THE UNIVERSITY OF WESTERN AUSTRALIA

UWA's Numerical Modelling Capabilities for Offshore Engineering

CENTRE FOR OFFSHORE FOUNDATION SYSTEMS

MODELLING SEABED SOFTENING AND RATE EFFECTS DURING PIPELINE PENETRATION

Offshore engineering design faces numerous geotechnical, hydrodynamic and structural challenges related to the nature of the operating environment. Prediction of performance of offshore infrastructure may involve consideration of geotechnical, hydrodynamic and structural response and interactions at the soil-fluid-structure interfaces.

The Numerical Modelling Technology research stream at the Centre for Offshore Foundation Systems (COFS) at The University of Western Australia (UWA) develops innovative computational techniques and tools necessary to model offshore processes and infrastructure, with a focus on developing computational algorithms capturing multi-phase sediment response, consolidation and strain rate effects in large deformation problems, multi-body hydrodynamic responses and non-linear soil-fluid-structure interaction.

Research from the Numerical Modelling Technology research stream at COFS has contributed to a number of predictive design methods used widely in engineering practice and codified in international design guidelines.

A range of numerical modelling capabilities are available at the Centre for Offshore Foundation Systems (COFS) from analysis with commercial software to development of in-house software and analysis methods.

Standard analysis

Analysis with commercial and academic software across geotechnics, hydrodynamics and structural response.

For example: Abaqus implicit and CEL; Plaxis; Optum; Uintah; ANySIM; DIFFRACT; OpenFOAM; Orcaflex; USFOS.

Advanced analysis

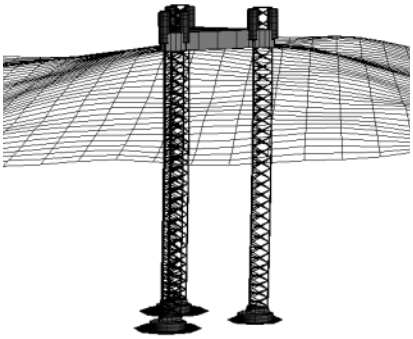
Analysis with in-house developed software.

For example: Large deformation FEA; Remeshing and Interpolation Technique with Small Strain (RITSS); Material Point Methods (MPM); Artificial Neural Networks (ANN); and Constrained New Wave (CNW) software.

Technology development

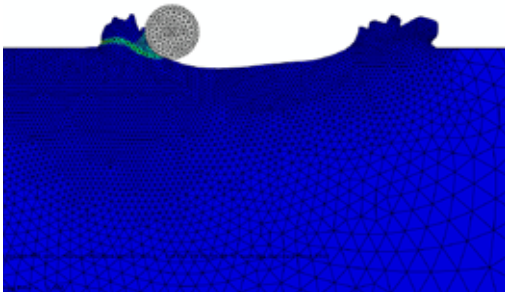
Development of subroutines and software to improve computational efficiency and capabilities.

For example: Cyclic loading; Rate dependency; Boundary element hydro-dynamics; non-linear potential flow; non-linear riser response.

