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NUMERICAL METHODS AND MODEL EXPERIMENTAL INVESTIGATIONS ON FLOATING WIND TURBINES

ZHIQIANG HU*, ZHENGSHUN CHENG†

* School of Engineering
Newcastle University
Newcastle upon Tyne, NE1 7RU, UK
Zhiqiang.hu@newcastle.ac.uk
https://www.ncl.ac.uk/engineering/staff/profile/zhiqianghu.html#background

† School of Naval Architecture, Ocean and Civil Engineering
Shanghai Jiao Tong University
800 Dongchuan Road, Shanghai, 200240 China
Zhengshun.cheng@sjtu.edu.cn

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ABSTRACT

Most offshore floating wind turbines have to bear complicated sea environmental loads during their service lives. The dynamic responses induced by sea environmental loads determine their operating efficiencies, structural safety, system reliability and cost-effects as well. In order to master the dynamic response characters of floating wind turbines, numerical methods are employed for integrated dynamic analysis, and basin experiments are often used for validations. Nevertheless, there are many challenging tasks in both numerical methods and model experiments for floating wind turbines, such as the simulations of rigid-flexible multibody system and the nonlinear coupling effect in numerical method, and the ratio scale effect between hydro- and aero- loads in model experiment conductions. These challenges have been attracting many scholars' attention and quite a few solutions have been proposed during the recent decade.

This session has 6 invited presentations, and it is aimed to introduce the latest research outcomes in the numerical methods and model experiments investigations for the dynamic analysis of floating wind turbines. These presentations will include the numerical methods and tools developed for dynamic analysis of floating wind turbines, for both horizontal axis turbine and vertical axis turbine; basin model experimental investigations for the validation of numerical methods and tools; and the applications of artificial intelligence technology and tools used on simulations for floating wind turbines.

It is expected that through the presentations and related activities in this session, all the scholars will have fruitful discussions on the latest researches of the numerical methods and tools applied in the field of dynamic analysis for floating wind turbines. It is also expected that this session will play an active role as a platform for the forthcoming collaborations in offshore renewable energy industry.

Titles of 6 invited presentations and presenters' information

1) Prof Zhiqiang Hu, Newcastle University, UK

   Title: 'Software-in-the-Loop combined Reinforcement Learning Method for Dynamic Response Analysis of Floating Wind Turbines'

2) Dr Zhengshun Cheng, Shanghai Jiao Tong University, China

   Title: 'Integrated dynamic analysis of floating vertical axis wind turbines'

3) Dr Xinliang Tian, Shanghai Jiao Tong University, China.

   Title: 'Advances in physical model testing of floating offshore wind turbines at Shanghai Jiao Tong University'

4) Dr Ling Wan, Newcastle University in Singapore

   Title: 'Numerical and experimental investigation of the integrated system of floating wind and wave energy converters'

5) Prof Xing Zheng, Harbin Engineering University, China

   Title: 'Numerical modelling and experimental studies on floating offshore wind systems'

6) Dr Yan Li, Tianjin University, China

   Title: 'Study on the Dynamic Behaviours of an Articulated Offshore Wind Turbine under the Freak Wave Scenario'

REFERENCES

Chen J, Hu Z, Liu G, Wan D. Coupled aero-hydro-servo-elastic methods for floating wind turbines. Renewable Energy 2019, (130), 139-153.

Zhang, P., Yang, S., Li, Y., Gu, J., Hu, Z., Zhang, R., & Tang, Y. Dynamic Response of Articulated Offshore Wind Turbines under Different Water Depths. Energies, 2020, 13(11), 2784.

Ling Wan, Zhen Gao, Torgeir Moan, Claudio Lugni. Experimental and numerical comparisons of hydrodynamic responses for a combined wind and wave energy converter concept under operational conditions. Renewable Energy 93 (2016), 87-100.

Cheng Z, Madsen HA, Gao Z, Moan T. A fully coupled method for numerical modelling and dynamic analysis of floating vertical axis wind turbines. Renewable Energy. 2017(107), 604-619.

Binrong Wen, Xinliang Tian, Zhihao Jiang, Zhanwei Li, Yongsheng Zhao, Tao Peng, Zhike Peng. Developments of Experimental Facilities and Techniques for Floating Wind Turbine Model Tests. 2020-DCW-0135

Ziying Yu, Zhenhong Hu, Xing Zheng, Qingwei Ma and Hongbin Hao. Aeroelastic Performance Analysis of Wind Turbine in the Wake with a New Elastic Actuator Line Model. Water 2020, 12, 1233; doi:10.3390/w12051233.