



# Jessie Levillain

## Academic career

- From Dec. **Post-doctoral fellow**, *CNES, Campus de la donnée*, Toulouse, France.  
2024 Supervision: Nicolas Gasnier. Project title: "Synergistic use of satellite data for monitoring surface water dynamics".

## Education

- Oct. **PhD in applied mathematics**, *CMAP, École polytechnique*, Palaiseau, France.  
2021–Sept. *Filament models for swimming at the microscopic scale*.  
2024 Supervision: François Alouges and Aline Lefebvre-Lepot.  
Defense: September 27th, 2024.  
Reviewers:  
◦ Astrid Decoene, Université de Bordeaux  
◦ Céline Grandmont, INRIA Paris  
Examiners:  
◦ Josselin Garnier, École polytechnique  
◦ Laëtitia Giraldi, INRIA Sophia Antipolis  
◦ Sébastien Martin, Université Paris-Cité
- 2017–2021 **École Normale Supérieure Paris-Saclay diploma**, *ENS Paris-Saclay*, Gif-sur-Yvette, France (Formerly ENS Cachan), Civil servant and student.  
◦ M2 Analyse Modélisation Simulation at Université Paris-Saclay, *magna cum laude* (numerical methods, mathematical modeling and parallel computing ; optimization, control and optimal transport).  
◦ Pre-doctoral research year abroad.  
◦ M1 Hadamard at Ecole Normale Supérieure Paris-Saclay, Université Paris-Saclay and École polytechnique, *magna cum laude* (dynamical systems, analysis, geometry, optimization and applications to physics).  
◦ Bachelor's Degree in Mathematics at ENS Paris-Saclay in partnership with Université Paris Diderot, *cum laude* (analysis, algebra, probability theory, quantum mechanics).
- 2015–2017 **Lycée Marcelin Berthelot**, *CPGE MPSI-MP\**, Saint-Maur-des-Fossés, France, *summa cum laude*.  
Two intensive years of training in mathematics, physics, and computer science, in order to take competitive examinations and enter the most prestigious engineering or research schools.

## Research Experience

- April – **CMAP, École polytechnique**, *Internship*, Palaiseau, France.  
August 2021 Simple micro-swimmer models. Internship supervised by Prof. François Alouges and Prof. Aline Lefebvre-Lepot.
- 2019 – 2020 **Politecnico di Torino**, *Pre-doctoral year of research abroad*, Turin, Italy.  
Internship in the Energy department of Politecnico di Torino, supervised by Prof. Fabio Freschi, on "H-matrices and ACA method" as a part of the MICEV project.
- April – **UCD School of mathematics and statistics**, *Internship*, Dublin, Ireland.  
August 2019 Internship supervised by Prof. Frédéric Dias, in the School of Mathematics and Statistics on "Extended Green's Law : Calculating Beta using machine learning".
- July 2018 **DTU Energi**, *Internship*, Copenhagen, Denmark.  
Internship supervised by Prof. Kaspar Kirstein Nielsen, Prof. Christian Bahl and Prof. Rasmus Bjørk, entitled "Optimizing magnet structures with neural networks".

- January – **CMLA, ENS Paris-Saclay, Internship**, Cachan , France.  
June 2018 "Deep burst denoising": Image denoising thanks to neural networks (machine learning). Supervised by Prof. Jean-Michel Morel, Pablo Arias and Thibaud Ehret, in tandem with Raymond Zhang.

## Teaching

- 2021 – 2024 **École polytechnique, Teaching fellow**, Palaiseau, France.  
Course list:
  - MAP350: Preparatory mathematics course in French, 1st year of Ingénieur Polytechnicien program
  - Computational mathematics (MAA106, Bachelor of Science, 1st year)
  - Numerical linear algebra and optimization (MAA251, previously MAA208, Bachelor of Science, 2nd year)
- Jan. – June 2021 **Institut Villebon Georges Charpak, Orsay, France.**  
Tutoring in mathematics for bachelor students.
- 2017 – 2018 **INSEP, Mathematics guest teacher**, Paris, France, Classes for high-schoolers.
- 2012 – 2015 **Lycée Notre Dame de la Providence, France.**  
Tutoring in Mathematics, English and all subjects for middle- and high-schoolers.

