MSc. Thesis Proposal

Title: Hydrodynamic Analysis of a Surfboard

Supervisors

Professor at IST
António Maximiano (Eng): Renewables and CFD Researcher at blueOASIS
Guilherme Vaz (Dr., inv. Prof): R&D manager at blueOASIS

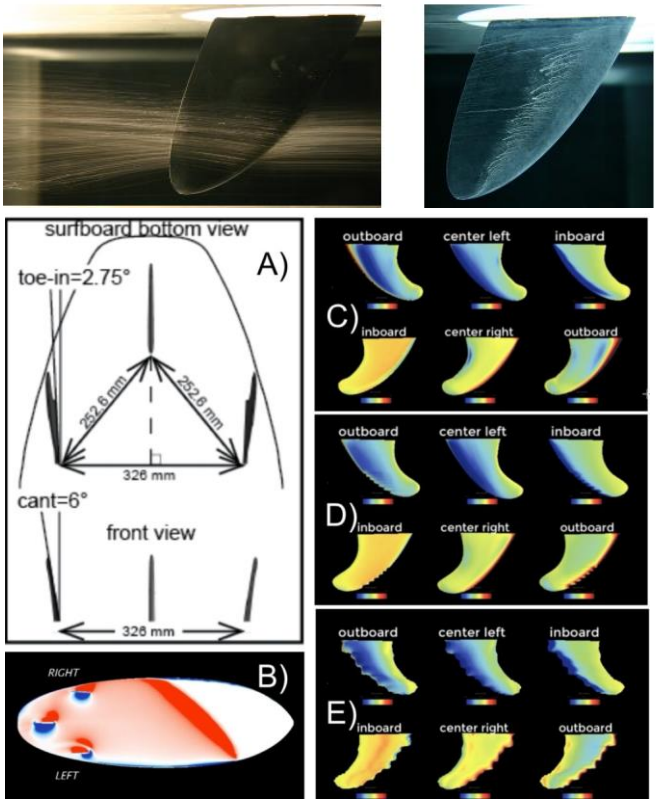
Introduction

Motivation

The market size for surfing equipment is estimated as over USD 1 Billion, with a growing trend forecasted for the foreseeable future. However, the surfboard shaping market remains dominated by surfboard designs, which are evolving based on the feeling and feedback of their users. This is a slow process, often with conflicting information from different users, low repeatability due to the nature of wave surfing, making it extremely hard to obtain significant data to improve designs in a reliable manner. High fidelity simulation tools, such as CFD, can be used to develop a systematic approach to obtain consistent and relevant data for different surfboard designs, complementing the current method of refining surfboard shapes based on expert user feedback.

Existing work

There is limited effort on the simulation of surfboard designs, such as simulation of flow around the fins of a surfboard while the surfboard is held captive (Sakellariou et al., 2017), including wind tunnel tests (Brandner & Walker, 2004); studies of the surfboard itself, or the interaction between surfboard and fins. A recent study measured the trajectory of surfers performing cutbacks on the wave and applied the same motion to a surfboard in calm water to measure pressure distribution on the board and fins, while testing whale inspired fins (Shormann et al., 2020). A description of this study with future works is also available in this blog.



Objectives

Assess different surfboard shapes/fin configurations using CFD for a surfboard performing a rotation in calm water. In order to do so, the following step-by-step approach is currently envisaged:

1. 3D unsteady simulations of different board and fin configurations under static, steady conditions
2. Verification of the numerical setup to obtain numerical uncertainties
3. 3D unsteady simulations of different board and fin configurations under dynamic conditions that represent a cut back maneuver

Requisites

Applicants must have:

- General knowledge on CFD.
- Coding experience with python or similar.

Good to have:

- Linux experience.
- Latex experience.
- Git experience.

Added value to have:

- Knowledge on uncertainty quantification.

Location

The student must be present at the office at least 4 days per week. This is mandatory to pursue a thesis with blueOASIS.
blueOASIS (www.blueoasis.pt) offices at Oeiras or Ericeira
Edificio D.Pedro, Quinta da Fonte, R. Malhões, 2770-071 Lisboa
R. Prudêncio Franco da Trindade 4, 2655-344 Ericeira

The student is invited to join the team in the office when the supervisor is present (at least three days per week).

Companies Involved

blueOASIS is a young team with more than 60 years of combined knowledge and experience on Aerospace, Mechanical, Naval and Maritime engineering. The multicultural and multidisciplinary team is committed to make our oceans safer and greener, using state of the art numerical and data science tools. BlueOASIS focuses on renewable energies, ocean cleaning, decarbonization, sustainable offshore structures and green ships optimization.

References:

Brandner, P., & Walker, G. (2004). Hydrodynamic Performance of a Surfboard Fin. *15th Australasian Fluid Mechanics Conference*.

Sakellariou, K., Rana, Z. A., & Jenkins, K. W. (2017). Optimization of the Surfboard Fin Shape using Computational Fluid Dynamics and Genetic Algorithms. *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology*, *231*, 344–354. https://doi.org/10.1177/1754337117704538

Shormann, D., Oggiano, L., & Panhuis, M. in het. (2020). Numerical CFD Investigation of Shortboard Surfing: Fin Design vs. Cutback Turn Performance. *Proceedings 2020, Vol. 49, Page 132*, *49*(1), 132. https://doi.org/10.3390/PROCEEDINGS2020049132