Hydrodynamic Modeling in Ocean Engineering focus on Wave Energy Converters

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Offshore Renewable Technologies research group of the Department of Mechanical and Aerospace Engineering (DIMEAS – Politecnico di Torino) is pleased to announce a seminar on Hydrodynamic Modeling in Ocean Engineering: focus on Wave Energy Converters. The seminar deals with the following modules:

- Introduction on Wave Power and lumped parameters hydrodynamic models
- Advanced CFD modeling techniques applied to ocean technologies and marine structures

Waves constitute a considerable amount of the energy in the oceans and seas, which has been estimated to be in the order of 10 TW, a quantity comparable with the actual world power demand. Since 2006, the Offshore Renewable Technologies research group of DIMEAS is working on the design and development of Wave Energy Converters (WECs) for oceans and seas renewable energy harvesting.
Numerical modeling of WECs behavior is one of the most important challenges for a proper estimation of performances and productivity.

The interactions between waves and WEC floating body represents the first stage of the energy conversion from waves to electricity and a proper modeling of the physical phenomena involved is crucial. In the first part of the seminar, a brief overview of Wave Power Technology will be presented, together with a focus on the lumped parameters hydrodynamic models, based on potential flow methods. This approach represent the fundamental modeling technique for the interaction between rigid bodies and surface waves.

The second part of the seminar will go beyond the lumped parameters models, starting with a review of the state of the art of high fidelity numerical models used in ocean engineering and focusing on a family of problems that need a accurate solution of the non-linear free surface and body boundary effects, flow separation, turbulence and vortex shedding phenomena. Wave energy converters working in resonance conditions belong to this family. But hydrodynamic solvers are not the only ingredient in the hydrodynamic design of efficient and reliable ocean technologies. Other enabling factors are automatic computer-driven optimization procedures, based on full parametric description of the geometry and risk-adverse probabilistic design approach.
This design philosophy is being experimented at MIT Sea Grant and VT-iShip lab, by means of a new mathematical framework that combines deep learning and Bayesian inference techniques to efficiently fuse information coming from different sources, such as multi-fidelity numerical models. Some examples of this new design paradigms and their implication in ocean engineering will be finally proposed.

Dates and Venue: Monday, 19th December 2016, from 4.00 to 6.00 pm, Sala Ferrari, DIMEAS (2nd floor)

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