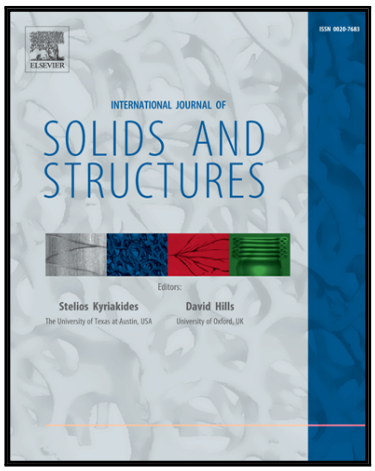

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A. Bacigalupo, L. Morini, A. Piccolroaz

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Multiscale asymptotic homogenization analysis of thermo-diffusive composite materials

A. Bacigalupo*[1], L. Morini[2], and A. Piccolroaz[2]

[1] *IMT Institute for Advanced Studies, Lucca, Italy*

[2] *Department of Civil, Environmental and Mechanical Engineering, University of Trento, Italy*

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Abstract

In this paper an asymptotic homogenization method for the analysis of composite materials with periodic microstructure in presence of thermodiffusion is described. Appropriate down-scaling relations correlating the microscopic fields to the macroscopic displacements, temperature and chemical potential are introduced. The effects of the material inhomogeneities are described by perturbation functions derived from the solution of recursive cell problems. Exact expressions for the overall elastic and thermodiffusive constants of the equivalent first order thermodiffusive continuum are derived. The proposed approach is applied to the case of a two-dimensional bi-phase orthotropic layered material, where the effective elastic and thermodiffusive properties can be determined analytically. Considering this illustrative example and assuming periodic body forces, heat and mass sources acting on the medium, the solution performed by the first order homogenization approach is compared with the numerical results obtained by the heterogeneous model.

*Corresponding author. Tel.: +39 0583 4326613, email address: andrea.bacigalupo@imtlucca.it