Design of a model scale multirotor wind turbine

Background

Figure 1: Different multirotor concepts for offshore wind turbines

The growing demand for large-scale offshore power generation led to a considerable increase in wind turbines' rotor size over the last decades. Although these gigantic turbines produce considerably more energy, also the turbines' production and operation costs increased significantly. It has been shown that the costs for rotor blades, transportation, installation, operation, and maintenance potentially can be reduced by installing multiple smaller rotors on only one floating support structure. An initial study on such multirotor systems (MRS) have estimated a cost reduction up to 15% compared to a single rotor of the same power output [Jamieson and Branney, 2014].

Project description

When it comes to the design of a lightweight, reliable, and efficient floating offshore MRS many different design parameters must be taken into account. For a given rated power output of an MRS, the number and size of the single rotors are the obvious first parameters that can be varied. Furthermore, the design of the support structure and its interaction with the rotors are considered to play a very central role for an MRS power output, loads and wake dynamics. The proposed project includes the design and construction of new MRS concepts and the measurement of forces and wake flows behind these setups. Different setups will be compared, with main objective to achieve high power production, low drag loads and fast wake flow recovery.

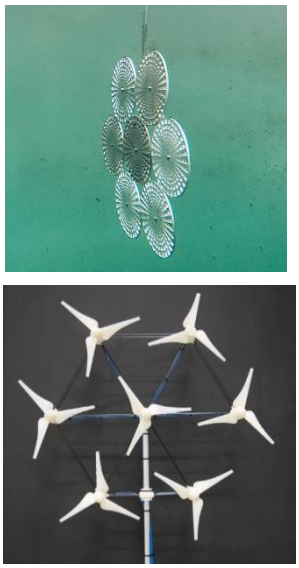

Figure 2:
(a) Multirotor discs setup tested in Marinlab
(b) potential new MRS with 3D printed rotors

Instead of traditional wind tunnel experiments with moving air, the current project will be conducted at HVL's MarinLab in water, while the MRS arrangement is moved relative to it. The results of different rotating and non-rotating setups will be compared and serve as reference data for numerical simulations.

Prerequisites and qualifications

The prospective student should have:

- High motivation and a professional attitude
- MAS304 Experimental methods or MAS312 Ocean renewable energy
- Good practical skills
- Computational skills in a CAD design and Matlab or similar

Contact

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