ARC Research Hub for Offshore Floating Facilities

eNewsletter

October 01, 2018

Welcome from Phil Watson, OFFshore ITRH Director

The last few months have been another busy time for both Hub researchers and our partners.

The team was well represented at several international events, with members also involved in the final 'showcase' of the ARC Centre of Excellence for Geotechnical Science and Engineering. We have followed up on an earlier commitment to revisit how we engage with our Hub industry partners, with the intention of creating pathways for more timely feedback and interaction. We have run some valuable training sessions for PhD students, and continue to reshape aspects of our research streams – especially important as the final wave of students joins the team. We've also made key progress in extending our reach – noted in more detail below, we have now signed a collaboration agreement with the Alan Turing Institute to explore research that combines data and physics based science; and are in discussion with other industry groups (clients, contractors and consultants) to explore where they can add value to our research – and so increase value for our partners.

With the weather warming up and the end of year approaching, we won't be slowing down. In addition to our research activities, we will hold our annual workshop in late November – and as we pass the half way point of the Hub, the focus of the session will naturally tend towards a review of future opportunities. Watch this space!

Engagement with the Hub is welcome – please don't hesitate to reach out.

Hub News

Creating real impact through close collaboration with our Industry Partners

In the true spirit of collaboration, OFFshore ITRH Research Fellow Ian Milne of the Project 2 stream (Wave-structure interaction) has been working closely with Senior Metocean Engineer Matthew Zed from Woodside Energy to develop a new software tool to efficiently predict the hydrodynamic motions of a floating facility from long term wave hindcasts, which is critical for ensuring safe and efficient operations.

The new software, Vessel Operability Planning Software (VOPS), has been adopted by Woodside's Operations team, resulting in significant ongoing cost savings.

The software was validated using new field data from a drillship operated by Transocean Ltd. and wave spectra hindcasts provided by Metocean Solutions Ltd. for a swell dominated site. Initial results of which were jointly presented at OTC Asia 2018 in March – see here.

This work has since been expanded upon and also demonstrates the ability to use ships as large wave buoys for independent validation of the hindcast wave spectra. The results of which have been recently published in the international journal *Ocean Engineering* – see here.

The key focus of the OFFshore ITRH is to work collaboratively to deliver real impact for our partner organisations (and the broader engineering community). The creation of the VOPS tool is just one of the ways we are doing this.

Sam Stanier wins the 2018 Baden Clegg Award

Congratulations to UWA Researcher and OFFshore ITRH Chief Investigator Dr Sam Stanier for winning the 2018 Dr Baden Clegg Award for his work on the RIGSS Joint Industry Project.

The award perpetuates the memory of Dr Baden Clegg (1925-1999), who was a lecturer at the University of Western Australia for around 30 years until his retirement in the mid-1980's and in recognition of his lifetime of achievement in the support and development of young geotechnical professionals. Dr Clegg was instrumental in the invention and development of both the ubiquitous Perth sand penetrometer and the Clegg Impact Hammer, both used for compaction control in earthworks and flexible pavements.

The award is presented annually by the Australian Geomechanics Society WA to a young geotechnical engineer or geologist (under the age of 35 years) for presentation of an outstanding 15-minute seminar on a topic of interest to the wider geotechnical community.

Sam Stanier graduated from The University of Sheffield with an MEng (Hons) degree in Civil Engineering in 2007. Following this he joined the Geotechnical Engineering Group at The University of Sheffield as a postgraduate student, investigating the use of transparent synthetic soils and Particle Image Velocimetry (PIV) techniques to assess the failure mechanics of geotechnical structures non-intrusively. Upon award of a doctorate in Geotechnical Engineering in 2011 Sam joined the Centre for Offshore Foundation Systems at UWA. Currently he is a Chief Investigator in OFFshore ITRH Project 4 stream (Shallow foundations and Novel anchors), an ARC DECRA fellow with a project entitled "Unlocking the changing strength of fine-grained soils in numerical analysis", and a co-

investigator in an ARC Discovery Project entitled “A 21st century laboratory testing device for geotechnical engineering”.

Further details about Sam’s research may be found here.

Collaboration with the Alan Turing Institute

In late 2017 OFFshore ITRH Chief Investigators Dr Ed Cripps and Professor Melinda Hodkiewicz were visited by highly regarded mathematician Professor Mark Girolami of The Alan Turing Institute (ATI), the national institute for data science and AI in the UK, to discuss potential collaboration. This led to the signing of a collaboration agreement between UWA and ATI which will used to facilitate the investigation of areas of collective interest.

As a result of the initial visit, a pilot project was identified which involves collaboration with the Project 1 and Project 5 team. The project involves the introduction of uncertainty in the (already developed) numerical model of soliton generation and behaviour.

The goal is to produce a more statistically robust model by incorporating uncertainty in the inputs, and propagating this uncertainty through the soliton model in a coherent way, so as to produce a predictive distribution of possible outputs to inform operational decision making.

The end result is to create a software package, which can be used by industry partners, to visualise model outputs, with associated uncertainty estimates. The direct impact of studying the uncertainty in numerical modelling and large data sets will be to create software tools for industry that improve efficiency, enhance safety, and minimise downtime.

