

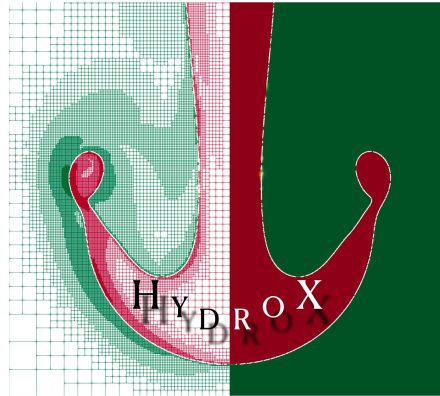
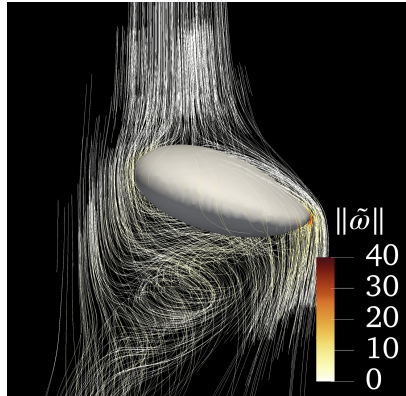
# PhD in Interfacial Fluid Mechanics with a focus on simulation and instability analysis

*Looking for opportunities in computational fluid dynamics, interfacial flow or instability analysis.*

Ilies Haouche

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## EDUCATION

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### PhD Candidate in Fluid Mechanics

November 2023 – October 2026

Under the supervision of Pr. Baudoin, IEMN, institute, University of Lille, France

- Developed and implemented research-level CFD methods for insoluble and soluble surfactant transport in multiphase flow.
- Extended and modified Basilisk-based numerical solvers, demonstrating strong ability to navigate, understand, and develop complex scientific codes.
- Coupled interfacial transport and adsorption–desorption kinetics in multiphase-flow simulations.
- Conducted linear stability analyses of two- and three-phase flows, combining mathematical modeling, analytical derivations, and numerical simulations.

### Master's Degree in Fluid Mechanics

September 2021 - June 2023

University of Lille, Villeneuve d'Ascq, France

Graduated with **high honours**

### Bachelor's Degree in Mechanical Engineering

September 2018 - June 2021

University of Lille, Villeneuve d'Ascq, France

Graduated with **honours**

## SKILLS

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- **Programming languages:** Python, Julia, C, C++, MATLAB, Mathematica, JavaScript, Fortran, Swift.
- **Numerical simulation codes:** Basilisk, OpenFOAM, COMSOL Multiphysics.
- **Numerical methods:** Finite Difference Methods (FDM), Finite Volume Methods (FVM), Finite Element methods (FEM), spectral methods, Volume of Fluid (VoF) method, Phase-Field (PF) method and Level-Set (LS) method.

- **Theoretical skills:** Linear stability analysis, N-interface Navier–Stokes models, Helmholtz decomposition, nonlinear theory, Bessel functions, Laplace and Fourier transforms.

## RESEARCH PUBLICATIONS

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- Jean-Paul Martischang, Benjamin Reichert, **Ilies Haouche**, Germain Rousseaux, Alexis Duchesne, and Michael Baudoin. “Orbiting, colliding, and merging liquid lenses on a soap film: Toward gravitational analogs.” *PNAS Nexus*, Vol. 5, Issue 4, Article 79, April 2026.
- **Ilies Haouche**, Benjamin Reichert, Michael Baudoin, and Palas Kumar Farsoiya. “A hybrid Volume-of-Fluid and Phase-Field method for Direct Numerical Simulations of soluble surfactant-laden interfacial flows.” Submitted to *Journal of Computational Physics*, April 2026.

### Manuscripts in preparation

- **Ilies Haouche**, Nikhil Yewale, and Ratul Dasgupta. “Linear stability analysis of two-interface multiphase interfacial flows.” Manuscript in preparation for *Journal of Fluid Mechanics*.
- **Ilies Haouche**, Benjamin Reichert, Michael Baudoin, and Palas Kumar Farsoiya. “Coupled VoF-phase field Surfactant transport for high Péclet number.” Manuscript in preparation for *Journal of Computational Physics*.

## SCIENTIFIC ACTIVITIES

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### Research Stays

- **Indian Institute of Technology Bombay (IIT Bombay)** September 2024 – November 2024  
**Host: Prof. Ratul Dasgupta**  
 Mumbai, India
  - Developed theoretical models for N-interface systems using linearized Navier–Stokes equations, Helmholtz decomposition, and modal expansions.
  - Performed analytical and numerical studies of three-phase interfacial flows, including water–oil–air configurations.
  - Using the three-phase flow solver in Basilisk.
- **Indian Institute of Technology Roorkee (IIT Roorkee)** November 2024 – December 2024  
**Host: Prof. Palas Kumar Farsoiya**  
 Roorkee, India
  - Developed a numerical solver for soluble surfactant transport in interfacial multiphase flows.
  - Implemented bulk and interfacial surfactant transport and adsorption–desorption kinetics, in Basilisk.
  - Contributed to the development of a coupled VOF/Phase field framework for surfactant-laden flows.

