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

Lecture of

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This talk is devoted to phase-field fracture methods with a focus on discretizations, solvers, adaptivity, optimization, and simulations. The key focus is on the accurate, efficient and robust numerical modeling. These include relationships of model, discretization, and material parameters and their influence on discretizations and the nonlinear (Newton-type methods) and linear numerical solution via iterative methods (e.g., multigrid).

One application of such high-fidelity forward models is in optimal control, where a cost functional is minimized by controlling Neumann boundary conditions. Further applications of our own work include phase-field fracture in porous media and a recently developed phase-field interface approach.

All parts are substantiated with numerical examples and typical numerical observations such as mesh/time refinement studies, computational robustness, computational convergence, and computational times by using high performance parallel computing.