Solids SPP 256
Variational Methods

Assumed strain methods in micromechanics, laminate composite voxels and level sets

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Abstract

This work deals with the composite voxel method, which - in its original form - furnishes voxels containing more than one material with a surrogate material law accounting for the heterogeneity in the voxel. We show that the laminate composite voxel technique naturally arises as an assumed strain method, i.e., the general framework introduced by Simo-Rifai, for a specific choice of enhanced strain field. As a consequence, laminate composite voxels may be regarded as a kinematic assumption within a discretization scheme rather than a part of material modeling, as suggested originally. We discuss how to seamlessly integrate composite voxels into the framework of a level-set description of the microstructure, in particular the accurate and efficient computation of normals and cut-volume fractions. In contrast to more traditional strategies based on subvoxelations, the introduced method avoids systematic errors when computing composite voxel properties. We demonstrate the applicability of the developed technology for a number of relevant computational examples.