Resilient Integrated-Coupled FOW platform design methodology (ResIn)

ResIn – 1st UK-China workshop

10th – 14th November 2017, Dalian University of Technology, Dalian, China

Dalian University of Technology International Convention Center, China,
Liaoning Sheng, Dalian Shi, Ganjingzi Qu, 凌工路 2 号

10th of November: Arrival

11th of November

9:00 – 11:30 Opening of the kick-off meeting

9:00	Welcome
9:05	Welcome speech on behalf of State Key Laboratory of Coastal and Offshore Engineering (SKLCOE) (Prof Bin Teng)
9:25	Welcome speech from PI of UK (Prof. Johanning)
9:45	Welcome speech from PI of China (Bing Chen)
10:05	Group photo
10:30	Visit of research facilities and equipment at *SKLCOE*

12:00 – 13:30 Lunch

13:30~16:30 Industry outreach

13:30	ResIn introduction – industry engagement (Prof. Johanning)
13:45	Academic project overview speech (15min speech & 5min discussion)
13:45	Delegate from UoEx
14:05	Delegate from DUT
14:25	Delegate from UoE
14:45	Delegate from ZJU
15:05	Delegate from UoB
15:30	Industry key speeches (15min speech & 5min discussion)
15:30	Delegate from MingYang
15:50	Delegate from NOTC
16:10	Delegate from SIDRI
16:30	Free discussion

18:00 - 20:00 Welcome reception

12th of November

9:00 - 11:30 Academic seminar I: Research background and ResIn inclusion

9:00	Introductions to the research speeches (Bing Chen)
9:10	Risk-based design for floating offshore wind energy – An overview of standards and challenges; Philipp Thies (UoEx)
9:30	Hydrodynamic investigation of an OWC wave energy converter (Dezhi Ning, DUT)
9:50	Towards modelling violent wave interaction with fixed and floating structures more accurately and efficiently; Jun Zang (UoB)
10:10	Novel control methods for load reduction of offshore wind turbines (Yulin Si, ZJU)
10:30	Coupled wind and wave analysis of two typical combined floating wind turbine and wave energy converter systems (Nianxin Ren, DUT)

Break

11:00	CFD Simulation of Free Surface Flows in OpenFOAM; Gavin Tabor (UoEx)
11:20	Development Status of Floating Offshore Wind Turbine (Wei Shi, DUT)
11:40	The road to the sea, model testing of marine renewable devices in the FloWave Ocean Energy Research Facility; David Ingram (UoE)

12:00 – 13:30 Lunch Break

13:30 - 16:30 Academic seminar II: Research background and ResIn inclusion

13:30	Introductions to the research speeches (Lars Johanning)
13:40	Numerical Simulation of Floating Body based on Viscosity Flow Model (Bing Chen, DUT)
14:00	Environmental Modelling of Waves and Tidal Currents for Marine Energy Applications; Venki Venugopal (UoE)
14:20	Interfacial Transition Zone of Ba bearing Sulphoaluminate Cement Concrete (Jun Chang, DUT)
14:40	Several problems in the design of mooring system: mooring damping, OPB load, snap tension (Dongsheng Qiao, DUT)

Break

15:20	The Study on Model Experiment in Ocean Engineering Based on Image Measurement Technology (Hai Du, DUT)
15:40	Reducing Peak & Fatigue Mooring Loads: A Validation Study for Elastomeric Moorings; Lars Johanning (UoEx)
16:00	Wave Interactions on Multiple Floating Bodies (Ying Gou, DUT)
16:20	Investigation of the Wave Energy Converter (WEC) Type Floating Breakwater (Mr. Xuanlie Zhao, on behalf of Prof. Kang, DUT)
16:40	Free discussion

18:00 – 20:00 Project Dinner

13th of November

9:00 - 11:30, 13:30 - 16:30 Internal ResIn project meeting; discussing

- Detailed project schedule (including tank test; CFD; porous & mooring designs);
- Joint disseminations (including web page, reports, workshops, etc.);
- Further collaborations (including student exchange, follow up projects, etc.)
- Project Engagement / Network plan

