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DIRECTION-DEPENDENT ORTHOGONAL DECOMPOSITION OF AN ORTHOTROPIC CONSTITUTIVE MODEL FOR A PHASE FIELD APPROACH TO FRACTURE

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We propose a new direction-dependent model for the unilateral contact constraint involved in the phase field approach to brittle fracture for materials with an anisotropic/ orthotropic nature. The model satisfies the orthogonality condition for anisotropic materials. Consequently, the additive decomposition of the (infinitesimal) strain tensor into a positive (tensile) part and a negative (compressive) part is performed such that the strain energy density is correspondingly partitioned into a crack-driving and a persistent part which, respectively, only depend on positive and negative strain tensors [1]. This implies that the present model can be applied to arbitrary anisotropic elastic behavior. On this basis, we generalize the well-known volumetric-deviatoric decomposition for materials with anisotropy/orthotropy [2]. The results are expected to provide a step forward when developing phase field fracture theories for brittle materials with anisotropic mechanical properties.

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