A homogenization method for ductile-brittle composite laminates at large deformations - DTU Orbit (03/11/2019)

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This paper presents a high fidelity homogenization method for periodically layered composite structures that accounts for plasticity in the matrix material and quasi-brittle damage in the reinforcing layers, combined with strong geometrical nonlinearities. A set of deliberately chosen internal kinematic variables results in a rigorous representation of the kinematics of the two constituents, which in turn allows for complex constitutive laws per constituent to be employed directly in the formulation. The model accounts for hyper-elastoplastic behavior in the matrix phase and hyper-elastic behavior in the reinforcement as well as for the bending stiffness of the reinforcement layers. Additionally to previously proposed models, the present method includes Lemaitre type damage for the reinforcement, making it applicable to a wider range of engineering applications. The capability of the proposed method in representing the combined effect of plasticity, damage and buckling at microlevel within a homogenized setting is demonstrated by means of direct comparisons to a reference discrete model.

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