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Probabilistic Homogenization of Hyperelastic Solid Foams

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The present study is concerned with a probabilistic homogenization scheme for amorphous hyperelastic solid foams at finite strain. The scheme is based on the multiple analysis of a small-scale representative volume with a randomized microstructure. The macroscopic stress-strain characteristics are determined numerically by means of a strain energy based homogenization procedure. This procedure assumes macroscopic mechanical equivalence of a representative volume element for the given microstructure and a corresponding volume element consisting of the effective medium if the average strain energy density is equal provided that the volume average of the deformation gradient for both volume elements is equal. The results are evaluated stochastically in terms of the stress mean values and the corresponding standard deviations describing the scatter band width. It is observed that the microstructural disorder has distinct effects on the effective stress-strain response of amorphous cellular solids.

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