

The Loading and Reliability of Fixed Steel Structures in Extreme Seas (LOADS)

The JIP is concerned with the calculation of wave and wave-current loads acting on a jacket structure in intermediate to deep water (40m – 180m). It includes the accurate prediction of sub-structure and wave-in-deck loads suitable for application in both deterministic and structural reliability analyses for both global and local loading cases.

Participants:



Principle service provider:

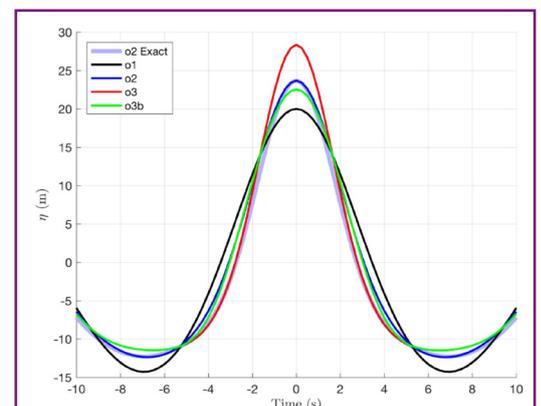
Offshore Consulting Group (OCG)

What is the problem:

If waves impact on the decks or horizontal beams at the top of fixed offshore jacket structures there is a large increase in the risk of structural collapse. Platform subsidence, sea level rise and recent industry advances in our understanding of crest height distributions, all imply that there is significantly more chance of waves hitting these structural elements than was previously thought. This represents a potential global structural integrity issue for offshore structures.

What is the solution:

Parameterised descriptions of crest height statistics and wave loading effects on sub-structure and topside members. These can then feed into structural reliability and local impact loading assessments within the context of a Monte Carlo analysis approach.

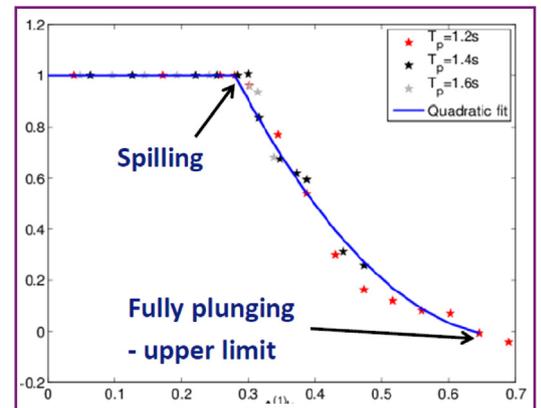


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What is the solution:

In order to do this, the probability distribution of wave crests needs to be well described taking into account the effects of non-linearities in the development of large waves, wave breaking and the effect of short-crestedness in seas. Additionally, the loading effects of both breaking and non-breaking waves needs to be robustly calculated incorporating the combined loading effects and timing offsets on topsides and jackets.



Progress to date:

The JIP has developed a new crest height probability distribution which takes into account wave non-linearities, wave spreading, spectral bandwidth and wave breaking across the range of water depths. The loading effect of the waves, particularly on the topside components has been modelled by a momentum flux method which has shown to correspond well to model testing. The long-term distribution of loading and probability of failure has been calculated using efficient Monte Carlo methods.

Next steps:

Complete Phase 1 of the study as described above and provide guidance to Participants as to how best to integrate the parameterised formulae for structural re-assessments. Subsequent phases are being assessed with potential plans including extension into shallower water and to look at local loading effects.

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