Fast forward to August 2018, when the OFFShore ITRH, in conjunction with Shell, hosted members of ATI for a week of workshops to explore further collaboration opportunities that will ultimately add significant value to the OFFshore Hub and its outcomes.

Training for Early Career Researcher

The OFFshore Hub has joined forces with the Australian Centre for LNG Futures (ACLNGF) to provide PhD students and Early Career Researchers (ECRs) with training opportunities in a variety of key areas. To date three workshops have been held in the Woodside OceanWorks space, with a fourth planned for next week.

The first two workshops focused on Science Communication, with presenters Dr. Miriam Sullivan of Curtin University, and editor Michael Hopkin of The Conversation presenting on a variety of methods for implementing

effective strategies to share knowledge, engage with an audience and effectively inform debate. The ultimate goal of this training is to create effective science communicators that can actively facilitate public engagement on scientific issues.

The third workshop focused on the Inclusion and Diversity agenda of the OFFshore Hub, with presenter Dr. Lucienne Tessens speaking on the subject of “Unconscious Bias”. This well attended, interactive workshop provided an opportunity for attendees to challenge their own and others’ biases, with the ultimate aim of fostering a more inclusive workplace.

The fourth workshop will be on “How to write a good academic paper”, at which PhD students will progress a technical publication they are currently working on. This popular session will be headed by OFFshore Hub Chief Investigator Dr. Conleth O’Loughlin, with support from a variety of mentors drawn from both the OFFshore ITRH and the ACLNGF.

Future sessions are in the works on a variety of topics including: post PhD career pathways, data analytics for complex engineering models, and further tools for effective science communication. Sessions topics are arranged largely based on requests from the PhD students and ECRs.

Conference Report: CPT'18 and ICPMG 2018

Members of the OFFshore Hub have recently been busy attending and presenting at international conferences in both Delft and London, in addition to OMAE in Madrid.

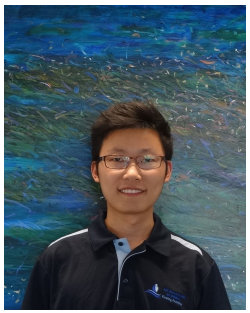
In June the 4th International Symposium on Cone Penetration Testing (CPT’18) was held in Delft, the Netherlands. This conference brings together world experts to discuss the geotechnical challenges involved in using the cone penetration test (CPT). Academics, researchers, consultants, practitioners, suppliers, certifiers and students shared their practical experiences and discussed applications of their research findings.

Hub members in attendance included Director Phil Watson, David White and Mark Randolph, who was one of three key note speakers. Mark’s speech was entitled “Penetrometer equipment and testing techniques for offshore design of foundations, anchors and pipelines”.

In July the 9th International Conference in Physical Modelling in Geotechnics (ICPMG) 2018 took place at City, University of London. The purpose of the conference was to communicate and disseminate recent developments in all aspects of geotechnical physical modelling.

Speakers at the event included Hub members Christophe Gaudin who spoke on “Geotechnical modelling for offshore renewables” and Susan Grovenec who spoke on “The role of centrifuge modelling in capturing whole-life responses of geotechnical infrastructure to optimize design”. Hub members Phil Watson and Conleth O’Loughlin were also in attendance.

PhD Student Spotlight



Hongchao Wang is one of the PhD students in the Project 2: Wave-structure interaction project stream. His research is focused on understanding the mechanisms of gap resonance under external waves. He is exploring how transient wave groups influence the gap resonance in between two offloading vessels by measuring the wave-generated hydrodynamic forces and their effect on offloading vessels during the unloading process.

As Hongchao explains, **"Using Computational fluid dynamics (CFD), I've reproduced experimental results of a complex 3D gap resonance phenomenon. Flow field information is used to demonstrate how the resonance builds up in the gap under a transient incident wave group. I've discovered that the damping effect on the oscillatory motion in the gap, during the decaying process, has a linear form. Higher harmonics are extracted using a phase-based decomposition method to more accurately predict gap resonance and reduce operational risks."**

By accurately predicting gap resonance, Hongchao's work will significantly impact FLNG facilities, by allowing them to proactively manage risk and in turn improve the efficiency of production processes.

Hongchao is an active participant in the OFFshore ITRH mentoring program. Incremental publication of Hongchao's research is listed here. For further details, please refer to Hongchao's profile page.

Publications

Interested in learning more about our work? Below is a list of some of our more recent publications. A full list of our publications can be found here. To request a PDF version please contact us.

- Milne, I.A., Zed, M. (2018) Full-scale validation of the hydrodynamic motions of a ship derived from a numerical hindcast. Ocean Engineering Volume 168, 15 November 2018, Pages 83-94
- Stanisic, D., Efthymiou, M., Kimiaei, M., Zhao, W. (2018) Design loads and long term distribution of mooring line response of a large weathervaning vessel in a tropical cyclone environment. Marine Structures Volume 61, September 2018, Pages 361-380
- Tom, J.G., Draper, S., White, D.J. (2018) Sediment transport and trench development beneath a cylinder oscillating normal to a sandy seabed. Coastal Engineering - available online 10 August 2018
- Astfalck, L.C., Cripps, E.J., Gosling, J.P., Hodkiewicz, M.R., Milne, I.A. (2018) Expert elicitation of directional metocean parameters. Ocean Engineering Volume 161, 1 August 2018, Pages 268-276

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