** 2015 – 2016  
 Bachelor degree in Mathematics and applications
-  **Université Savoie Mont Blanc, Chambéry, France** 2013 – 2015  
 First and second year of Bachelor in Mathematics

## Publication

### Preprints

-  *The minimal polynomial extrapolation method for linear complementarity problems arising from American option pricing*, with Martin J. Gander and Si-Wei Liao, Submitted (2025)
-  *From PDEs constrained optimization to controllability problems via time domain decomposition*, with Pierre-Henri Cocquet, Submitted (2025)
-  *Optimized Schwarz methods for heterogeneous heat transfer problems*, with Martin J. Gander and Tingting Wu, Submitted (2025)
-  *Representing inhibition in growth kinetics: the Haldane KIS*, with Olivier Bernard and Nan Pan, Submitted (2024)

### International peer-reviewed journal papers

-  *Topography optimization for enhancing microalgal growth in raceway ponds*, with Olivier Bernard, Jacques Sainte-Marie and Julien Salomon, *SIAM Journal on Control and Optimization*, 63(4):2451–2471 (2025)
-  *Should hydrodynamics be taken into account when calculating the growth rate of microalgae in a photobioreactor?* with Olivier Bernard and Joel Ignacio Fierro Ulloa, *SIAM Journal on Applied Mathematics*, 85(4):1906–1925 (2025)
-  *New time domain decomposition methods for parabolic optimal control problems II: Neumann–Neumann algorithms*, with Martin J. Gander, *SIAM Journal on Numerical Analysis*, 62(6):2588–2610 (2024)
-  *New time domain decomposition methods for parabolic optimal control problems I: Dirichlet–Neumann and Neumann–Dirichlet algorithms*, with Martin J. Gander, *SIAM Journal on Numerical Analysis*, 62(4):2048–2070 (2024)
-  *Theoretical growth rate of microalgae under high/low-flashing light*, with Olivier Bernard and Joel Ignacio Fierro Ulloa, *Journal of Mathematical Biology*, 86(48):1–32 (2023)

- 📄 *Optimization of mixing strategy in microalgal raceway ponds*, with Olivier Bernard and Julien Salomon, *International Journal of Robust and Nonlinear Control*, 33(9):4989–5010 (2023)
- 📄 *Optimal optical conditions for microalgal production in photobioreactors*, with Olivier Bernard, *Journal of Process Control*, 112:69–77 (2022)

### Internationales peer-reviewed conferences proceedings

- 📄 *Non-overlapping Schwarz methods in time for parabolic optimal control problems*, with Martin J. Gander, To appear in *Domain Decomposition Methods in Science and Engineering XXVIII. DD 2024* (2025)
- 📄 *Dirichlet–Neumann and Neumann–Neumann methods for elliptic control problems*, with Martin J. Gander, In *Domain Decomposition Methods in Science and Engineering XXVII. DD 2022. Lecture Notes in Computational Science and Engineering*, vol 149. Springer, Cham. 207–214 (2024)
- 📄 *Mixing strategies combined with shape design to enhance productivity of a raceway pond*, with Olivier Bernard and Julien Salomon, In *16th IFAC SYMPOSIUM on Advanced Control of Chemical Processes*, 54(3):281–286 (2021)
- 📄 *Optimizing microalgal productivity in raceway ponds through a controlled mixing device*, with Olivier Bernard and Julien Salomon, In *2021 American Control Conference*, 640–645 (2021)
- 📄 *Controlling the bottom topography of a microalgal pond to optimize productivity*, with Olivier Bernard, Jacques Sainte-Marie and Julien Salomon, In *2021 American Control Conference*, 634–639 (2021)

## Grant & Scholarship

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Parrainage of INRIA PARIS grant of 1000 euros with Bastien Chaudet-Dumas and Lucas Perrin, 04/2023–06/2023.

Project BOUM grant of 1000 euros from the SMAI (French Society of Industrial and Applied Mathematics) with Bastien Chaudet-Dumas and Lucas Perrin, 11/2022–06/2023.

PhD scholarship at École doctorale de Sciences Mathématiques de Paris Centre (ED386), 10/2018–09/2021. (I also competed for and was awarded a PhD scholarship at Université Côte d’Azur/EDSTIC, but I declined this offer.)

