The choice of representative volumes for random materials

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The most widely employed method for determining the effective large-scale properties of random materials is the representative volume element (RVE) method: It basically proceeds by choosing a sample of the random medium - the representative volume element - and computing its properties. To obtain an accurate approximation for the effective material properties, the RVE should reflect the statistical properties of the material well. Hence, it is desirable to choose a large sample of the random medium as an RVE. However, an increased size of the RVE comes with an increased computation cost. For this reason, there have been attempts in material science and mechanics towards capturing the statistical properties of the material in a better way in an RVE of a fixed size. We provide an analysis of an approach by Le Bris, Legoll, and Minvielle, which has been capable of improving the computational efficiency by a factor of 10-50 in some numerical examples by such an ansatz.