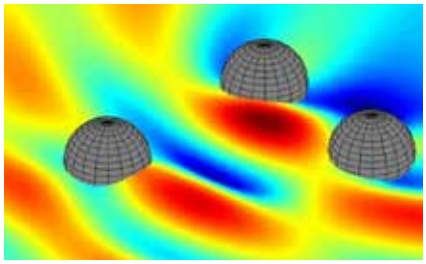


MODELLING A JACK-UP UNDER EXTREME WAVES

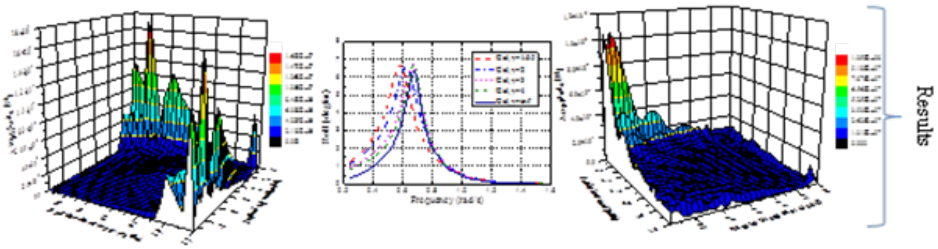
NUMERICAL MODELLING CAPABILITIES AT COFS



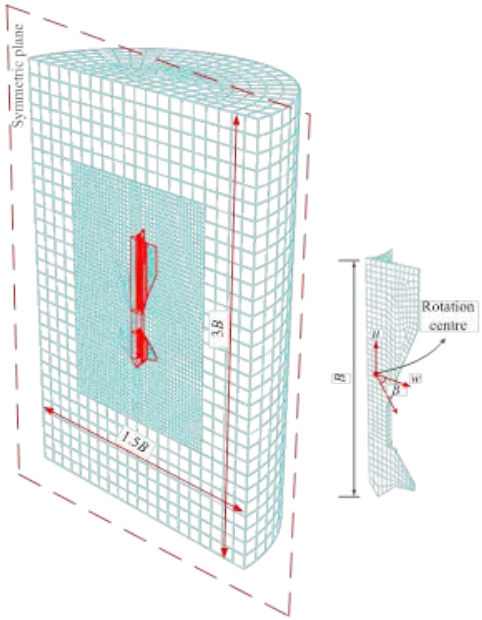
MODELLING LARGE-DEFORMATION LATERAL BUCKLING RESPONSE OF A SUBSEA PIPELINE IN SOFT MARINE DEPOSIT



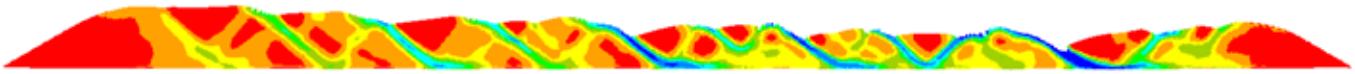
MODELLING FREE SURFACE ELEVATIONS AROUND FLOATING STRUCTURES



MODELLING MULTI-BODY HYDRODYNAMICS FOR FLNG OFFLOADING



ANCHOR CAPACITY MODELLING



MODELLING SOIL SOFTENING IN A MASS SLIDING EVENT ALONG A GENTLE SLOPE WITH MESHLESS MATERIAL POINT METHOD

Projects involved in:

- Interpretation of intelligent site investigation tools
- Transient and sustained tension response of skirted foundations
- Mobile foundation performance
- Axial walking and lateral buckling of on-bottom pipelines
- Submarine slide kinematics and impact on seabed structures
- Installation and operational mechanics of anchors
- Dynamic penetration of anchors
- Effect of random soils on foundation and anchor response
- Spudcan punch through in multi-layered soils
- Seabed mobility and scour
- Hydrodynamics of multi-body response during FLNG offloading
- Simulating high-order nonlinear wave-structure interactions
- Wave on deck green water problems
- Coupling between vessel motions and mooring dynamics
- Hydrodynamics of wave energy devices and arrays
- Fatigue design and dynamic structural response of risers
- Probabilistic structural response of facilities to extreme waves
- Structural response of mooring lines for floating vessels

The Numerical Modelling Technology research stream at COFS comprises a team of academic staff and postgraduate students with expertise in modelling interactions and processes from the seabed to the water's surface. The team has capabilities in offshore geotechnics, seabed mobility, hydrodynamics, sloshing, and structural analysis as well as modelling at the interfaces of these disciplines. The team carries out a range of pure and applied research, extending numerical modelling capabilities, contributing to joint industry projects and providing analysis for consultancy for offshore projects worldwide.

Please get in touch if you would like further information about our work or would be interested in getting involved with the Numerical Modelling Technology team at COFS.

Contact

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