Modelling of crack propagation in strongly anisotropic media using phase-field fracture and LEFM

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Abstract

The study of crack propagation in anisotropic media is becoming increasingly important in structural mechanics. Additive manufacturing processes, in particular, are being investigated for their capacity to produce custom parts and their potential to repair structures (Ngo et al., 2018). Understanding and modeling their mechanical degradation is crucial to ensure the safe application of 3D-printed materials. However, knowledge of crack propagation modeling in these materials still needs to be completed. The microstructure of anisotropic materials induces anisotropy in their fracture toughness, complicating the modeling process. While some models can qualitatively represent crack propagation in such materials, only a few quantitative studies are currently available. Previous studies (Corre & Lazarus, 2021; Zhai, 2023) have demonstrated that strongly anisotropic phase-field fracture models can effectively capture crack propagation in anisotropic media. Building on this foundation, this work further evaluates the capabilities of strongly anisotropic phase-field fracture models. In particular, we aim to investigate more complex propagation problems, such as cases involving crack path bifurcation. Simulations will be compared against Linear Elastic Fracture Mechanics results, using the Generalization of the Maximum Energy Release Rate to anisotropic media.

References

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