

Convergence analysis of full elastic tensors to homogenization predictions in periodic composite material design

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Abstract

Periodic homogenization models are often used to compute the elastic properties of periodic composite materials based on the shape and periodicity of a given material microstructure. This paper extends previous work to 3-D analysis and anisotropic design cases investigating how rapidly the mean compliance and the 21 independent elastic coefficients from the apparent stiffness tensor converge to the corresponding values of the homogenized tensor. The outcome indicates that it is sufficient to have a low scale factor to replace the non-homogeneous composite by the equivalent homogeneous material with the moduli computed by homogenization.

Keywords: homogenization; optimization; topology; scale; cellular.