ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

Seminar

Middle East Technical University, Ankara, Turkey
Civil Engineering Department, K1 Building, room: 106

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A SYSTEM FOR THE HYDRODYNAMIC DESIGN OF FLOATING WIND TURBINE PLATFORMS

Speaker: Dr Emre Uzunoğlu

About Speaker: Dr Uzunoğlu obtained his PhD from the University of Lisbon under the supervision of Professor Dr Carlos Guedes Soares. He works at the Centre for Marine Technology and Engineering (CENTEC), Lisbon, on offshore platforms, renewable energies, and ship dynamics since 2009. His focus is the development of a conceptual and hydrodynamic design system for floating wind energy platforms. The systemization process aims to provide an integrated solution to 3D modelling, hydrodynamics, hydrostatics, and mooring analysis. This type of approach reduces the concept development stage to days instead of months while also increasing the precision. The method was used to develop a self-float capable TLP platform for the European Union's ARCWIND project. Dr Uzunoğlu has taken part in several European and Portuguese funded projects, and various experimental testing campaigns.

Abstract: The presentation describes a system that allows concept evaluation and hydrodynamic design of offshore platforms efficiently and with higher precision. It is demonstrated through an example of a tension leg platform for wind energy. After a brief introduction of wind energy and design methods, the systemization of the process is described. It goes through the mass matrix estimations, hydrostatics, mooring system design, and dynamic analysis. The focus is the "blank-sheet scenario" generally encountered within novel fields, where all variables are unknown and statistical data is unavailable.
Under this scenario, the proposal is to use a multi-purpose 3D model without requiring user intervention or moving data between software. Instead, the same quadrilateral mesh is used for all calculations after modifying a format used by panel method codes. The need to use simplified tables and spreadsheets is eliminated. The frequency-domain wave responses are obtained with a potential flow solver and assessed to approximate the platform's performance with the wind turbine. The assessment includes the detection of slack mooring occurrences. The setup allows completing the initial design with a minimal amount of input data. A time-domain model for simulations is also built within the system. The platform is assumed to operate in Galicia, Spain, to discuss sets of environmental conditions considering the mooring line responses. Two primary variables are used to illustrate a sizing algorithm on 231 hull variations. A measure of performance is given to clarify the required time for the design space assessment with this method. The work will help to understand the difference between the analysis and design problems along with the particular issues encountered in novel fields.

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