16:30 Closing of the meeting

14th of November: Departure

UK Participants

Professor Lars Johanning

Reducing Peak & Fatigue Mooring Loads: A Validation Study for Elastomeric Moorings

Abstract

This presentation will outline studies towards elastomeric, nonlinear mooring elements addressing the design challenge by partially de-coupling the stiffness profile from the MBL and offering an initial soft response with increasing stiffness for higher strains. These nonlinear elastomeric moorings have the potential to reduce the peak and fatigue mooring loads, as shown by numerical studies. The study uses real field data recorded in order to predict the load reductions that are achievable with elastomeric moorings. The presentation is related to innovative designs in WP 2 of ResIn project.

Biography: Prof. Lars Johanning, Chair of Ocean Technology at the University of Exeter, received PhD from Imperial College of Science, Technology and Medicine at 2003. He has worked in University of Exeter College of Engineering, Mathematics and Physical Sciences since 2007. Now, he is the head of Offshore Renewable Energy.

He is a leading researcher with international recognition in the field of ocean energy and technology with a focus towards hydrodynamics and mooring systems. During his career Prof Johanning has led multiple challenging research projects to a successful outcome and has developed the ORE group at Exeter to its current strength. His research outputs include over 130 peer reviewed book chapters, journal and conference papers dedicated to Offshore Renewable Energy and related topics including multi-disciplinary publications on resource characterisation and environmental studies. Professor Johanning is currently a Visiting Scholar at Dalian University of Technology, a selected Senator at the University of Exeter, Supergen (UKCMER) wave energy lead, and is the programme Director on the Marine-i Hub project, a £6.8m European Regional Development Fund (ERDF) project as part of the Marine Hub Cornwall Enterprise Zone to stimulate and support business-led and market-driven R&D and innovation.

Dr Philipp Thies

Risk-based design for floating offshore wind energy – An overview of standards and challenges

Abstract

This presentation will give an overview to the most pertinent standards for the design of floating offshore wind turbines. It will review the common design principles and identify the main challenges. There will be an emphasis on the probabilistic design, target safety levels for the structural design. The limits states and their effect for the floating platform designed will also be described. The presentation is related to the WP4 and the risk based design and optimisation methodology to assess and evaluate the design innovations as part of the ResIn project.

Biography: Dr Philipp R. Thies is a Senior Lecturer in Renewable Energy in the College of Engineering, Mathematics and Physical Sciences (CEMPS) at the University of Exeter. He holds a Dipl.-Wi.-Ing. degree in Energy- and Environmental Energy from the University of Flensburg (Germany) and a PhD in Renewable Energy from the University of Exeter (UK).

His research interest lies in the reliability engineering of renewable energy technologies with a focus on offshore energy. He has developed novel component reliability testing approaches, Bayesian statistical analysis approaches for situations of data uncertainty and has been deeply involved in several national and international research and industry-led projects seeking to technology demonstration in the field and at large-scale in the lab. His work has aligned computational modelling with application driven design improvements and extensive planning, execution and evaluation of component reliability and testing campaigns.

He was the Principal Investigator in the UK-China Newton Fund Marine Energy Challenge project "Energy absorbing mooring systems: Risk-based investigation for high intensity typhoon conditions in China" (EP/M019942/1). The project investigated novel mooring solutions for extreme load conditions in China. He also the academic PI on an industry-led project funded by Innovate UK, titled "Dynamic Load Reduction and Station Keeping Mooring System for Floating Offshore Wind" (Grant Ref : 101970) and is acting as the Program Lead for the BEng/MEng Energy Engineering.

Professor Gavin Tabor

CFD Simulation of Free Surface Flows in OpenFOAM

Abstract

Free surface flow, where water and air are separated by a macroscopic and resolved interface, is of significant importance in a range of engineering applications, including obvious applications in the ResIn project. A wide variety of interface tracking and interface capturing methods have been developed in CFD, including the Volume of Fluid method which is implemented and developed in OpenFOAM. I will present some developments in the methodology together with applications in urban drainage, tidal turbines and bridge scour, and discuss implications for the modelling in WP3 of the project.