## Supervision

- 2025 **Research internship (M2), LMO, Université Paris-Saclay**, Orsay, France.  
Co-supervision with Matteo D'Achille on "Random assignment problems for satellite data acquisition".  
Duration: 6 months.
- 2025 **Research internship (M2), CNES**, Toulouse, France.  
Co-supervision with Nicolas Gasnier on "Uncertainty quantification and data hybridation for water storage evaluation". Duration: 6 months.
- 2023 **Bachelor thesis (L3), CMAP, École polytechnique**, Palaiseau, France.  
"On the Perron-Frobenius theorem: discovering Google's PageRank algorithm". Duration: 2 months.
- 2022 **Bachelor thesis (L3), CMAP, École polytechnique**, Palaiseau, France.  
"Introduction to image denoising: on BM3D". Duration: 2 months.

## Publications

\*Authors listed in alphabetical order.

### Articles (2)

- 2024 **Jessie Levillain**, François Alouges, Akash Choudhary, Antonio DeSimone, Sankalp Nambiar, and Ida Bochert\*. Bi-directional low reynolds number swimmers with passive elastic arms. *Accepté pour publication dans ESAIM:ProcS, CJC-MA 2023*, 2024.
- 2023 François Alouges, Aline Lefebvre-Lepot, and **Jessie Levillain**. A limiting model for a low reynolds number swimmer with  $N$  passive elastic arms. *Mathematics in Engineering*, volume 5, pages 1–20, 2023.

### Preprints (2)

- 2025 François Alouges, Aline Lefebvre-Lepot, **Jessie Levillain**, and Clément Moreau. The  $N$ -link model for slender rods in a viscous fluid: well-posedness and convergence to classical elastohydrodynamics equations. *Soumis*, 2025. <https://hal.science/hal-04944051>.
- 2024 François Alouges, Irene Anello, Antonio DeSimone, Aline Lefebvre-Lepot, and **Jessie Levillain**. Some mathematical models for flagellar activation mechanisms. *En cours de révision, soumis*, 2024. <https://hal.science/hal-04689234>.

### In preparation (3)

- 2025 Romain Thoreau, **Jessie Levillain**, and Dawa Derksen\*. Challenging multimodal representation learning by alignment in remote sensing. *In preparation*, 2025.

- 2025 **Jessie Levillain** and Jérôme Monnier. River network models for bathymetry estimates from altimetry measurements. *In preparation*, 2025.
- 2025 Iain Henderson, **Jessie Levillain**, and Jérôme Monnier. Covariance operators to estimate river bathymetries from altimetry measurements. *In preparation*, 2025.

## Communications

### National and international conferences

- May 2024 **CANUM 2024**, *Le bois-plage-en-Ré, Ile de Ré, France*, Mini-symposium organizer and talk on low-Reynolds-number swimming.
- Sept. 2023 **CJC-MA 2023**, *Gif-sur-Yvette, France*, Bi-directional low-Reynolds-number swimmer models.
- Aug. 2023 **ICIAM 2023**, *Tokyo, Japan*, Co-organization and chairing of a mini-symposium on low-Reynolds-number swimming with C. Moreau and talk.
- Sept. 2022 **CJC-MA 2022**, *Calais, France*, A mathematical model of flagellar activation mechanisms.
- June 2022 **CANUM 2020+2**, *Évian-les-bains, France*, Flagellar Locomotion of Micro-organisms. invited by L. Giraldi and P. Lissy (Mini-symposium)

### Seminars and workshops

- March 2025 **Séminaire "Analyse, Phénomènes Stochastiques et Applications"**, *LMBA, Université de Bretagne Occidentale, Brest, France*.
- Oct. 2024 **Workshop "Bio- and bio-inspired locomotion of elongated bodies across scales and fields"**, *LS2N, Ecole Centrale Nantes, Nantes, France*.
- April 2024 **Séminaire de l'équipe CALISTO**, *INRIA Université Côte D'Azur, Sophia Antipolis, France*.
- March 2024 **Séminaire des doctorants du LAMFA**, *LAMFA, Université d'Amiens, France*.
- Aug. 2023 **RIMS Fluid Dynamics Workshop**, *Kyoto, Japan*, Flagellar activation mechanisms: inside an N-axoneme .
- June 2023 **AJS Seminars**, *SISSA, Trieste, Italy*, A limiting model for a low Reynolds number swimmer with  $N$  passive elastic arms.
- Jan. 2023 **Séminaire des doctorants du CMAP et du CMLS**, *École polytechnique, Palaiseau, France*.
- Oct. 2022 **RIMS Fluid Dynamics Group seminar**, *Kyoto University, Japan*.
- Oct. 2022 **Microscale Ocean Biophysics online seminar**.

