

# RESEARCH DIRECTIONS

## Swell idea for marine construction

Dr Chunwei Zhang, from the Institute for Infrastructure Engineering, is leading an investigation into ways of limiting the effects of a heaving motion on the work of offshore crane ships. The project, which is supported by a UWS Research Partnership Grant and Tianjin Haixu Technology Development Co, aims at improving the safety and reliability involved in a crucial aspect of gas and oil exploration. Dr Zhang's research team includes Professor Brian Uy from UNSW and Dr Won Hee Kang from UWS.

'Offshore crane ships and recently built deep-water pipe-laying vessels are necessary for oil and gas exploration infrastructure construction,' says Dr Zhang. 'During harsh sea conditions, immense dynamic loads affect the crane structure – the load motion is difficult for the crane operator to control and the load may be damaged or lost. Ship motion is a complicated interaction between the air, sea and a ship's hull. Ocean waves, which are mainly caused by wind but occasionally by earthquakes and tidal forces, continuously disturb ships and result in complicated patterns of movement. The full motion state of a ship can be represented using six degrees of freedom. These comprise three rotary motions – roll, pitch and yaw – and three linear motions – surge, sway and heave. Of particular concern in offshore infrastructure is the "heave" motion, which is the vertical movement of a ship's centre of gravity.'

Accurate positioning of the load on the seabed can be nearly impossible, affecting underwater installations of pipelines for oil and gas.'

The motion of ships has previously been studied using models, statistics, simplistic assumptions and the experience of mariners. Through work in the laboratory and on-site, using gyroscopes, accelerometers and computational methods, this



project aims to develop a monitoring system to measure and estimate the full state of motion – position and posture – of a ship in a range of sea conditions. The results will then be used in an on-board decision support system to make prompt decisions for ship and crane operators. The ultimate goal is the application of the project findings and techniques in the development of motion control systems.

Harsh sea conditions that cause excessive ship motion in turn delay or jeopardise deep water infrastructure construction and operation safety. This research project has the potential to improve the output of an industry that is active in all parts of the globe.

**Project Title:** Monitoring, evaluation and control of ship motions for offshore infrastructure construction

**Funding has been set at:** \$70,000

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