Modeling, Discretization, Optimization, and Simulation of Phase-Field Fracture Problems

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Jul 21, 2024
WCCM/PANACM - Short Course W24-01, Vancouver
8h30 - 16h30 (4 sessions)

Preface

This class is designed for students and peers who had basic classes in calculus, introduction to numerical methods, continuum mechanics, and finite elements.

The **goal** is to give an introduction to phase-field fracture modeling.

This class is organized into four parts:

- Modeling
- Numerics
- Optimization
- Simulations

Philosophy of this class: Mixture of very basic techniques that are immediately applied to 'complicated' practical and/or current research problems.

Denis Khimin, Leon Kolditz, Viktor Kosin, Katrin Mang, Thomas Wick
(Hannover, Paris, Erlangen, Vancouver 2023-2024)

Preliminaries

Schedule (today, Jul 21, 2024)

- 8:30 - 10:00 Session 1, Exercise 1;
- 10:30 - 12:00 Session 2, Exercise 2;
- 13:00 - 14:30 Session 3, Exercise 3;
- 15:00 - 16:30 Session 4, Discussion.

Literature and software

Materials presented in this short course are largely based on the lecture notes:

- **Denis Khimin, Leon Kolditz, Viktor Kosin, Katrin Mang, Thomas Wick; Modeling, Discretization, Optimization, and Simulation of Phase-Field Fracture Problems, 2023** https://doi.org/10.15488/15172

  and

- **Thomas Wick; Multiphysics Phase-Field Fracture: Modeling, Adaptive Discretizations, and Solvers Radon Series on Computational and Applied Mathematics, Band 28, de Gruyter, October 2020**
  https://www.degruyter.com/document/doi/10.1515/9783110497397/html

- and many references cited in both documents.

Software:

- Basic finite element library: deal.II www.dealii.org
- Basic optimization library: DOpElib www.dopelib.net
- Specific code for phase-field fracture: pfm-crack https://github.com/tjhei/cracks
- Specific code for phase-field optimal control (private github; let me know in case you are interested):
  https://github.com/tommeswick/phase_field_fracture_optimal_control