Biography: Prof. Gavin Tabor is Associate Professor in CFD in the University of Exeter and is based at the Exeter (Streatham) campus. After a PhD in Computational Astrophysics he changed areas to undertake postdoctoral research in CFD at Imperial College, where he was involved in the early development of the OpenFOAM open source CFD code. In 2000 he was appointed to a lectureship at Exeter, developing a world-leading research group in CFD and teaching CFD and fluid dynamics at the UG level.

His research covers a wide range of topics within CFD, including turbulence, combustion, multiphase flow, and applications of CFD in a variety of areas such as biomechanics and renewable energy. Current research projects include work on Machine Learning and CFD for optimisation, solid fuel combustion, simulation of vortex separators used in Urban Drainage applications, simulation of design and manufacture of compact heat exchangers, and of course the ResIn project on floating wind turbines. He is a prominent member of the international OpenFOAM community involved in organising both the UK Users Group and the international Workshop; is a member of the IOP Computational Physics Group committee, and involved in the CCP-WSI collaboration Wave-Structure Interaction.

Professor David Ingram

The road to the sea, model testing of marine renewable devices in the FloWave Ocean Energy Research Facility

Abstract

FloWave is the most advanced ocean energy research basin in the world. The 25m diameter, 2m deep, circular basin uses 168 force feedback wave makers and 28 fully controllable bi-directional impellers to create multi-directional seas with tidal currents in any relative direction. FloWave was commissioned in 2014 and over the last three and a half years has tested a number of wave, tidal and floating wind platforms. The basin has been used to recreate, at scale, sea conditions from the European Marine Energy Centre's wave site. This presentation will discuss why FloWave was built and how it helps de-risk marine energy projects prior to deployment in the sea. David will also highlight some of the key research outputs from the UK Centre for Marine Renewable Energy.

Biography: Prof. David Ingram was awarded a personal chair in Computational Fluid Dynamics by the Court of the University of Edinburgh in June 2009, following his appointment as a Reader in the Institute for Energy Systems in April 2006. He is currently the Director of Discipline for Engineering Mathematics. Previously he was the Schools Director of Research and the Head of the Engineering Graduate School. He joined IES from Manchester Metropolitan University (MMU) where he was Reader in Scientific Computation in the Department of Computing and Mathematics. He joined MMU as lecturer in Mathematics (specialising in Numerical Analysis) following the completion of his PhD in 1992.

David is currently Research Director of the UK Centre for Marine Energy Research (EP/P008682/1, EP/M014738/1 & EP/I027912/1), a £5.3M, interdisciplinary, challenge led, collaborative research programme funded under the RCUK SuperGen programme that coordinates the research work of more than 100 academic and research staff across 25 UK Universities in both the wave and tidal energy sectors. He is also director of the Industrial Doctoral Centre for Offshore Renewable Energy (EP/J500847/1), a £6.5M center that is training 66 EngD students from 2012-2022. IDCORE is funded by the ETI and the RCUK Energy programme and is run by a consortium of the Universities of Edinburgh, Exeter and Strathclyde, together with the Scottish Association for Marine Science and HR-Wallingford. David was one of three investigators who secured £6M funding from the EPSRC to design build the £12M FloWave facility, the world's first, circular, combined wave and current test basin.

David has published over 100 journal and conference papers, achieving over 1500 citations with an H-index of 17 (excluding self-citations). He is named on a patent application (IT-2016-00130691) and is a member of the project team for the IEC 62600-1 standard, and a member of the present marine energy committee of the International Ships and offshore Structures Congress (ISSC)

Dr Venki Venugopal

Environmental Modelling of Waves and Tidal Currents for Marine Energy Applications

Abstract

This presentation will summarise studies carried out at Edinburgh University on the numerical modelling of waves and tidal currents for resource assessments and energy device modelling. The

presentation will cover on setting up the numerical model, challenges in calibration and validation process and description of hindcast wave and tidal current parameters. The presentation will also be extended to include the application of numerical modelling to investigate the impact of large scale wave and tidal energy array of devices on the environment. The methodology covered in the presentation will be relevant to WP-1 of the ResIn project.