## Organization

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Mini-symposium at *29th International Domain Decomposition Conference (DD XXIX)* under the title **Iterative and direct solvers for optimization and inverse problems**, with Marcella Bonazzoli and Tommaso Vanzan, Milan, 2025

Mini-symposium at *28th International Domain Decomposition Conference (DD XXVIII)* under the title **Transmission conditions in domain decomposition methods and optimal control problems**, Thuwal, 2024

Research school on **Iterative Methods for Partial Differential Equations 2023 (IMPDE2023)** with Bastien Chaudet-Dumas and Lucas Perrin, Paris, 2023.  
Website: <https://impde2023.sciencesconf.org>

Mini-symposium at *27th International Domain Decomposition Conference (DD XXVII)* under the title **Convergence analysis of non overlapping domain decomposition methods**, with Bastien Chaudet-Dumas, Pragues, 2022

Mini-symposium at *45ème Congrès National d’Analyse Numérique (CANUM2022)* under the title **Méthodes parallèles pour les équations aux dérivées partielles**, with Bastien Chaudet-Dumas and Martin J. Gander, Evian-les-Bains, 2022

## Research stay

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**10.02.2025 – 14.02.2025**, laboratory for applied sciences in mechanics and electrical engineering (SIAME) at UPPA, collaboration with Pierre-Henri Cocquet and Yves Le Guer.

**16.07.2021 – 15.08.2021**, team Biocore at INRIA Sophia Antipolis, collaboration with Olivier Bernard and Joel Ignacio Fierro Ulloa.

**02.2020 – 04.2021**, team Biocore at INRIA Sophia Antipolis, collaboration with Olivier Bernard.

## Talk

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**Milano, June 23-27, 2025**, *Some recent results on time domain decomposition methods for PDE-constrained optimization*, 29th International Domain Decomposition Conference (DD29)

**Fort Worth, March 5, 2025**, *Non-overlapping domain decomposition methods for time parallel solution of PDE-constrained optimization problems*, SIAM Conference on Computational Science and Engineering 2025

**Pau, February 13, 2025**, *Time domain decomposition and application to PDE-constrained optimization problems*, Seminar in Laboratory of Mathematics and its Applications of PAU

**Geneva, September 10, 2024**, *Time domain decomposition and application to PDE-constrained optimization problems*, University of Geneva, Swiss Numerical Analysis Day 2024

**Podbanské, March 16, 2024**, *Time domain decomposition methods for parabolic optimal control problems*, Grand Hotel Permon, ALGORITMY 2024

**Thuwal, January 31, 2024**, *Dirichlet-Neumann and Neumann-Neumann Methods for Parabolic Optimal Control Problems II*, 28th International Domain Decomposition Conference (DD28)

**Roscoff, April 13, 2023**, *Modélisation et optimisation de la production d'algues: défis et enjeux*, Station Biologique de Roscoff, Workshop Interdisciplinary

**Marseille, March 14, 2023**, *Méthodes de décomposition de domaines et quelques applications pour les problèmes du contrôle optimal*, Institut de mathématiques de Marseille, Seminar of Applied Analysis

**Amiens, March 6, 2023**, *Méthodes de décomposition de domaines et quelques applications pour les problèmes du contrôle optimal*, Laboratoire Amiénois de Mathématique Fondamentale et Appliquée, Seminar of Applied Analysis of Amiens

**Lugano, August 25, 2022**, *Multigrid method for optimal control problem*, International Multigrid Conference 2022 (IMG2022)

**Pragues, July 25, 2022**, *Dirichlet-Neumann and Neumann-Neumann Methods for Parabolic Control Problems*, 27th International Domain Decomposition Conference (DD27)

**Pragues, July 25, 2022**, *Dirichlet-Neumann and Neumann-Neumann Methods for Elliptic Control Problems*, 27th International Domain Decomposition Conference (DD27)

**Marseille, July 11, 2022**, *Non-overlapping domain decomposition methods for parabolic control problems*, 11th Conference on Parallel-in-Time Integration (PinT2022)

**Evian-les-Bains, June 14, 2022**, *Non-overlapping Domain Decomposition Methods for Elliptic Control Problems*, 45th French National Congress of Numerical Analysis (CANUM2020)

**Paris, April 13, 2022**, *Domain Decomposition Methods and Applications for Optimal Control Problems*, Laboratory Jacques-Louis Lions, Seminar of team ANGE

**Jouy-en-Josas, January 24, 2022**, *Some modelling and optimization problems for microalgal raceway pond*, INRAE Jouy-en-Josas, Seminar of MaIAGE

**Geneva, November 2, 2021**, *Microalgal raceway ponds modelling and optimization problems*, Section of Mathematics, Numerical Analysis Seminar

