Numerical methods for hemivariational inequalities modelling a delamination problem

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We present some efficient numerical methods [1-4] for nonconvex nonsmooth variational problems with applications to contact mechanics. The motivation comes from double cantilever beam (DCB) test problems [5]. As a model we consider a delamination problem. Delamination is a typical failure mode of composite materials caused by weak bonding. It arises when a crack initiates and propagates under a destructive loading. The variational formulation of the delamination problem leads to hemivariational inequality with a nonsmooth functional defined on the contact boundary. The problem is first regularized and then discretized either by finite element methods or boundary element methods. Directly approach by applying numerical methods of non-differentiable optimization after discretization of the problem by finite elements is also considered. Finally, we present some numerical examples and compare some of the methods. We numerically compute the displacements and obtain the stresses within the crack tip near area under a given mode I loading, that can not be measured by the DCB test.

This is a joint work with J. Gwinner and H.-J. Gudladt from UniBw München.

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