The Institute for Applied Dynamics (LTD) of Friedrich-Alexander-Universität Erlangen-Nürnberg is offering at the earliest possible time a

master thesis

with the topic

Spatially adaptive simulation of a 3D phase-field fracture model

Fracture in materials is an ever-present phenomenon. Especially in the aerospace industry, understanding their behaviour is necessary for designing any structure with a low safety factor. A smeared approach like the phase-field fracture model has gained traction in recent years due to its simplicity to model complex crack paths and straightforward implementation. However, detailed simulations are computationally expensive. The benefit of adaptive simulation approaches is to save computational costs by resolving only the most relevant areas with a fine mesh.

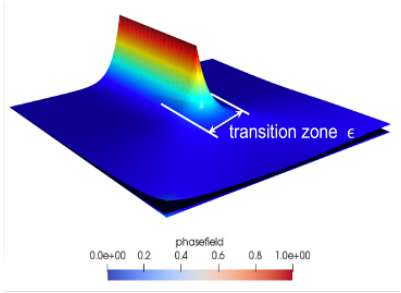

Figure 1: Phase-Field representing initial crack

The goal of this project is to build upon an adaptive phase-field model in 2D and to extend it to a 3D domain to account for various modes and complex geometry. The implementation of this phase-field model will be carried out in the framework of FEniCS/deal.II.

This topic is related to the Research Training Group GRK 2423 FRASCAL "Fracture across Scales".

The thesis involves

- extending the phase-field model to a 3D domain to account for various modes of fracture
- extending the spatially adaptive epsilon and adaptive mesh refinement strategy to a 3D domain
- simulating benchmark problems for numerical validations and convergence studies
- improving the fracture model with existing strain energy splits and irreversibility approaches

Qualifications

- studies in the field of Mechanical Engineering, Computational Engineering, Mathematics or similar
- knowledge in solid mechanics and finite element method
- good programming skills are essential, preferably in Python and C++
- good written and verbal communication skills in English

If interested, please E-mail to:
M.Sc. Dhananjay Phansalkar
dhananjay.phansalkar@fau.de