Biography: Dr Venki Venugopal has joined the University of Edinburgh as Lecturer in 2005 and he is currently Reader with the Institute for Energy Systems, School of Engineering. He received a Bachelor of Technology degree in Civil Engineering (1991), Master of Technology in Ocean Engineering (1994) and PhD in Ocean Engineering (United Kingdom, 2003).
His research interests include numerical modelling of wave and tide propagation in ocean and bay scale, wave and tidal power resource modelling, interaction of wave–current-turbulence-marine energy structure modelling, arrays of wave and tidal energy devices modelling, physical modelling of wave and tides in laboratory and their interaction, extreme waves, offshore wind energy, climate change modelling, environmental impact modelling of waves and currents, breakwaters, general offshore structures modelling and ocean wave statistics. He is currently leading the EPSRC research [FlowTurb project, EP/N021487/1] on the characterisation of combined wave-current-turbulence interactions on tidal energy resources, performance of tidal turbines in turbulent flow conditions, and the resulting fatigue loads on tidal turbine rotor blades and support structures for both floating and seabed fixed tidal turbines. His previous work [EPSRC TeraWatt, EP/J010170/1] explored ways in which marine spatial planning and policy development can enable the maximum level of marine energy extraction, while minimizing environmental impacts.

Dr Jun Zang

Towards modelling violent wave interaction with fixed and floating structures more accurately and efficiently

Abstract

This presentation will highlight our recent advances in the development and application of advanced numerical methods to challenging coastal and offshore problems. By implementing appropriate numerical methods, different problems, such as performance and survivability analysis of wave energy devices, wave over-topping of breakwaters, and wave impact on floating structures can be modelled more accurately and efficiently. In the presentation, I shall give an overview on our recent studies on applying Particle-in-Cell method, open source CFD tool OpenFOAM and potential flow solver to wave interaction with fixed and floating structures. This presentation is related to WP3 and the numerical simulation of floating structures.

Biography: Dr Jun Zang is a Reader (Associate Professor), and the Founding Director of the Research Unit for Water, Environment and Infrastructure Resilience (WEIR) at the University of Bath. Prior to joining Bath in 2007, she was a Departmental Lecturer at the University of Oxford. Before that, she took on various roles in both academia and industry after she graduated with a PhD in coastal and offshore engineering from Dalian University of Technology. She was the Chair of the PRIMaRE, a partnership of world-class research institutions based

in the West, South, and South West of England for research in marine renewable energy for the academic year 2015-2016.

Dr. Zang's research group at Bath is one of the international leading groups in developing and using advanced CFD tools in modelling complex free surface flows, violent wave impact on coastal and offshore structures, urban and coastal flooding, and the performance and survivability of wave energy devices. She has led and participated in multiple national and international large research projects on various topics, which include EU funded project investigating violent wave impact on fixed offshore wind turbine foundations (as Project Leader), several wave energy related projects on the optimisation and survivability of WECs (as Bath Principle Investigator), and wave structure interactions (including CCP-WSI collaboration on wave-structure interaction). She is also a committee member of a couple of top international conferences in the field and chaired major conferences in recent years.

China Participants

Professor Bing Chen

Numerical Simulation of Floating Body based on Viscosity Flow Model

Abstract

This presentation introduce numerical simulations that have been carried out by the author on the interactions between wave and structures based on viscosity flow model. The methods for tracking the motion of free surface have been used includes the Arbitrary Lagrangian-Eulerian (ALE) method, Volume of Fluid (VOF) method, and Level Set method. The strategy could be adopted in the numerical simulation of floating offshore wind turbine platform's response to the extreme wave climate is discussed at last. The presentation is related to innovative designs in WP 2 and coupled computational modelling in WP 3 of ResIn project.

