INTERNSHIP FOR ENGINEERING SCHOOL OR MASTER DEGREE

2026

Sensitivity analysis of an unsteady CFD model of a vertical-axis tidal turbine.

Laboratory:

Laboratoire Universitaire des Sciences Appliquées de Cherbourg (LUSAC)

Team: Flows and Environment

Contact:

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CONTEXT:

As the world moves towards a low-carbon energy production model, marine renewable energy is experiencing significant growth. Some of these technologies have already reached a certain maturity, such as offshore wind turbines, while others are still at the prototype stage, such as wave and tidal energy. But whatever the technology, all would benefit from advanced modeling methods to better predict their behavior. Over the years, the Flow and Environment team at LUSAC laboratory has developed expertise in modelling MREs such as tidal turbines. One of the simulation methods used is the Lattice Boltzmann Method (LBM) coupled to Large Eddy Simulation (LES). It has already been applied successfully to modeling tidal sites and tidal turbines [1-3]. Recently, the focus of our study has been on Vertical Axis Tidal Turbine (VATT). The main method used to model a Vertical Axis Tidal Turbine (VATT) is the Actuator Line Model (ALM), which is coupled with our LBM-LES tool. To increase understanding and confidence in this model, a deeper knowledge of the influence of ALM-LBM-LES simulation parameters is required. These parameters include, but are not limited to, spatial discretisation, the interpolation scheme, and the force kernel.

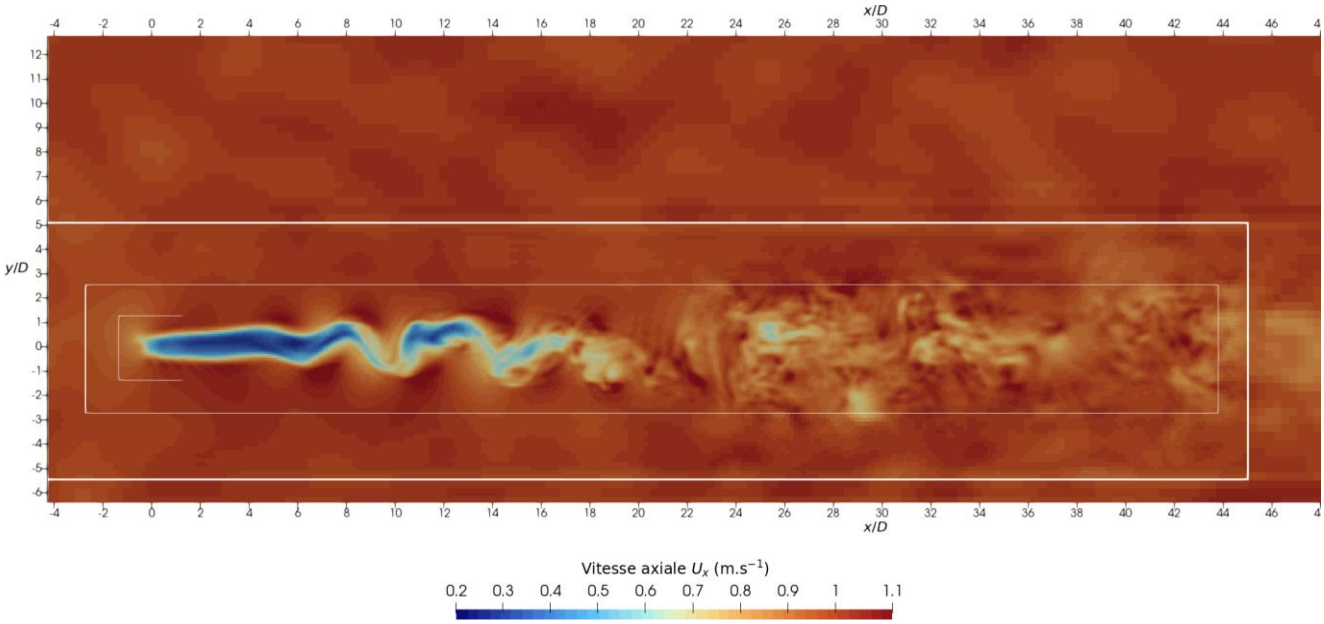

Figure 1 : ALM-LBM-LES simulation of VATT.

CONTENT:
The CFD library used for this internship is Palabos [4]. By running unsteady simulations of a single VATT, you will assess the influence of the various simulation parameters on the turbine wake and its performance. Depending on your progress, you may consider turbulent inflow and/or multiple turbines. Data visualization and post-processing of results will be carried out mainly using Paraview and Python scripts. Simulations will be run in a Linux environment, on our local cluster and/or on the CRIANN cluster.

KEYWORDS:
tidal turbine, turbulence, actuator line, large eddy simulation, lattice Boltzmann method, C++ programming.

PROFILE:
The candidate should follow a Master degree or Engineering School in hydrodynamic, aerodynamics or fluid mechanics. Good writing skills are expected. A taste for numerical simulation and programming is necessary and expected.

DATES AND DURATION:
Starting in February/March 2026 for a duration of 6 months.

SALARY:
4.35 €/hour (≈ 620 €/month, minimum amount based on 2025 and may increase in 2026)

LOCATION:
Cherbourg, Normandie, France.

REFERENCES:

[1] Philippe Mercier and Sylvain Guillou, "The impact of the seabed morphology on turbulence generation in a strong tidal stream", Physics of Fluids 33, 055125 (2021).

[2] Grondeau Mikaël, Sylvain Guillou, Philippe Mercier, and Emmanuel Poizot. 2019. "Wake of a Ducted Vertical Axis Tidal Turbine in Turbulent Flows, LBM Actuator-Line Approach" Energies 12, no. 22: 4273.

[3] Grondeau Mikaël and Sylvain Guillou. 2025. "Predicting interactions between full-scale counter rotating vertical-axis tidal turbines using actuator lines". Journal of Marine Science and Engineering. 13. 1382. 10.3390/jmse13081382

[4] Jonas Latt, Orestis Malaspinas, Dimitrios Kontaxakis, Andrea Parmigiani, Daniel Lagrava, Federico Brogi, Mohamed Ben Belgacem, Yann Thorimbert, Sébastien Leclaire, Sha Li, Francesco Marson, Jonathan Lemus, Christos Kotsalos, Raphaël Conradin, Christophe Coreixas, Rémy Petkantchin, Franck Raynaud, Joël Beny, Bastien Chopard. “Palabos: Parallel Lattice Boltzmann Solver”, Computers & Mathematics with Applications, Volume 81, 2021, Pages 334-350.