### Poster presentations

- Sept. 2024 **École polytechnique**, *Palaiseau, France*, Conférence des 50 ans du CMAP.
- July 2023 **CIMNE**, *Barcelona, Spain*, XX Jacques-Louis Lions Spanish-French School on Numerical Simulations in Physics & Engineering.

## Short-term research visits

- Aug. 2023 **RIMS, Kyoto University**, *Kyoto, Japan*, 1 week.  
Invited by Dr. Clément Moreau and Prof. Kenta Ishimoto.
- May – June 2023 **SISSA**, *Trieste, Italy*, 2 months.  
Collaboration with Irene Anello and Prof. Antonio De Simone. Funded by 'Programme Visibilité Scientifique Junior', Fondation Mathématiques Hadamard.
- Oct. 2022 **RIMS, Kyoto University**, *Kyoto, Japan*, 3 weeks.  
Invited by Dr. Clément Moreau and Prof. Kenta Ishimoto.

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## Grants and awards

- 2023 **Vivaldi Program**, *FMJH and LMH*, 1.3k€.  
Funded XX Jacques-Louis Lions Spanish-French School on Numerical Simulations in Physics & Engineering.
- 2023 **Junior scientific visibility**, *FMJH and LMH*, 2.3k€.  
Funded research stay at SISSA, Trieste, Italy.
- 2022 **Energy4Climate**, *Institut Polytechnique de Paris*.  
Funded conference CANUM 2020+2.
- 2021 **EDMH**, *Institut Polytechnique de Paris*.  
PhD funding from doctoral school EDMH.
- 2019 **Civil servant competitive exam**, *ENS Paris-Saclay*.  
Laureate of the competitive exam at the end of the first year of Masters to become a civil servant at ENS Paris-Saclay.
- 2019 **Erasmus+ internship grant**.  
Partially funded internship in Dublin.
- 2018 **Sophie Germain excellence scholarship**, *FMJH*, 10k€ per year, for two years.  
Masters scholarship for outstanding students pursuing a degree in any school member of the Paris-Saclay group.

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## Collective responsibilities and diffusion

- Jan. 2022 – 2024 **PhD student representative at CMAP lab council**, *CMAP, École polytechnique*.
- Jan. 2024 **Journée Maths en Herbe**, *IHES, Bures-sur-Yvette, France*, Open science day, introductory talk on micro-swimming.

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## Personal commitments

- Since Nov. 2024 **Occit'à bloc**, *Toulouse*.  
Bouldering competitor at a national level; involvement in the steering committee.
- Since Sept. 2024 **Marie Rose Escalade**, *Fontainebleau, France*, Organizer and one of the co-founders.  
Climbing collective for diversity and inclusion.
- 2022 – 2024 **Women's Bouldering Festival mentor**, *Fontainebleau, France*.
- 2022 – 2024 **Girls in Bleau coach**, *Fontainebleau, France*.  
Coach at local outdoor climbing club for women.
- 2022 **Online guidebook creation and crag cleanup**, *La Troche, Palaiseau, France*.  
P. Lagouanelle, J. Levillain, and A. Grisel-Davy. La Troche guidebook for bleau.info and Cosiroc.  
PDF: [https://bleau.info/images/topos/la\\_troche\\_apr\\_2022\\_compressed.pdf](https://bleau.info/images/topos/la_troche_apr_2022_compressed.pdf)
- 2017 – 2020 **Involvement in various student associations**, *ENS Paris-Saclay*.  
Co-founder and active member of cooking club Bon Viv[ens] (2018-2020), active member of the student union (2017-2018).
- 2014 – 2018 **United Network EU**, *Committee director*, Rome, Italy and Paris, France.  
IMUNA/United Network EU: Planning and chairing debates in English in Rome (IMUN) and Paris (FMUN) for high school students in English in direct partnership with the UN. Speeches and training classes for students on the subjects they will be debating on, and on rules of procedure during debates.

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## Miscellaneous skills

- Programming Languages Advanced level in MATLAB, Python. Intermediate level in C/C++ and CamL.
- Office Proficient in LaTeX, beamer and office tools.

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## Languages

English Cambridge C2 diploma, lived in America.  
French Native language.  
Italian Advanced, B2-C1.  
German Intermediate, Goethe Institute B2 diploma.  
Korean Beginner.