INTERACT-NovioOcean – Assessment of interaction effects between wave energy converters

Background and motivation
A few full-scale single-unit wave energy converter (WEC) prototypes have been deployed in the ocean. Further commercialisation requires the installation of many WECs in array systems. The upscaling to array systems is a challenge due to the interaction effects between WECs and their subcomponents. New design and assessment methods are needed which together with advanced simulation models can be used to design wave energy parks accounting for interaction effects for optimum system performance e.g. power, fatigue life, levelised cost of electricity (LCoE).

Objectives and goals of the project
This thesis will study Novige’s WEC concept NovioOcean (see the upper right figure from a lab, and the lower right figure from a numerical simulation) by numerical simulations of different array configurations. The hydrodynamic performance and electricity production will be compared for a variety of installation and operation conditions, e.g., bathymetry, wave scatter diagram, and layout of the wave energy park. Finally, since the layout of a wave energy park depends on the installation site’s specific conditions it is of value to have a tool that easily/quickly can help an engineer design a wave energy park. The thesis project should propose a simple methodology that can be used in the preliminary design of wave energy parks.

Methods and tools
The DNV-GL software SESAM (weak nonlinear wave theory) and a CFD (nonlinear wave theory) software will be used to do the numerical simulations. A single WEC unit model developed at the division, both in SESAM and in a CFD software, can be used at the beginning of the project. They can be copied to form the wanted size and shape of the WEC park that will be analysed. The thesis should be written in Word using a template provided by the department.


Number of students: 2 students is recommended.

Prerequisites: (recommended) some experience from CFD.

Tasks
- Literature study.
- Collection of Metocean data for candidates to installation sites to be used in the simulations.
- Definition of wave energy parks suitable for Novige’s WEC and installation requirements.
- Frequency-domain simulations, and fully coupled simulations in the time-domain.
- Parametric studies.
- Development of a simple methodology for the preliminary design of wave energy parks.
- Write a thesis report and present it at a public seminar.

Contacts
Supervisors: Jonas Ringsberg (Jonas.Ringsberg@chalmers.se), Hua-Dong Yao (Huadong.Yao@chalmers.se), Xinyuan Shao (Xinyuan.Shao@chalmers.se)
Examiner: Professor Jonas Ringsberg, Division of Marine Technology