

On quasistatic crack propagation in finite-strain elasticity

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In this lecture we give an overview on rate-independent crack propagation models which were derived and investigated as joint work with Chiara Zanini (University of Udine) and Alexander Mielke (WIAS Berlin). Assuming that the crack path is known in advance, we model crack propagation on the basis of the Griffith fracture criterion. The central quantity in the classical Griffith criterion is the energy release rate (ERR), which is the derivative of the elastic energy with respect to the crack length. The classical Griffith criterion states that a crack does not move as long as the ERR is strictly less than the material dependent fracture toughness. Since in the finite-strain case minimizing deformations are not necessarily unique, the ERR is not well defined in the above strict sense, but it exists as a generalized subdifferential. We reformulate classical crack evolution models in terms of the generalized ERR and prove the existence of solutions via a vanishing viscosity method. The behavior of the model is illustrated via an example.