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# PHASE-FIELD AND GRADIENT DAMAGE MODELS FOR FRACTURE: THEORY, ALGORITHMS AND APPLICATIONS

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## ABSTRACT

While the phase-field approach to fracture [1] was first derived as the regularization of the sharp crack formulation in [2], recasting Griffith's energetic crack propagation criterion into a variational problem, it was shown later that it can be constructed as a special type of gradient damage model [3]. In a continuum setting, it introduces a second field variable – the phase-field, interpretable as damage variable – smoothly transitioning between the intact and the fully broken material state. Originally proposed for brittle fracture, the method has since then been extended to also take more complex materials and phenomena into account, such as ductile fracture, dynamic fracture or fracture in heterogeneous materials to name but a few. Due to the strong mathematical background and their straightforward numerical implementation, the models have been successfully established as powerful framework in many different contexts and applications.

Despite their successful application as well as their mathematical and numerical advantages, many challenges of phase-field and gradient damage models remain to be addressed. These challenges include amongst others the fine temporal and spatial discretization, the latter associated with the inherent length scale, efficient and robust solution algorithms for the highly non-linear and non-convex energy functional as well as their application to multi-axial stress states and to e.g. heterogeneous or anisotropic materials. In this minisymposium, our objective is to discuss recent advances in phase-field and gradient damage models, with talks addressing challenges in theory, algorithms and applications alike.

## REFERENCES

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