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Phase-Field Fracture Models for Polymer Nano-Composites

Paras Kukmar[1], and Julia Mergheim[2]

[1] Institute of Applied Mechanics & Central Institute for Scientific Computing, Friedrich-Alexander Universität Erlangen-Nürnberg, Erlangen, Germany [paras.kumar@fau.de]

[2] Institute of Applied Mechanics, Friedrich-Alexander Universität Erlangen-Nürnberg, Erlangen, Germany [julia.mergheim@fau.de]

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Accurate computational modeling of crack propagation in composite materials entails resolution of complex crack toplogies including branching and coalescence of multiple cracks. In recent years, diffuse crack modeling approaches or the well-known phase-field fracture models [3, 4] have emerged as a promising alternative, to the traditionally discrete crack modeling approaches such as the extended finite element method, for modeling crack propagation, especially in case of heterogeneous materials [2]. In this work we incorporate the idea of continuously graded interphases [1], previously employed for modeling size effects in the hyperelastic case, into the phase-field fracture model. This enables us to capture the size effects observed in the fracture behaviour of polymer nano-composites. The suitability of the current approach for modeling the aforementioned class for heterogeneous materials is depicted by means of suitable numerical examples.

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