Periodic homogenization of SMA composites

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Abstract

In this work we propose a homogenization framework for periodic composites with shape memory alloy (SMA) constituents. We study the mechanical behavior of these composites under various mechanical and uniform isothermal conditions, by solving the homogenization problem in the macroscopic and the microscopic scale simultaneously. The numerical implementation of the developed framework considers three parts: the macroscale analysis, the representative volume element problem and the computation of the effective tangent modulus. Numerical examples on multilayered composites with SMA and elastic or elastoplastic constituents demonstrate the framework’s capabilities, as well as the complexity of the composite response and the SMA stress state, even in the case of uniaxial macroscopic stress conditions.

Keywords: Periodic homogenization, shape memory alloys, pseudoelastic loading

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