

Master thesis (m/f/d): Elastic-plastic probabilistic fatigue crack propagation assessments of pressure vessels

The DLR Institute of Maritime Energy Systems in Geesthacht/Kiel focuses on research and developments of innovative solutions for decarbonization in shipping and transfers them into practice by cooperation with industry. To support this, the department of Ship Reliability conducts research and develops methods to ensure the safe and reliable operation of novel energy components and related infrastructure within maritime energy systems.

Modelling for structural integrity assessments always have to deal with parameter uncertainties which arises from measurement data, statistics, geometry, calculation model, and human factors. Consideration of extreme bounded values may lead to overly-conservative result for structural integrity assessments. In the case of infrastructures for renewable energy systems, the effect of renewable energy sources on material and failure mechanism still raises research questions, and the parameter uncertainties are inevitable. Therefore, rather than deterministic assessments, probabilistic fatigue assessments can assist with well-informed decision-making process to maintain the structural integrity of the infrastructures. This thesis aims to extends the use-case of a tool to evaluate the remaining fatigue life of damaged pressure vessels and pipelines by including elastic-plastic fatigue crack propagation model.

The tasks related to this position will include:

- Researching into elastic-plastic fatigue crack growth calculation models for cylindrical pressure vessels, thick-walled and thin-walled pipelines.
- Investigating the regulatory requirements for fatigue crack growth assessments of pressure vessels.
- Determining the failure criteria of these target structural components.
- Integrating the elastic-plastic failure model to the existing in-house probabilistic fatigue crack propagation assessment tool (Python-programming skill is desired).
- Validation of results, and writing the reports.

Qualifications sought:

- Specialized in the fields of mechanical/ material/ reliability/ maritime - engineering/ technology, physics, or any comparable degree program.
- Familiarity with programming languages, preferably Python, Fortran, or MATLAB.
- Background knowledge in fatigue, fracture mechanics, structural mechanics and material.
- Proficiency in conducting literature reviews, gathering and analyzing data, and interpreting research findings.

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