ICONN "Summer" School 2018: Hydro-Aero-Elastic Modelling and Mooring Analysis

Dates: Monday 22nd October – Friday 26th October 2018
Location: Aalborg University, Thomas Manns Vej 23, Room: 1-334
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As part of the EU funded project, ICONN, Floating Power Plant will be collaborating with Aalborg University to give a week-long "summer" school on AeroElastic Modelling and Mooring Analysis. ICONN is a unique European Industrial Doctorate initiative to meet the current and future demand for highly skilled offshore wind and wave energy engineers by developing and advancing European capacity in the design, development and performance optimisation for Offshore Wind and Wave Energy installations. In line with the principles of the ICONN project, the summer school will be given with both an industrial and academic focus as well as complimentary training on presentation skills.

Each student will leave the summer school with all the necessary tools and knowledge to analyse floating wind turbines with a variety of mooring solutions. During the workshop, the students will work together to model the OC4 test case of a 5MW NREL wind turbine on a floating foundation. Whilst the challenges will be faced as a group, each student will run the analysis themselves on their own laptop.

The practical skills gained will be complimented with technical presentations by leading researchers in mooring systems and computational fluid dynamics. These academic lectures will be complimented by an industrial perspective on the floating wind energy industry by the CEO of Floating Power Plant.

Day	Activities
Monday	10:00 – 10:30 Coffee and introduction 10:30 – 12:00 ESRs present their work to each other 12:00 – 13:00 Lunch 13:00 – 14:00 Discussion on how to improve presentations 14:00 – 16:00 Lecture: Introduction to hydro-aeroelastic modelling
Tuesday	08:00 – 10:00 Set-up Worked example 10:00 - 10:30 Coffee 10:30 -12:00 Lecture: Mooring systems for large floating structures – Design choices 12:00 – 13:00 Lunch 13:00 – 16:00 Worked example
Wednesday	08:00 – 10:00 Worked example 10:00 - 10:30 Coffee 10:30 -12:00 Lecture: Computational modelling of mooring systems 12:00 – 13:00 Lunch 13:00 – 16:00 Worked example
Thursday	08:00 – 9:00 Worked example 09:00 - 10:00 Lecture: Computational Fluid Dynamics - Is it the answer to all hydrodynamic modelling problems? 10:00 - 10:30 Coffee 10:30 -12:00 Lecture: CFD (continued) 12:00 – 13:00 Lunch 13:00 – 16:00 Finalise worked example
Friday	08:00 – 10:00 Lecture: LCOE and Finance for renewable energy devices 10:00 - 10:30 Coffee 10:30 -12:00 Re-present work to each other 12:00 – 13:00 Lunch

Title	Lecturer	Description
Introduction to hydro-aeroelastic modelling	Dr. Morten Thøtt Andersen • Post doc at AAU • Specialist in Moorings and Modelling of floating wind turbines	Aeroelastic models are a necessity to analyse the performance and load characteristics of wind turbines. With the wind energy pushing into deeper and deeper waters, floating wind turbines have become a reality. This adds an extra layer of complexity to the modelling as the structures interaction with the waves and a mooring system must also be coupled to the aerodynamic forces. Several existing aeroelastic codes have been coupled to existing hydrodynamic codes over recent years to attempt to solve this complex problem. This lecture will discuss an international comparative study that has been performed on the different codes, and introduce in more detail the FAST-Moordyn coupling to be used in the worked example.
Mooring systems for large floating structures – Design choices	Dr. Guilherme Moura Paredes • Post doc at AAU • Previous Marie Curie PhD fellow	The interaction of a floating structure is influenced by the type of mooring that is used, and the exact characteristics of the mooring system selected. The process of selecting appropriate mooring for a specific site and device can be complicated. This lecture addresses the different types of moorings available and the scenarios under which certain mooring components might be applicable.
Computational modelling of mooring systems	Dr. Guilherme Moura Paredes • Post doc at AAU • Previous Marie Curie PhD fellow	In order to perform numerical analysis of a floating structure, such as a wave energy device or floating wind turbine, in the time-domain, the mooring system must be modelled. This lecture will address the different modelling solutions to choose from and what the numerical modeller should consider when choosing each type.
Computational Fluid Dynamics - Is it the answer to all hydrodynamic modelling problems?	Dr. Claes Eskilsson • Associate Professor at AAU • Expert in CFD of wave energy devices	Accurate simulations of wave-induced loads on structures and moving bodies, are key in ocean engineering application. Standard engineering tools for wave-body interaction based on linear radiation-diffraction theory have been applied broadly to floating offshore wind and wave energy converters with often satisfactory results. However, there are important instances when these methods fail to give reliable results (e.g. WECs operating in resonance, steep storm waves, overtopping of devices) and nonlinear methods should be used instead. Over the last 5 years computational fluid dynamics models

		(CFD) have become an additional engineering tool in the marine renewable sector. In this talk we will, in addition to give a brief overview of the CFD technology in general, discuss specific topics for using CFD applications to marine renewables such as wave propagation, coupled mooring, PTO control, etc.
LCOE and project Finance for renewable energy devices	Anders Køhler • CEO of Floating Power Plant • Degrees in Energy Engineering and Business	The renewable energy industry is developing fast, with some technologies now becoming bankable. The future must include a mix of different technologies however, and some technologies are still in their early stages of development. The Levelised Cost of Energy (LCOE) is commonly being used as a comparative measure between the technologies. Whilst a large academic focus is often placed on improving technical or theoretical efficiencies of renewable energy devices, this is not always the key to bringing down the LCOE and making them bankable for project finance.