Training program of OpenFAST for the design of offshore wind turbines
29-30 April 2024

ONLINE

ABOUT THE COURSE

The design of wind turbines requires engineers to run thousands of fully coupled aero-hydro-servo-elastic simulations, including power production, start-up, shutdown and other fault-type design load cases. OpenFAST is a well-validated and widely-used open source tool for coupled simulations of wind turbines. However, it is difficult to use OpenFAST for the new users due to the absence of the graphical user interface.
This course aims to deliver a training program for the design of offshore wind turbine including floating type and fixed-bottom foundation. The 8 lectures will be delivered by Dr Yang Yang who is a very professional user of OpenFAST, which is developed by NREL, USA. This course will introduce how to download, compile, and run the OpenFAST program. The monopile type and semi-submersiblefloating NREL 5MW wind turbines are used for the case study. The training contents of the 8 lectures are given as follows:

WHO SHOULD ATTEND

Engineers & scientists involved in the design and analysis of offshore floating wind turbine structures including foundations. Personnel from oil companies, class societies and offshore structures builders will benefit from attending this course. The course is innovative in both content & structure with careful balance of theory & practice.

COST

The registration fee of the workshop will be £695+VAT (UK VAT ONLY) which includes course notes.

COURSE MATERIAL

The lecture notes will be sent in advance.

PAYMENT

Payments can be made by cheque (made payable to ASRANet Ltd.), cash or bank transfer. Please enquire for details.

CONTACT
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PROGRAMME

(All timings in BST (GMT +1))

Monday 29 April 2024

9.00-10.30 Lecture 1: Basic introduction to OpenFAST

- Brief description of numerical simulation tools and the basic functionality of OpenFAST.
- How to download executable program, source code, examples
- Introduction to the archives
- How to run OpenFAST

10.30-10.45 Break

10.45- 12.15 Lecture 2: Modeling of an offshore wind turbine Part 1: Rotor-Nacelle assembly and tower

- Breakdown of the wind turbine system
- Introduction to the coordinate system and output channel
- Aerodynamic modeling of the blade and tower
- Structural modeling of the blade and tower
- Modeling of rigid bodies

12.15-12.45 Lunch

12.45- 14.15 Lecture 3: Modeling of an offshore wind turbine Part 2: Substructure/ support system

- Modeling of the monopile (including SSI effect)
- Modeling of the Semi-submersible floating platform
- Modeling of mooring system

14.15-14.30- Break

14.30-16.00 Lecture 4: Modeling of an offshore wind turbine Part 3: Environmental conditions

- Modeling of wind
- Modeling of wave and current
- Modeling of hydrodynamics of Morison elements (Monopile wind turbine)

Tuesday 30 April 2024

09.00-10.30 Lecture 5: Modeling of an offshore wind turbine Part 4: Hydrodynamics of the floating wind turbine

- HydroDyn requirement for potential theory solutions
- WAMIT outcome format
- Viscosity correction (added damping or Morison equation)

10.30-10.45 Break

10.45- 12.15 Lecture 6: Case study Part 1: Dynamics of the monopile wind turbine (DLC1.1)

- Definition of the torque-pitch controller
- Steady-state performance
- Turbulent wind modeling
- Normal power production

12.15-12.45 Lunch

12.45-14.15 Lecture 7: Case study Part 2: Dynamics of the monopile wind turbine (DLC2.1, 3.1, 4.1, 5.1, 6.1, 7.1)

- Normal power production with a pitch failure DLC2.1
- Start-up scenario DLC3.1
- Normal shutdown scenario DLC4.1
- Emergency shutdown scenario DLC5.1
- Parked and idling condition DLC6.1
- Parked plus fault conditions (yaw misalignment, brake system failure)

14.15-14.30 Break

14.30-16.00 Lecture 8: Case study Part 3: Dynamics of the floating platform

- Free-decay simulations
- Mooring system effect
- Second-order hydrodynamics

LECTURER CV

Dr Yang Yang

Dr Yang Yang was a postdoctoral research associate in Liverpool John Moores University during October 2018 to December 2020. He is now an associate professor based in Ningbo University since May 2021. He has published more than 60 papers and 11 papers in refereed SCI journals as the first author. Dr Yang has been granted for more than 10 projects from the Nature Science Foundation of China, Nature Science Foundation of Zhejiang Province, and other industrial corporations. He is devoted to the development of a fully coupled modeling methodology, structural control measure, and structural healthy monitoring algorithm for offshore energy systems. Dr Yang is a very professional user of OpenFAST and has developed a seismic coupled analysis and structural control architecture for fixed bottom offshore wind turbines based on FAST. In addition, he has developed a fully coupled framework (F2A) for floating offshore wind turbines based on AQWA and OpenFAST, and F2A is released to the public for free to use. In terms of the coupled modeling of an integrated floating wind-wave-current energy system, he has developed a numerical tool by implementing PTO modeling capability within F2A.