Accepted Manuscript

Sensitivity to material contrast in homogenization of random particle composites as micropolar continua

Emanuele Reccia, Maria Laura De Bellis, Patrizia Trovalusci, Renato Masiani

PII: S1359-8368(17)32508-8

DOI: 10.1016/j.compositesb.2017.10.017

Reference: JCOMB 5337

To appear in: *Composites Part B*

Received Date: 25 July 2017

Revised Date: 31 August 2017

Accepted Date: 10 October 2017

Please cite this article as: Reccia E, De Bellis ML, Trovalusci P, Masiani R, Sensitivity to material contrast in homogenization of random particle composites as micropolar continua, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.10.017.

Sensitivity to material contrast in homogenization of random particle composites as micropolar continua

Emanuele Reccia[1*], Maria Laura De Bellis[2], Patrizia Trovalusci[1], Renato Masiani[1]

[1]Department of Structural and Geotechnical Engineering, Sapienza University of Rome,
[2]Department of Innovation Engineering, University of Salento, Lecce, Italy
[*] *corresponding author* emanuele.reccia@uniroma1.it

Abstract

Several composite materials used in engineering – such as ceramic/metal matrix composites, concrete, masonry-like/geo–materials and innovative meta–materials – have internal micro-structures characterized by a random distribution of inclusions (particles) embedded in a matrix. Their structural response is highly influenced not only by the mechanical properties of components, but also by the shape, size and position of the inclusions.

In this work, we adopt a statistically-based micropolar homogenization procedure, to obtain the overall elastic properties of homogeneous micropolar continua able to naturally account for scale and skew–symmetric shear effects. Attention is paid to the sensitivity to material contrast, defined as the mismatch between classical and micropolar constitutive properties of matrix and inclusions. A statistical specifically conceived convergence criterion is adopted which allow us to identify the REV (Representative Volume Element) for any value of material contrast.

Keywords— Particle Composites, Micropolar continua, Scale-Dependent Statistical Homogenization, Representative Volume Element

1 Introduction

Particle composites are a special class of heterogeneous materials exhibiting an internal microstructure characterized by particles randomly distributed