Centre for Offshore Foundation Systems
Lloyd's Register Foundation
Postgraduate Scholarship Opportunities

Since its establishment in 1997, the Centre for Offshore Foundation Systems (COFS) at the University of Western Australia has developed into one of the most sophisticated research and modelling facilities in offshore geomechanics and engineering anywhere in the world. A large team of internationally recognised researchers, consulting engineers and technical staff work together to solve some of the key engineering challenges of today and tomorrow. Our work on the mechanics of seabed sediments, offshore foundations systems, pipeline and deep water offshore engineering and geohazards provides pivotal support to both the local and global engineering community.

COFS has partnered with the Lloyd's Register Foundation (LRF) to establish the LRF Chair in Offshore Foundations and Research Centre of Excellence (CoE). The CoE will carry out, at the highest international standard, fundamental and applied research in the areas of seabed sediment, offshore geohazards and in offshore foundations and energy systems.

There are 3 fully funded projects available to students who wish to complete their PhD in offshore geotechnical engineering. Successful students will receive a scholarship stipend of AU$35,500 per year, tax free, as well as covering tuition fees (if applicable). Students who wish to apply must have achieved first class honours in a relevant degree (or equivalent industry experience), and meet the English requirements for enrolment at UWA. The 3 projects on offer are:

- Effect of installation on subsequent response of offshore foundations under lateral loading
- Cyclic capacity of plate anchors in sand
- Optimising arrays of wave energy converters to produce at maximum power and survive extreme seas

More information on these projects are on the back page. Each project will also have an Industry mentor.

To submit your interest to do a PhD in one of these projects, please email your information:

- resume
- full academic transcripts
- details of any published papers
- results of English test such as IELTS (if applicable)

to the COFS Administrative Officer Monica Mackman at
enquiries-cofs@uwa.edu.au

Effect of installation on subsequent response of offshore foundations under lateral loading
Supervised by Britta Bienen

The aim of this research will be to understand and quantify the influence of installation history on the performance of offshore monopiles under cyclic loading from the ocean environment. The effects of installation are important – but not currently accounted for in predictive methods or international guidelines – as they can significantly change the response. A combination of novel numerical and physical modelling techniques will be used to assess the impact, and will include development of advanced constitutive model for large deformation finite element analysis in sands as well as use of a unique vertical, horizontal and rotational actuator developed for use in the UWA centrifuge. Testing will concentrate on how different installation methods effect the accumulated rotations of the foundation under subsequent cyclic loading. The project will build on on-going collaborative research on monopiles with colleagues at Hamburg University of Technology (funding from the Deutsche Forschungsgemeinschaft DFG) and suction caissons (with a PhD project sponsored by LR and ongoing research with colleagues at NGI and Oxford University).

Cyclic capacity of plate anchors in sand
Supervised by: Shiaohuey Chow, Conleth O'Loughlin and Mark Randolph

The development of offshore renewable energy, particularly wave energy industry has taken off slowly due to technical and economic challenges. One critical challenge is to produce a reliable and cost effective anchoring system to anchor the floating energy device to seabed. A solution could be the plate anchors, which are used for mooring large floating structures for hydrocarbon exploration in deep water. The behaviour of plate anchors has been widely studied for application in clay, but not in sand where offshore floating renewable energy devices are typically located. Therefore, it is crucial to investigate the response of plate anchors in sand, particularly when subjected to long-term cyclic loading due to the wind and wave loading acting on the floating facility. In the extreme case of severe storm condition, the anchor will experience partially drained to undrained cyclic loading that is large in amplitude and very short in time scale. Therefore, this project aims to: (a) develop an experimental database of plate anchor capacity in sand considering different configurations (embedment depth, loading condition etc.) and a wide strain rate range (covering both service and extreme storm condition); and (b) validate the experimental results using a macro-element model incorporating the recently developed hardening memory surface constitutive model in collaboration with the University of Bristol. This project will produce valuable experimental data and a framework that provide better prediction of cyclic capacity of plate anchor in sand

Optimising arrays of wave energy converters to produce at maximum power and survive extreme seas
Supervised by Scott Draper, Hugh Wolgamot and Mark Cassidy

Most traditional wave energy devices aim to maximise average power generation across a range of sea states first, and then to independently design a sufficiently large anchoring system to ensure the device survives extreme loads. Efficient wave devices, however, should not separate these design requirements and should instead represent design solutions to the joint optimisation problem of maximising power generation subject to minimising extreme loads. The purpose of this PhD project is to explore this fundamental joint analysis for a single wave energy device and to then extend the analysis to an array of wave energy devices. The extension to an array of devices is of critical importance in understanding the longer term potential of wave energy farms (such as the three device farm which has been deployed just this month off Western Australia by Carnegie Wave Energy). Arrays also offer interesting engineering advantages which may help to make wave energy generation more commercially viable. These advantages include (i) potential for interactions between devices to alter the power produced by each device, in a manner dependent on incident wave frequency and direction, and (ii) the potential to reduce extreme foundation loads by mooring devices to several shared foundations. This second advantage results because devices are generally loaded out-of-phase as a wave passes through an array, and is an advantage that would be quantified systematically for the first time in this PhD project by studying the joint optimisation problem.

If you would like any further information please either
email Monica Mackman at enquiries-cofs@uwa.edu.au or telephone +61 8 6488 3094

www.cofs.uwa.edu.au
http://www.cofs.uwa.edu.au/collaborations/lrf