Institut für
Angewandte Mathematik

Leibniz
Universität
Hannover

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Announcement for WS 18/19:
Numerical methods for contact problems: application to variational phase-field fracture propagation

Contents and Structure of this Class:

This course is devoted to numerical modeling of fracture processes modeled in terms of a variational phase-field method. Using this approach, roughly-speaking, lower-dimensional fractures in a given displacement field are represented with the help of a smoothed indicator function, the so-called phase-field variable.

- In part I, we briefly recapitulate mathematical modeling, including advantages and shortcomings of the phase-field fracture approach, followed by properties on the continuous level.

- In part II, we concentrate on classical numerical aspects. First, we introduce Ambrosio-Tortorelli elliptic functionals to approximate the lower-dimensional crack path in the same dimension as the displacement field. Second, we focus on the treatment of crack irreversibility. Third, discretizations in time and space are considered. Fourth, we address the numerical solution of the nonlinear and linear subproblems.

- In part III of this course, we focus special topics such as on the crack width and crack volume computation, and discuss further numerical aspects of enforcing the crack irreversibility constraint. Also, we briefly discuss pressurized fracture.

- All concepts are substantiated with algorithms and numerical tests in the theoretical and practical exercises.

Dates and rooms (Oct 15, 2018 - Feb 2, 2019):

- Lecture: Wednesdays 14.00 - 16.00 h in room C311 in the main building

- Theoretical exercises: Mondays (every two weeks) 14.00 - 16.00 h again in room C311

- Practical exercises: Tuesdays (every two weeks) 14.00 - 16.00 h in room F411 (cip-pool, main building)

Literature:

- K. Mang, T. Wick; Numerical methods for variational phase-field fracture problems; in preparation, will be provided online before mid-October, 2018

Recommended prerequisites:

- Numerical methods for partial differential equations; see e.g., `https://www.ifam.uni-hannover.de/1562.html` (lecture notes in English, version Jul 10, 2018)

- Numerical methods for nonlinear and coupled problems

- C++ (for the practical exercises) - this is not an introductury class for C++

Language:
The class and exercises will be taught in English language.

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