An information-theoretic approach for obtaining property PDFs from macro-specifications of microstructural variability[1]

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ABSTRACT

Probability distribution functions (PDFs) providing a complete representation of property variability in polycrystalline materials are difficult to obtain. Reconstruction of probability distribution of material properties on the basis of limited morphological information is an inverse problem of practical significance since many macroscopic properties depend strongly on geometrical variability of the micro- constituents. We characterize the unknown probabilities of the microstructural parameters making use of the macro-information given in the form of average values (such as average grain sizes) and using the concepts of maximum information entropy (MAXENT) and stochastic geometry. The PDFs are used to generate consistent samples of microstructures whose properties are assessed using a multi-scale framework based on a newly developed fully implicit Lagrangian large strain homogenization framework.

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