Topological Sensitivity Analysis Applied to the Francfort-Marigo Damage Model

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Abstract
The topological sensitivity analysis was formally introduced in 1999, and since then became a rapidly expanding research field. This analysis provides the variation of a given functional when the domain is topologically modified by an infinitesimal perturbation, for example by introducing a hole. The main result of this procedure is a scalar field named Topological Derivative that can be seen as a first order approximation of the value of the functional associated to the perturbed domain. In this paper the topological sensitivity analysis is applied to the Francfort-Marigo damage model, which is used to model brittle materials in quasi-static problems. The expressions for the Topological Derivative are developed and an algorithm is proposed to use this information on the study of damage propagation. Some numerical test cases are evaluated to verify the algorithm's performance.

Keywords: topological sensitivity analysis, Francfort-Marigo model, topological derivative