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Y. Benveniste

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Abstract

This paper is a reconsideration and reformulation of the Mori-Tanaka's theory in its application to the computation of the effective properties of composites. Previous applications of the theory in this context continued to be linked with eigenstrain, equivalent inclusion, and back stress concepts, and many times involved energy considerations. In this paper we adopt the â€˜direct approachâ€™ of defining and computing effective moduli. By elucidating the nature of the approximation in applying Moriâ€”Tanaka's theory to composites insofar as the â€˜concentration-factorâ€™ tensors are concerned, we achieve a straightforward exposition and interpretation of the method which are different than those existing in previous formulations. The analysis is given for two-phase composites with anisotropic elastic constituents and an inclusion phase consisting of aligned or randomly oriented ellipsoidal particles. The derived simple expressions for the predicted stiffness and compliance tensors permit a proof of the

self-consistency of the method, a discussion of the predictions' relation to the Hashin-Shtrikman bounds in the case of isotropic constituents and randomly oriented ellipsoidal particles, and finally a derivation of some new results in randomly cracked bodies with penny-shaped cracks.

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