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MODIFIED PHASE FIELD MODEL FOR APPLICATION TO MATERIALS WITH ANISOTROPIC FRACTURE RESISTANCE

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Thin walled metallic structures like tubes or plates often reveal an anisotropic fracture resistance, which is mainly caused by manufacturing processes like hot rolling or extruding. This kind of anisotropy significantly complicates the prediction of the propagation direction of a crack exposed to a certain load state.

Phase field modeling of fracture is an approach, that provides several benefits for the numerical simulation of a crack path. Hence, this method was recently applied to quasi static and dynamic brittle fracture [1, 2]. Within a phase field fracture model the energy released due to the formation of a crack is captured by a crack energy functional. The total energy, which governs the evolution of the crack field by means of minimization principles, is the sum of the elastic and the crack surface energies. Accordingly, for an estimation of the propagation direction no additional criterion, not even for the case of an anisotropic fracture resistance has to be utilized like within conventional crack prediction methods. Accounting for a directional fracture resistance, the non-local component of the crack functional is enhanced to the effect that the surface energy becomes possibly anisotropic. However, the effects on the crack field's evolution, caused by the modification of the non-local term of the crack functional are complex. A parameterization with regard to the anisotropic material behavior is therefore complicated.

Several aspects of this issure are discussed and results of crack path simulations are visualizied to show the accuracy of the proposed model, also with respect to findings from experiments.

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