***Biography*:** Prof. Bing Chen is Associate Professor in the Dalian University of Technology and is based at the Panjin campus. After received PhD in Ocean Engineering in 1998 at the State Key Laboratory of Coastal and Offshore Engineering (SLCOE), and following two years of postdoctoral research in CFD at the Department of Engineering Mechanics in DUT, he works in the Department of Hydraulic Engineering in the same university since July, 2000. He was a Visiting Scholar to the University of Western Australia in 2001, and to the Institute for Energy System of the University of Edinburgh in 2011. He transferred from Dalian to the School of Ocean Science and Technology at Panjin campus of DUT since 2013.

His research interests covers many aspects of ocean engineering, including wave loads, local scour, and coupling interaction between fluid and structures, mainly by numerical simulations. He has extended his research into the area of marine renewable energy since 2011. He is the PI of the NSFC 2014 general program "Development of a new vertical axis tidal turbine-submerged carrier system". He was the PI of exchange program "Development of a new buoy-type energy converter" funded jointly by NSFC and Royal Society of Edinburgh (NSFC-RSE, 2013), and the technical director of Special Funding Project (2011) "Laboratory investigation and sea trail of new vertical axis tidal turbine and direct-driven generator system" funded by the State Oceanic Administration (SOA) of China, led the laboratory investigations and took part in the sea trail of the tidal device. He is now serving as the PI of Chinese team of this ResIn project.

Professor Dezhi Ning

Hydrodynamic investigation of an OWC wave energy converter

Abstract

This presentation will outline studies towards hydrodynamic performance of oscillating water column (OWC) wave energy converter performed at DUT. Numerical, experimental and analytical models are all considered. Influences of wave nonlinearity and viscosity on energy conversion efficiency and wave loads on the structure are presented. Analytical solution of a cylindrical OWC device was derived,

which possesses the possibility of coupling with FOW to reduce the wave loading. The presentation is related to innovative designs in WP 2 of ResIn project.

***Biography*:** Prof. Dezhi Ning, Deputy Director of Hydraulic Engineering and Vice Dean of State Key Laboratory of Coastal and Offshore Engineering (SLCOE) at Dalian University of Technology (DUT), received PhD from DUT of Coastal and Offshore Engineering in 2005. Afterwards, he worked as a postdoc at Department of Engineering Science at Oxford University from 2005 to 2007.

Prof. Ning currently serves as the Head of Offshore Renewable Energy Research Centre at DUT, leading one of the top research groups on wave hydrodynamics and wave energy conversion (WEC) in China. He is the Principal Investigator for four NSFC projects on nonlinear wave interaction with marine structures, interaction of extreme wave and uniform current with offshore structures, interaction of extreme wave and moored body, and hydrodynamics of floating OWC Wave Energy Convertor. He also leads a collaborative grant by NSFC and RS for survivability and hydrodynamics of a fixed OWC device, and a Royal Academy of Engineering Project under Newton Fund for the integration of WECs and floating breakwaters. At present, He has published over 120 peer-reviewed journal/conference papers in proposed areas, and chaired UK-China Tidal Energy Collaborative Workshop in 2015 and 32nd International Workshop of Water Waves and Floating Bodies in 2017.

Professor Haigui Kang

Investigation of the Wave Energy Converter (WEC) Type Floating Breakwater

（Presented by Mr. Xuanlie Zhao）

Abstract

High construction-cost is one of the obstacles that limit the development of wave energy converters. Integrating wave energy converters (WECs) into other marine facilitates may reduce the construction cost of WECs. In this presentation, a concept of wave energy converter-breakwater integrated system with simple configuration will be presented. Analytical investigation on the performance of the integrated system is conducted firstly. Then the experimental investigation with considering the nonlinearity of the power take-off (PTO) system is conducted. The variations of the capture width ratio and transmission coefficient against PTO damping force are given. From point-view of engineering application, the proposed system can economically operate in water of medium depth and the function of both produce power and sea defence can be achieved.

