Component Reliability for WECs

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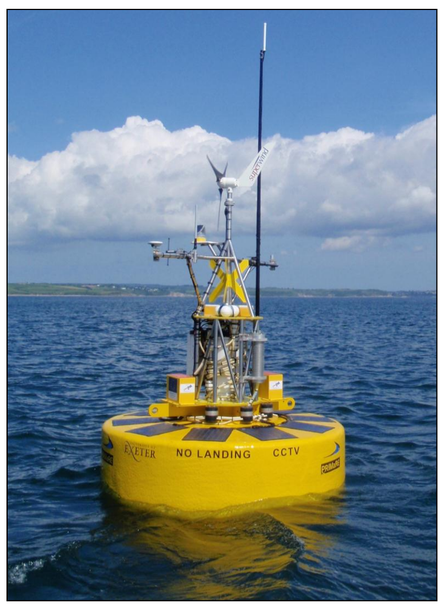
Work stream: Reliability

Introduction

Component reliability and survivability are frequently cited as key challenges for the successful deployment of WECs. Over-engineering results in unnecessary equipment and deployment costs. This makes it important to understand component reliability to inform efficient yet robust design specifications.

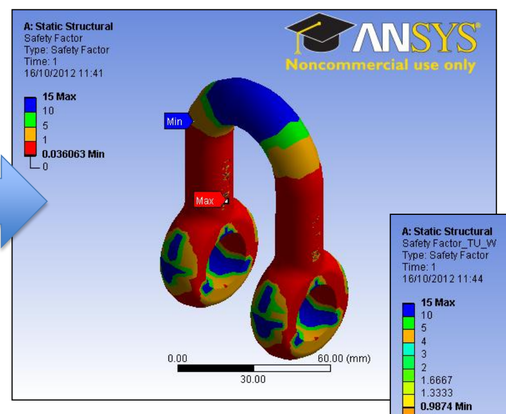
This poster introduces an approach to component reliability testing to estimate failure rates using a combination of simulation, accelerated testing and sea deployment, with a focus on fatigue failures. It builds upon work by Thies *et al* [1-2] with recommended practice from DNV Guidelines [3].

Approach

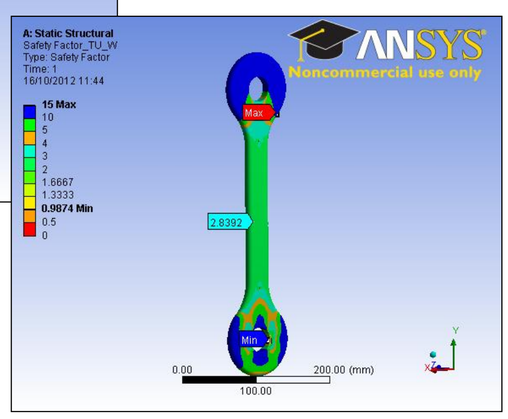


1. South West Mooring Test Facility (SWMTF): Mooring load data analysed from 9 month deployment – maximum loads & cycles identified.

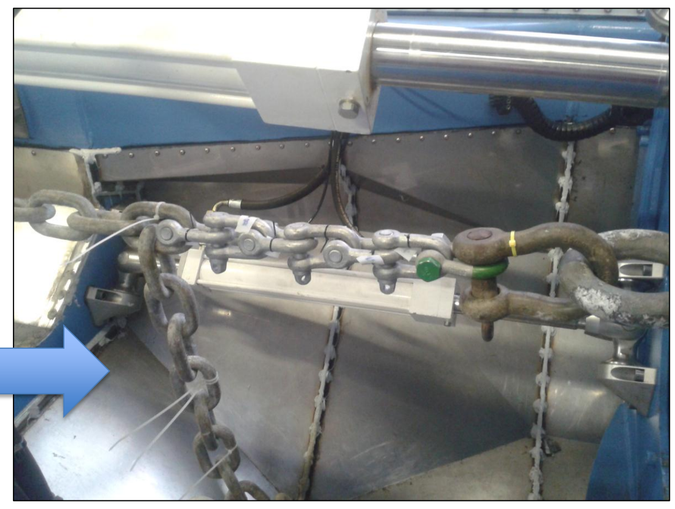
2. Finite Element Analysis (FEA): Models of components developed. Load regimes applied to replicate those measured at sea.



Case study 1: Shackle



Case study 2: Test piece

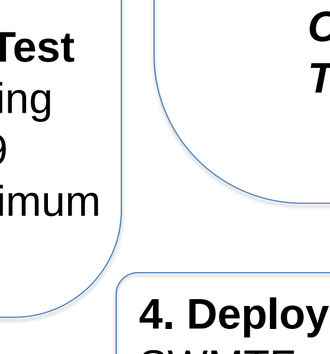


3. Dynamic Marine Component test facility (DMaC): Pre-aging and pre-testing of components, prior to deployment at sea. Focus on fatigue cycling of components.

4. Deployment: Components deployed at sea on a mooring limb of SWMTF. Exposed to sea conditions with detailed monitoring.

Analysis

1. Review failures



Dye-penetrant testing

X-Ray analysis

2. Compare results: Quantify accuracy of FEA models and analytical methods. *Question: How can the different techniques complement one another to speed up component testing?*

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References

1. Thies, P., Smith, G. & Johanning, L. (2012). "Addressing failure rate uncertainties of marine energy converters." Renewable Energy, 44: 359-367.

2. Thies, P., Johanning, L. & Smith, G. (2011). "Towards component reliability testing for marine energy converters." Ocean Engineering, 38: 360-370.

3. DNV recommended practice (2001). Fatigue Design of Offshore Steel Structures.