### Conferences, Workshops, and Summer Schools

- **IRN Hydrobio 2026** December 2026  
 Indian Institute of Technology Kharagpur (IIT Kharagpur), Kharagpur, India  
 Oral presentation: “Surfactant transports for high Péclet number”
- **JMC 2026** October 2026  
 University of Toulouse, Toulouse, France  
 Oral presentation: “Dynamics and instability of a rising bubble with soluble surfactants at high Péclet number”
- **BIFD 2026** June 2026  
 University of L’Aquila, L’Aquila, Italy  
 Oral presentation: “Rayleigh–Taylor instability in the presence of surfactants: a theoretical and numerical study using a coupled VOF/diffuse-interface method”

- **Basilisk/Gerris Users' Meeting** July 2025  
University of Oxford, Oxford, United Kingdom  
Oral presentation: "Numerical method to simulate soluble surfactants"
- **IRN Hydrobio 2025** June 2025  
University of Paris-Saclay, Paris, France  
Poster presentation: "Waves at oil–water interfaces: the initial value problem"
- **Global Initiative of Academic Networks (GIAN) Course on Small-Scale Intensified Two-Phase Processing** December 2024  
Indian Institute of Technology Roorkee (IIT Roorkee), Roorkee, India  
Winter school
- **IRN Hydrobio 2024** October 2024  
Indian Institute of Technology Madras (IIT Madras), Chennai, India  
Poster presentation: "Analysis of interface phenomena: soap-film instability and waves at water–oil–air interfaces"
- **MicroNanoFluidics 2023** June 2023  
Villa Clythia, Fréjus, France  
Summer school

## RESEARCH SOFTWARE

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- **Basilisk Sandbox for Interfacial Flows and Surfactant Transport** 2023 – Present  
Development of a numerical solver for soluble surfactant transport in interfacial flows using the Basilisk framework, including bulk and interfacial transport, adsorption–desorption kinetics, and Marangoni effects.  
Code repository: Basilisk sandbox
- **Educational YouTube Channel on Programming for Numerical Methods** 2024 – Present  
Creation of educational videos in French and English on programming languages for numerical methods, scientific computing, and fluid mechanics simulations, with tutorials covering Python, numerical algorithms, and Basilisk.  
Channel: YouTube channel

## TEACHING EXPERIENCE

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- **Master's Internship Supervision** 2026 – Present  
*Institute of Electronics, Microelectronics and Nanotechnology, University of Lille, France*
  - Currently supervising a Master's student internship (M2) on numerical simulations of surfactant-laden interfacial flows.
  - Providing guidance on the theoretical background, numerical implementation, data analysis, and scientific writing.
- **Teaching Assistant during PhD – Third Year** 2025 – 2026  
*University of Lille, France*
  - Completed 60.5 hours of teaching in undergraduate and graduate courses.
  - Courses taught: Integrative Project (L3), Supervised Research Project (M2), and Thermodynamics (L2).
- **Teaching Assistant during PhD – Second Year** 2024 – 2025  
*University of Lille, France*
  - Completed 64 hours of teaching in undergraduate and graduate courses.
  - Courses taught: Integrative Project (L3), Introduction to Fluid Mechanics (L1), and Supervised Research Project (M2).
- **Teaching Assistant during PhD – First Year** 2023 – 2024  
*University of Lille, France*

- Completed 64 hours of teaching in undergraduate and graduate courses.
- Courses taught: Advanced Numerical Methods (M1), Integrative Project (L3), Introduction to Fluid Mechanics (L1), and Fundamentals of Mechanics (L1).

- **Tutor**

2022 – 2023

*University of Lille, France*

- Completed 180 hours of tutoring in undergraduate and graduate courses.
- Courses taught: Elementary Numerical Methods (L3), Introduction to Scientific Computing (L2), Advanced Numerical Methods (M1), and Acoustics (M1).

## INTERNSHIPS

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- **Rayleigh–Taylor Instability** October 2023  
Institute of Electronics, Microelectronics and Nanotechnology (IEMN)  
University of Lille, France
- **Acoustic Streaming Modeling using COMSOL** January 2023  
Institute of Electronics, Microelectronics and Nanotechnology (IEMN)  
University of Lille, France
- **Crystal Sedimentation in a Vortical Flow** September 2022  
Unité de Mécanique de Lille (UML)  
University of Lille, France

## CONTACTS

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- **Pr. Michael Baudoin:** michael.baudoin@univ-lille.fr
- **Pr. Ratul Dasgupta:** dasgupta.ratul@iitb.ac.in
- **Pr. Palas Kumar Farsoiya:** palas.farsoiya@ch.iitr.ac.in