Biography: Prof. Haigui Kang is a Professor at Dalian University of Technology. He was Vice Dean of School of Engineering and Architecture (1996~2002) and Vice Dean of Institute for Energy System (2008~2014) at Dalian University of Technology. He was a Visiting Scholar at the HR Wallingford UK (1991~1992) and Visiting Professor at Virginia Institute of Marine Science USA (2000). He was the person in charge of UK-China Science and Technology Cooperation Project with the University of Edinburgh which was financial supported by the British Council (2000~2005).

His research interests include marine renewable energy application; physical model testing and numerical simulation of hydrodynamic forces on coastal and offshore structures due to regular waves, irregular waves, and combined wave and current, as well as shoaling of wave spectra. He has developed simultaneous measurement techniques for velocity and concentration fields using PIV (Particle Image Velocimetry) and LIF (Laser Induced Fluorescence) techniques. He has extended his research into the area of marine renewable energy since 2006.

He was responsible for many research projects of marine renewable energy. Recent years, he leads the Project ”Research on the reliability of foundation supporting structures of offshore wind power” financial supported by the East China Design & Research Institute 2015, the Project “Study on vertical pipe-restrained floating breakwater doubled as wave power generation device" funded by NSFC 2013, and the Special Funding Project “Laboratory investigation and sea trail of new vertical axis tidal turbine and direct-driven generator system” funded by the State Oceanic Administration (SOA) of China 2011.

Professor Jun Chang

Interfacial Transition Zone of Ba bearing Sulphoaluminate Cement Concrete used in Marine environment

Abstract

Abstract: In this paper, fine cement particle are used to pre-coat aggregates in concrete for decreasing the thickness and the connectivity of ITZ, and improving the strength and sea water impermeability of concrete. The porosity of the concrete of uncoated and pre-coated aggregates is measured, the result indicates that porosity of concrete of pre-coated aggregates is reduced and the strength, sea water resistant is improved. In addition, the interfacial transition zone (ITZ) of Ba bearing sulphoaluminate cement concrete is analysed by SEM-EDS and the results show that there is a large amount of ettringite crystal in the ITZ.

***Biography*:** Prof. Jun Chang has worked in building Materials institute of Dalian University of Technology from 2011. His research field mainly focus on special cement for resistance seawater corrosion. He received Ph.D. in Materials science at Wuhan University of Technology 2004 and worked as a Visiting professor in McGill University, Montreal, Quebec, Canada on 2005-2006.

His research work mainly focus on special cement materials, which is calcium barium (strontium) sulphoaluminate (CBaSA and CSrSA) cement and it has excellent performance, such as rapid hardening, early strength and high strength, impermeability and seawater corrosion resistance. Calcium barium (strontium) sulphoaluminate cements, plugging materials and concrete interface agent were invented based on CBaSA, CSrSA and C_2S minerals. The award of National prize for technological inventions was obtained based on this research work. The series materials were widely used to repair and strengthening in coastal concrete engineering.

Professor Dahai Zhang

Development of ocean energy research in Zhejiang University

Abstract

A brief introduction to the research on ocean renewable energy in Zhejiang University.

***Biography*:** Associate Professor Dahai Zhang, Vice Deputy Secretary-General of Division of Ocean Technology System, Chinese Society of Oceanography; Vice Deputy Director of the Institute of Ocean Engineering and Technology at Ocean College, Zhejiang University of (ZJU), received PhD from ZJU of Mechanical and Electronic Engineering in 2010. Afterwards, he worked as a postdoc at Department of Mechanical Engineering at ZJU in 2011 and worked as a postdoc at Department of Engineering in Lancaster University from 2012 to 2013.

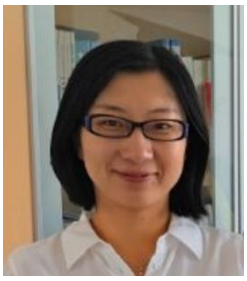
Associate Professor Zhang has worked with various research projects dealing with modelling, design and measurements of renewable energy electrical machines such as wave energy converter, tidal current turbine and wind turbine. He has published over 40 peer-reviewed journal/conference papers in proposed areas, and chaired 5th China Marine Renewable Energy Conference in 2016 and 3th China Ocean Technology Conference as organizing president in 2017.

