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Autore	Mishnaevsky L (Leon)
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materials

2.6 Topological and statistical description of microstructures of compositesReferences; 3 Damage and failure of materials: concepts and methods of modeling; 3.1 Fracture mechanics: basic concepts; 3.1.1 Griffith theory of brittle fracture; 3.1.2 Stress field in the vicinity of a crack; 3.1.3 Stress intensity factor and energy release rate; 3.1.4 J-integral and other models of plastic effects; 3.2 Statistical theories of strength; 3.2.1 Worst flaw and weakest link theories; 3.2.2 Random processes and stochastic equations; 3.2.3 Fiber bundle models and chains of fiber bundles

3.3 Damage mechanics3.3.1 Models of elastic solids with many cracks; 3.3.2 Phenomenological analysis of damage evolution (continuum damage mechanics); 3.3.3 Micromechanical models of void growth in ductile materials; 3.3.4 Thermodynamic damage models; 3.3.5 Nonlocal and gradient enhanced damage models; 3.4 Numerical modeling of damage and fracture; References; 4 Microstructure-strength relationships of composites: concepts and methods of analysis; 4.1 Interaction between elements of microstructures: physical and mechanical models

4.1.1 Theories of constrained plastic flow of ductile materials reinforced by hard inclusions4.1.2 Shear lag model and its applications; 4.2 Multiscale modeling of materials and homogenization; 4.2.1 Multiscale modeling; 4.2.2 Homogenization; 4.3 Analytical estimations and bounds of overall elastic properties of composites; 4.3.1 Rule-of-mixture and classical Voigt and Reuss approximations; 4.3.2 Hashin-Shtrikman bounds; 4.3.3 Dilute distribution model; 4.3.4 Effective field method and Mori-Tanaka model; 4.3.5 Composite sphere and composite cylinder assemblage

4.3.6 Self-consistent models and other effective medium methods

Sommario/riassunto

Mechanical properties of composite materials can be improved by tailoring their microstructures. Optimal microstructures of composites, which ensure desired properties of composite materials, can be determined in computational experiments. The subject of this book is the computational analysis of interrelations between mechanical properties (e.g., strength, damage resistance stiffness) and microstructures of composites. The methods of mesomechanics of composites are reviewed, and applied to the modelling of the mechanical behaviour of different groups of composites. Individual chapters are dev