**Venice, June 13, 2021**, *Mixing Strategies Combined with Shape Design to Enhance Productivity of a Raceway Pond*, 11th IFAC SYMPOSIUM on Advanced Control of Chemical Processes 2021 (AD-CHEM21)

**Sophia Antipolis, June 3, 2021**, *Some optimization problems in an algal raceway pond*, INRIA Sophia Antipolis, Seminar of team BIOCORE

**Online, May 28, 2021**, *Shape design combining with a mixing device in an algal raceway pond*, 8th EGRIN school

**New Orleans, May 25, 2021**, *Optimizing microalgal productivity in raceway ponds through a controlled mixing device*, 2021 American Control Conference (ACC2021)

**New Orleans, May 25, 2021**, *Controlling the bottom topography of a microalgal pond to optimize productivity*, 2021 American Control Conference (ACC2021)

**Toulouse, May 18, 2021**, *Microalgal raceway ponds modelling and optimization problems*, Institut de Mathématiques de Toulouse, Seminar of Modelling, Analysis and Calcul

**Online, December 3, 2020**, *Microalgal raceway ponds modelling and optimization problems*, Congress of Numerical Analysis for young researchers 2020 (CAN-J 2020)

**Online, November 4, 2020**, *Optimization problems of a microalgal raceway to enhance productivity*, Seminar of team ANGE

**Paris, May 28, 2019**, *Réduction de modèle pour l'équation de Burgers*, Laboratory Jacques-Louis Lions, Ph.D. seminar

**Paris, December 12, 2018**, *Model Reduction for hyperbolic Equations*, Laboratory Jacques-Louis Lions, Seminar of team ANGE

## Supervision

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### Ph.D

**Si-Wei Liao**, 12.2023 – , co-supervision with Martin J. Gander (CSC scholarship, joint with Lanzhou University).

**Tingting Wu**, 12.2023–03.2025, co-supervision with Martin J. Gander (CSC scholarship, joint with Nanjing University of Aeronautics and Astronautics). Defended 07/03/2025, now assistant professor in Wuxi Taihu University.

**Joel Ignacio Fierro ulloa**, 10.2021–10.2024, co-supervision with Olivier Bernard. Defended 29/10/2024, now postdoc in INRIA Grenoble team DANCE.

### Master

**Melina Andorra**, 02/2025 - 06/2025, co-supervision with Martin J. Gander for numerical analysis seminar Master reports.

**Guillaume Louis**, 02/2025 - 06/2025, co-supervision with Martin J. Gander for numerical analysis seminar Master reports, now PhD in the University of Geneva with Gilles Vilmart.

**Yano Rasolofo**, 02/2025 - 06/2025, co-supervision with Martin J. Gander for numerical analysis seminar Master reports.

**Joel Ignacio Fierro ulloa**, 06.2021–09.2021, co-supervision with Olivier Bernard.

### Bachelor

**Dylan Machado**, 05.2022–08.2022, co-supervision with Julien Salomon. Now Ph.D in INRIA Saclay team POEMS.

## Teaching

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### University of Geneva (290h)

2024-2025	Mathematics for computer scientists	Bachelor first year	28h
	Numerical Analysis for PDEs	Master	30h
	Numerical Analysis Seminar	Master	26h
2023-2024	Analysis II - Real Analysis	Bachelor second year	28h
	Mathematics for computer scientists	Bachelor first year	30h
	Scientific computation for electro-magnetism	Master	8h
	Animator of Mathscope	School groups	
2022-2023	Analysis II - Real Analysis	Bachelor second year	28h
	Numerical Analysis	Bachelor second year	28h
	Animator of Mathscope	School groups	
2021-2022	Analysis II - Real Analysis	Bachelor second year	56h
	Numerical Analysis	Bachelor second year	28h

### Sorbonne University (196h)

2019-2020	Mathematics for scientific study I	Bachelor first year	108h
	University certificate of return to higher education for exiled persons	Bachelor preparation	10h
2018-2019	Analysis and Algebra for science	Bachelor first year	36h
	Numerical methods for differential equations	Bachelor third year	28h
	University certificate of return to higher education for exiled persons	Bachelor preparation	14h

## Review activity

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IEEE, CDC conference proceedings

Springer, Computational and Applied Mathematics

Elsevier, ADCHEM conference proceedings, Computers & Mathematics with Applications, Automatica

Global Science Press, International Journal of Numerical Analysis and Modeling

## Service

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Since 2023, jury member of Maturité (high-school final test in Switzerland) in the Canton of Geneva for several high-schools: Collège Sismondi, Collège Rousseau, Collège de Candolle, École Moser, Collège Saussure.