Dr. Ying Gou

Wave Interactions on Multiple Floating Bodies

Abstract

This presentation introduces numerical simulations of wave interactions on multiple floating bodies by diffraction and radiation theory. It was extended to simulations of array wave energy converters. Basing on the mode superposition method, it was also used to simulate wave interactions on elastic structure. The advantage of this numerical model is less computational cost and high efficiency. It can serve as a tool to give preliminary prediction.



Biography: Dr. Ying Gou is Associate Professor in the Dalian University of Technology. She joined DUT as Lecture after received PhD of Coastal and Offshore Engineering from DUT in 2006. She worked as a postdoc at Department of Naval Architecture and Ocean Engineering in Seoul National University for one year from 2010 to 2011.

Her research interests include numerical modelling of wave interactions with multiple floating bodies, hydrodynamic characteristic of ocean structures in two-layer fluid, hydroelastic response of very large floating structures and the acceleration technology of Boundary element method. She was the Principal Investigator of NSFC projects ‘Analysis of the hydrodynamics of mooring multi-floating bodies under wave actions in frequency and time domain’ and the Co-PI of NSFC project ‘Hydrodynamic research and optimum design of a new-style bottom-hinged flap wave energy device’. She is currently in charge of the NSFC project ‘Study of slow-drift motions of large floating structures in two-layer fluid’.

Professor Wei Shi

Development status of Floating offshore wind turbine

Abstract

This presentation will highlight the recent development of floating offshore wind turbine including the concept design, model test and demonstration project all over the world. Experience from the existing floating projects, such as Hywind demo, will be discussed. Especially the technical challenges in numerical modelling and other issues be addressed. The presentation is related to coupled computational modelling in WP 3 of ResIn project.

***Biography*:** Dr. Wei Shi, an associate professor of Deepwater Engineering Research Centre at Dalian University of Technology (DUT), received PhD from POSTECH in Korea in 2013. Afterwards, he worked as an assistant professor in Konkuk University in 2013 and postdoc at Department of Marine Technology at NTNU in Norway from 2014 to 2017.

His research interests include numerical modelling of both fixed-bottom and floating offshore wind turbine, wind turbine drivetrain dynamics, ice-structure interaction for offshore wind turbine. Meanwhile he has a good experience in dynamic analysis of mechanical system. He is serving as an international advisory committee in Asia-Pacific Forum on Renewable Energy 2017.

Dr Dongsheng Qiao

Several problems in the design of mooring system: mooring damping, OPB load, snap tension

Abstract

This presentation will outline three problems which would be useful for the design of mooring system, including the mooring damping, the out-of-plane bending (OPB) load, and the snap tension. A new quasi-static model of calculating mooring damping considering the friction between seabed and mooring line is established, which could be used to predict the global response of floating system. The finite model of mooring chain link under OPB load is established, and the combined wear and corrosion effect is considered in the fatigue analysis. Under large amplitude and high frequency excitation, there could be indicate a strong possibility of snap tension behaviour in the mooring line, and the maximum tension could be times of pre-tension. The study is related to WP 2 of ResIn project.

Biography: Dr Dongsheng Qiao is Associate Professor of Deepwater Engineering Research Center, Dalian University of Technology. His research interest lies in the analysis of floating platform and its mooring system, numerical simulation and experimental study on hybrid model testing method of floating platform. He has developed a concept design of mooring line with buoys, passive and active truncated design of mooring system in the hybrid model test of floating platform, trajectory prediction of plate anchor.

