

## Modelling and Evaluating Impact Loads For Single Lift Operations by Decommissioning Vessels

Offshore production platforms in the North Sea must be decommissioned when production has ceased. A platform can be decommissioned using single lift with AMC (Active Motion Compensation) and transported to another desired location. However, the AMC is considered to be an expensive component. This thesis investigates a passive method of single lift to analyse further possible reduction in costs of decommissioning. A passive single lift involves no active motions compensation and the interaction between platform and vessel will cause uncontrollable impact. A time domain model was developed to evaluate the loads during the single lift procedure. Prescribed motions for the vessel were used as a conventional method, assuming no deviating responses after impact due to its dominant inertia capacity. The Pioneering Spirit was used as reference vessel. Environmental loading on the topside during a beam wave corresponding to an annual stochastic JONSWAP spectrum was used as representative condition. Multiple 1-, 2- and 3-Dimensional impact models with two vessel motions methods were built for modelling the motions of the vessel. The first was the prescribed motions method corresponding to a frequency domain stochastic response, lacking the account for coupling onto the vessel. The second method incorporated the coupled motions by use of the impulse response function (Cummins equation), to evaluate the motions after impact. A sensitivity analysis on the stiffness's within the system was performed which quantified the effects on the loads. A second analysis quantified the impact between the prescribed and coupled motions, their responses, and loads corresponding to the components within the system.

The results show that accounting for the pitch and heave motions in 3-D modelling, using the coupled motions method, resolves in the most accurate responses and a decrease in motion responses after impact. The coupled motions method is found to be a more appropriate method of modelling for the complete behaviour and loads of this type of impact problem, but more time consuming in solving. It showed a decrease of the mean forcing due to decreasing vertical motions after impact. An increase in mean zero-crossing frequency after impact and caused an increase in number of impacts. Finally the analyses showed that the substructure of the platform was the most critically loaded component.

