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A NEW APPROACH FOR MODELING THE NORMAL AND TANGENTIAL CONTACT IN PHASE FIELD CRACKS

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The knowledge of crack propagation behavior is of great interest in many applications in engineering. The phase field method, approximating sharp interfaces with diffuse interfaces, has become a valuable tool for computing crack paths. Besides those paths itself, the interactions inside the cracks are of great interest, too. Especially when dealing with cyclic loading, contact of the crack edges may occur which yields unsymmetrical behavior, since compressive normal forces should be transferred beyond the crack while tensile normal forces should not. One way to handle this, is using anisotropic formulations. Two simple but popular approaches for considering mechanical anisotropies inside a phase field crack are introduced in [1] and in [2]. While both the approaches do a good job in specific considerations, the actual resulting displacement field indicates unrealistic behavior. In the present work a new approach is presented. Similar to [3], a formulation based on the actual crack orientation is used. This enables better control of the anisotropy by considering the normal direction and the tangential direction inside the crack separately, which allows to regulate crack opening, closing and sliding. The tracking of the directions inside the crack is based on the gradient of the phase field order parameter. The initial-boundary value problem is implemented in FEM to investigate the model for 2D problems and representative loads. The model is capable to describe important aspects of the crack contact behavior.

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