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Nota di contenuto	Homogenization of Coupled Phenomena in Heterogenous Media; Contents; Main notations; Introduction; Part one. Upscaling Methods; Chapter 1. An Introduction to Upscaling Methods; 1.1. Introduction; 1.2. Heat transfer in a periodic bilaminated composite; 1.2.1. Transfer parallel to the layers; 1.2.2. Transfer perpendicular to the layers; 1.2.3. Comments; 1.2.4. Characteristic macroscopic length; 1.3. Bounds on the effective coefficients; 1.3.1. Theorem of virtual powers; 1.3.2. Minima in the complementary power and potential power; 1.3.3. Hill principle; 1.3.4. Voigt and Reuss bounds 1.3.4.1. Upper bound: Voigt 1.3.4.2. Lower bound: Reuss; 1.3.5. Comments; 1.3.6. Hashin and Shtrikman's bounds; 1.3.7. Higher-order bounds; 1.4. Self-consistent method; 1.4.1. Boundary-value problem; 1.4.2. Self-consistent hypothesis; 1.4.3. Self-consistent method with simple inclusions; 1.4.3.1. Determination of ϵ for a homogenous

spherical inclusion; 1.4.3.2. Self-consistent estimate; 1.4.3.3. Implicit morphological constraints; 1.4.4. Comments; Chapter 2. Heterogenous Medium: Is an Equivalent Macroscopic Description Possible?; 2.1.

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Methodology; 2.4.3. Parallels between macroscopic models for materials with periodic and random structures; 2.4.3.1. Periodic materials; 2.4.3.2. Random materials with a REV

2.4.4. Hill macro-homogeneity and separation of scales 2.5. Comments on multiple scale methods and statistical methods; 2.5.1. On the periodicity, the stationarity and the concept of the REV; 2.5.2. On the absence of, or need for macroscopic prerequisites; 2.5.3. On the homogenizability and consistency of the macroscopic description; 2.5.4. On the treatment of problems with several small parameters; Chapter 3. Homogenization by Multiple Scale Asymptotic Expansions; 3.1. Introduction; 3.2. Separation of scales: intuitive approach and experimental visualization

3.2.1. Intuitive approach to the separation of scales 3.2.2. Experimental visualization of fields with two length scales; 3.2.2.1. Investigation of a flexible net; 3.2.2.2. Photoelastic investigation of a perforated plate; 3.3. One-dimensional example; 3.3.1. Elasto-statics; 3.3.1.1. Equivalent macroscopic description; 3.3.1.2. Comments; 3.3.2. Elastodynamics; 3.3.2.1. Macroscopic dynamics: $PI = O(2)$; 3.3.2.2. Steady state: $PI = O(3)$; 3.3.2.3. Non-homogenizable description: $PI = O()$; 3.3.3. Comments on the different possible choices for spatial variables 3.4. Expressing problems within the formalism of multiple scales

Sommario/riassunto

Both naturally-occurring and man-made materials are often heterogeneous materials formed of various constituents with different properties and behaviours. Studies are usually carried out on volumes of materials that contain a large number of heterogeneities. Describing these media by using appropriate mathematical models to describe each constituent turns out to be an intractable problem. Instead they are generally investigated by using an equivalent macroscopic description - relative to the microscopic heterogeneity scale - which describes the overall behaviour of the media. Fundamental que
