

Thesis topic: A modular array of small-scale bioinspired flow sensors

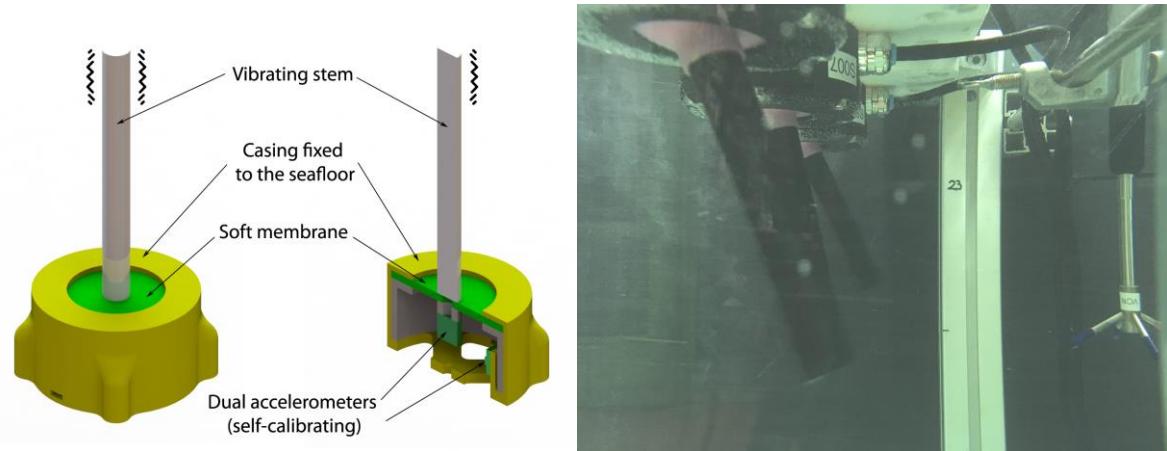


Figure 1 Hydromast first design (left) and hydromasts placed into flow (right)

Description of the work:

Centre for Biorobotics has been working on the development of a bioinspired of flow sensing device, the hydromast. The hydromast is inspired by the biological lateral lines, which are the mechanoreceptive flow sensing organs of fish. Specifically, it is an upscaled version of the neuromast, and consists of a vibrating stem elastically fixed to a pressure sensitive body. We have applied the sensors in field for various applications: ship wake detection, river flow classification and continuous flow measurements (see video links below).

The working principles of the hydromast are now described and we have turned our attention on simplification and scalability of the technology for hydrodynamic imaging in the field as well as improving the range of flows the device can measure. The goal of the proposed thesis is to:

- design, assemble and test a modular small scale hydromast sensing unit using Hall sensors (*level: BSc*);
- Analyze the cost-effectiveness of the design against the available technology (*level: BSc*)
- investigate the mast size on the velocity range of the hydromast (*level: BSc/MSc*);
- assemble an array of Hall sensor based hydromasts (dependent on the application wired or wireless) and apply the array in real life measurement scenario (*level: MSc*)

Links:

- Flow classification: <https://www.youtube.com/watch?v=BqjRzdgDQq8>
- Hydromast laboratory calibration: <https://www.youtube.com/watch?v=9Rnb6Qt474c>
- Hydromast design: https://link.springer.com/chapter/10.1007/978-3-319-42417-0_55
- Flow classification: <https://ieeexplore.ieee.org/abstract/document/8288809>

What do we expect from you?

- We expect you to be diligent and be able to do independent work on the project
- Experience designing mechanics and electronics
- Experience with CAD and basic programming skills

What will you learn?

- Get experience in designing under water sensors and sensor arrays
- Plan and conduct experiments
- Get practical work experience

Why does it matter?

The work helps us to visualize the flow better on various scenarios, starting from small scale habitat studies in rivers (1m to 10m) to large scale coastal phenomena (1 to 20km). The improved design of the hydromast should allow us to have longer deployment time and also improve the scalability of the technology.

Keywords: Laksymi, hydromast, flow sensing

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