

Master's Thesis Internship – Start date : 04/2026 – Duration : 6 Months

Development of high-fidelity simulation of transonic and transcritical flows using the Lattice Boltzmann method

Project Context: The REVCO₂ Project

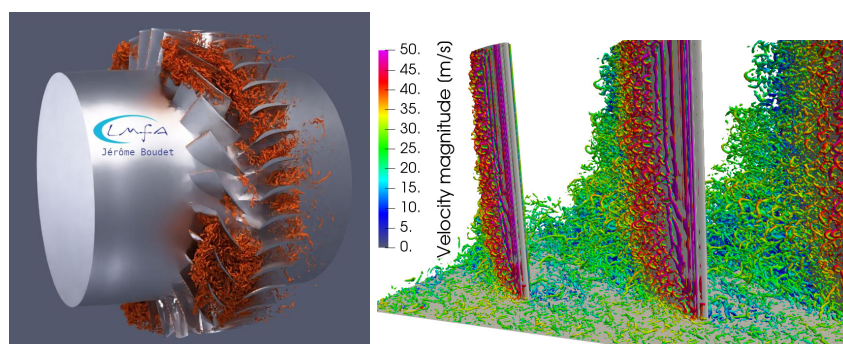
The intermittent nature of renewable energy sources highlights the need for diversification and optimization of energy recovery and conversion systems to ensure a stable and secure energy supply. Among potential energy sources, solar radiation, biomass combustion or gasification, geothermal heat, and industrial waste heat all play critical roles. One promising solution for harnessing these energy sources is the **supercritical CO₂ (sCO₂) Brayton cycle**, which offers high thermodynamic efficiency, compact equipment, and adaptability to a wide range of heat sources, including next-generation nuclear reactors and industrial waste heat. This master's thesis is part of the PEPR REVCO₂ project, a collaborative effort between four research laboratories (CETHIL, Lafset, LMFA and LUSAC).

Internship Objectives

The primary objective of this Master's thesis research project is to evaluate the current limitations of the **CFD solver ProLB** in regard of the global needs in the REVCO₂ project. The student will then concentrate on the implementation of the Equation of State for supercritical CO₂ into the ProLB solver and its subsequent validation.

The ProLB CFD Solver

ProLB is an innovative Computational Fluid Dynamics (CFD) software solution. Based on the Lattice-Boltzmann method, its successfully-validated solver performs inherently transient simulations of highly complex flows with a competitive turnaround time.



Examples of high-fidelity simulations performed with the [ProLB solver](#).

Application Details

- **PhD Opportunity:** This internship may lead to a **PhD continuation** within the REVCO₂ program, focusing on integrating the developments for turbomachinery design and energy optimization.
- **Location:** The intern will be hosted at the **LMFA laboratory** (Laboratoire de Mécanique des Fluides et d'Acoustique) on the **École Centrale de Lyon** campus (Ecully).
- **Supervision:** The project will be jointly supervised by Lucien Vienne (CNRS Engineer, LBM specialist), Alexis Giauque (Associate Professor ECL, Thermodynamics specialist), and Emmanuel Leveque (CNRS Research Director, LBM specialist).
- **Candidate Profile:** We are looking for an Engineering or Master's student with a strong background in **fluid mechanics and numerical flow simulation**. The ideal candidate is passionate about the new opportunities offered by cutting-edge CFD methods. Prior experience in CFD and/or CFD code development (**Python, C++**) would be a significant advantage.
- **Stipend:** Approximately **620€ per month**, in accordance with French regulations for Master's internships.
- **How to Apply:** Applications must include a CV, a cover letter, and transcripts for the current and previous academic years. Please send all documents to : lucien.vienne@ec-lyon.fr