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MICROPOLAR IDENTIFICATION OF PERIODIC CAUCHY MATERIALS THROUGH ASYMPTOTIC HOMOGENIZATION

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We propose a micropolar-based asymptotic homogenization approach for the analysis of composite materials characterized by periodic microstructure. First, in the framework of the asymptotic homogenization, we derive the upscaling relations to express the macro-descriptors (macro displacement and the micropolarrotation fields) as a function of the micro displacement field. The micro displacement field is, in turn, obtained by exploiting a third order approximation of the asymptotic expansion. It follows that the macro descriptors are directly related to both perturbation functions and micropolar two-dimensional deformation modes. Furthermore, we introduce a properly conceived energy equivalence between the macroscopic point and a microscopic representative portion of the periodic composite materialis to derive the consistent overall micropolar constitutive tensors. We observe both that these constitutive tensors are independent on the choice of the periodic cell, and that the internal-length-scale-dependent constitutive tensors vanish when the microstructure tends to vanish. We finally propose some illustrative example to show the capabilities of the proposed approach.

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