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Abstract

Within the framework of the homogenization of heterogeneous media, a non local model is proposed. A field of non-local filtered stiffness tensor is introduced by filtering the solution to the homogenization problem. The filtered stiffness tensor, depending on the filter to heterogeneity size ratio, provides a continuous transition from the actual micro-scale heterogeneous stiffness field to the macro-scale homogenized stiffness tensor. For any intermediate filter size, the homogenization of the filtered stiffness yields exactly the homogenized stiffness, therefore it is called macroscopically consistent. The non-local stiffness tensor is intrinsically non symmetric, but its spatial fluctuations are smoothed, allowing for a less refined discretization in numerical methods. As a by-product, a two step heterogeneous multiscale method is proposed to reduce memory and computational time requirements of existing direct schemes while controlling the accuracy of the result. The first step is the estimation of the filtered stiffness at sampling points by means of an oversampling strategy to reduce boundary effects. The second step is the numerical homogenization of the obtained sampled filtered stiffness.

Keywords: Homogenization, Non-local modelling, Filtering, Heterogeneous

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