Dr. Nianxin Ren

Coupled wind and wave analysis of two typical combined floating wind turbine and wave energy converter systems

Abstract

This presentation introduce coupled wind and wave analysis of two combined floating wind turbine (WT) and wave energy converter (WEC) systems. One is named STC (Spar-Torus-Combination) system and the other is named TWWC (TLP-WT-WEC-combination) system. The Long-term performance estimation of the STC system with different survival modes has been investigated based on a coupled analysis of wind-wave-induced stochastic response using the SIMO-TDHMILL code in the time domain. The energy production, structural fatigue damage and extreme responses of the STC system have been estimated based on the long-term wind-wave joint distribution at two selected sites in European waters. The new proposed survival strategy can significantly reduce the long-term fatigue damage and extreme responses of the original STC system by effectively avoiding the possible heave resonance effect when the torus is locked to the spar at the mean water level (MWL). In addition, dynamic responses of the TWWC system under typical operational seas cases have been investigated by using both time-domain numerical simulations and scale model tests (1:50). Numerical and experimental results are presented and compared. Good agreements are achieved.

***Biography*:** Dr. Nianxin Ren has joined at the Dalian University of Technology as a Lecturer since 2012. He received a PhD in Engineering Mechanics in 2011 at the Harbin Institute of Technology (HIT), and he worked as a postdoctor at Center for Ships (CeSOS) and Ocean Structures at Norwegian University of Science and Technology (NTNU) for two years (from 2013.05 to 2015.03).

His research interests covers many aspects of offshore renewable energy, including floating offshore wind turbine, typhoon extreme loads, novel combined wind turbine and wave energy systems and CFD simulation, mainly by coupled aero-hydro dynamic simulations and scale model tests. He has joined the European Communities Program: “Marine Renewable integrated Application Platform” (2013-2015). He is the PI of the NSFC 2017 Youth scholar program “Multi-body dynamic coupling effect study of a novel wind energy and wave energy combined structure system”. At present, He has published over 30 peer-reviewed journal/conference papers and 3 patents for invention in proposed areas.

Dr. Hai Du

The Study on Model Experiment in Ocean Engineering Based on Image Measurement Technology

Abstract

We combine the particle image velocimetry (PIV) technology with digital image correlation (DIC) algorithm and deduce some image processing methods from PIV to solve the problem of model

experiments in ocean engineering. When integrating PIV into motion measurement, the precision and stabilization of experimental system will be greatly strengthened. Our study uses this kind of image measurement method to meet a series of requirements in model experiments, such as 6Dof trial, water level measurement, glass tube vibration measurement and so on. Our research maybe useful for the model experiments in ResIn project.

***Biography*:** Dr. Hai Du, Engineer of the State Key Laboratory of Coastal and Offshore Engineering at the Dalian University of Technology, received PhD in electronic and information engineering at 2009.

His research interests include non-contact motion measurement, 3D reconstruction based on computer vision and sensor control technology. He has designed several efficient measurement devices which can be used in ocean engineering experiments. Dr. Hai Du is currently a visiting scholar at University of Western Australia and try to fuse optical measurement technology into model experiments of ocean engineering to explore more accurate and more reliable measurement methods and experimental devices.

Assistant Professor Yulin Si

Novel control methods for load reduction of offshore wind turbines.

Abstract

Extra loads on wind turbine structures resulted from complex wind and wave environment are seen as the main design challenge for offshore wind turbines. In terms of load mitigation, studies show that improved blade pitch control strategy could be helpful, such as superimposing an additional damping control feedback loop to the baseline controller. Alternatively, structural control methods, which have been widely used in large civil engineering structures, offers another novel solution. This presentation will introduce the structural control concept for load reduction of offshore wind turbines.

***Biography*:** Dr. Yulin Si received his Bachelor's and Master's degrees from Harbin Institute of Technology in Control Science and Engineering in 2009 and 2011, respectively. Then he started his PhD study in the University of Agder in Norway and obtained the PhD degree in offshore wind energy in 2016. Afterwards, he joined the Zhejiang University as an assistant professor. His current research interests include advanced control system design and load reduction of offshore wind turbines, fault detection and fault tolerant control of offshore wind turbines. He has published over 10 peer reviewed journal/conference papers in this field.