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KADE BRADFORD

Micromechanics of defects in solids Springer Science & Business Media
This book presents the most recent progress of fundamental nature made in the new developed field of micromechanics: transformation field analysis, variational bounds for nonlinear composites, higher-order gradients in micromechanical damage models, dynamics of composites, pattern based variational bounds.
Micromechanics of Composite Materials Springer Nature
This book is aimed at those in engineering/scientific fields who have never learned programming before but are eager to master the C language quickly so as to immediately apply it to problem solving in numerical analysis. The book skips unnecessary formality but explains all the important aspects of C essential for numerical analysis. Topics covered in numerical analysis include single and simultaneous equations, differential equations, numerical integration, and simulations by random numbers. In the Appendices, quick tutorials for gnuplot, Octave/MATLAB, and FORTRAN for C users are provided.
Introduction To Micromechanics And Nanomechanics (2nd Edition) Springer Nature
This book sterns from a course on Micromechanics that I started about fifteen years ago at Northwestern University. At that time, micro mechanics was a rather unfamiliar subject. Although I repeated the course every year, I was ne ver convinced that my notes have quite developed into a final manuscript because new topics emerged con stantly requiring revisions, and additions. I finally came to realize that if this is continued, then I will never complete the book to my total satisfaction. Meanwhile, T. Mori and I had coauthored a book in Micromechanics, published by Baifu-kan, Tokyo, in Japanese, entitled 1975. It received an extremely favorable response from students and researchers in Japan. This encouraged me to go ahead and publish my course notes in their latest version, as this book, which contains further development of the subject and is more comprehensive than the one published in Japanese. Micromechanics encompasses mechanics related to microstructures of materials. The method employed is a continuum theory of elasticity yet its applications cover a broad area relating to the mechanical behavior of materials: plasticity, fracture and fatigue, constitutive equa tions, composite materials, polycrystals, etc. These subjects are treated in this book by means of a powerful and unified method which is called the 'eigenstrain method. ' In particular, problems relating to inclusions and dislocations are most effectively analyzed by this method, and therefore, special emphasis is placed on these topics.
Micromechanics and Nanosimulation of Metals and Composites Wiley
This book presents the micromechanics of random structure heterogeneous materials, a multidisciplinary research area that has experienced a revolutionary renascence at the overlap of various branches of materials science, mechanical engineering, applied mathematics, technical physics, geophysics, and biology. It demonstrates intriguing successes of unified rigorous theoretical methods of applied mathematics and statistical physics in material science of microheterogeneous media. The prediction of the behaviour of heterogeneous materials by the use of properties of constituents and their microstructure is a central problem of micromechanics. This book is the first in micromechanics where a successful effort of systematic and fundamental research of the microstructure of the wide class of heterogeneous materials of natural and synthetic nature is attempted. The uniqueness of the book lies in its development and expressive representation of statistical methods quantitatively describing random structures which are at most adopted for the forthcoming evaluation of a wide variety of macroscopic transport, electromagnetic, strength, and elastoplastic properties of heterogeneous materials. Applies the unified generalized theory to analze the broadest range of problems Sheds light on opportunities for a fundamentally new generalized theory leading to discovery of fundamentally new effects critical for a wide range of nonlinear and nonlocal problems Successfully combines advanced numerical methods for analysis of a finite number of interacting inhomogeneities in either the bounded or unbounded domains .
Micromechanics of Materials, with Applications Springer Science & Business Media
Intended as a first introduction to the micromechanics of porous media, this book entitled “Microporomechanics” deals with the mechanics and physics of multiphase porous materials at nano and micro scales. It is composed of a logical and didactic build up from fundamental concepts to state-of-the-art theories. It features four parts: following a brief introduction to the mathematical rules for upscaling operations, the first part deals with the homogenization of transport properties of porous media within the context of asymptotic expansion techniques. The second part deals with linear microporomechanics, and introduces linear mean-field theories based on the concept of a representative elementary volume for the homogenization of poroelastic properties of porous materials. The third part is devoted to Eshelby’s problem of ellipsoidal inclusions, on which much of the micromechanics techniques are based, and illustrates its application to linear diffusion and microporoelasticity. Finally, the fourth part extends the analysis to microporo-in-elasticity, that is the nonlinear homogenization of a large range of frequently encountered porous material behaviors, namely, strength homogenization, nonsaturated microporomechanics, microporoplasticity and microporofracture and microporodamage theory.
Introduction to Micromechanics World Scientific
The work deals with the thermomechanical mechanical behavior of microstructured materials, which has attracted considerable interest from both the academic and the industrial research communities. The past decade has witnessed major progress in the development of analytical as well as numerical modeling approaches and of experimental methods in this field. Considerable research efforts have been aimed at obtaining microstructure-property correlations and at studying the damage and failure behavior of microstructured materials. The book combines an overview of important analytical and numerical modeling approaches in continuum micromechanics and is aimed at academic and industrial researchers, such as materials scientists, mechanical engineers, and applied physicists, who are working or planning to work in the field of mechanics of microstructured materials such as composites, metals and ceramics.
Micromechanics of Contact and Interphase Layers North Holland
Here is an accurate and timely account of micromechanics, which spans materials science, mechanical engineering, applied mathematics, technical physics, geophysics, and biology. The book features rigorous and unified theoretical methods of applied mathematics and statistical physics in the material science of microheterogeneous media. Uniquely, it offers a useful demonstration of the systematic and fundamental research of the microstructure of the wide class of heterogeneous materials of natural and synthetic nature.
Advances in Mechanics and Mathematics Springer Science & Business Media
In this second edition several new topics of technological interest have been added. These include: coupled mechanical and nonmechanical overall properties of heterogeneous piezoelectric materials, new upper and lower bounds for these coupled properties, a systematic comparison between the average-field theory and the results obtained using multi-scale perturbation theory, an account of the uniform-field theory, improveable bounds on overall moduli of heterogeneous materials which remain finite even when isolated cavities and rigid inclusions are present, and a brief account of a fundamental duality principle in anisotropic elasticity. In addition, better explanations of a number of topics are given, more recent references are added, the Subject Index has been expanded and printing and typographical errors have been corrected. The material is organized into two parts preceded by a précis. Part 1 consists of four chapters which are organized into fourteen sections and four appendixes. It deals with materials with microdefects such as cavities, cracks, and inclusions, as well as with elastic composites. Part 2 consists of two chapters which are divided into seven sections. It provides an introduction to the theory of linear elasticity, added to make the book self-contained, since linear elasticity serves as the basis of the development of small-deformation micromechanics. Part 2 mainly contains part of the lecture notes on elasticity which the first author wrote in the late 1960's. The material is mostly standard, given for background information.
Micromechanics and Nanomechanics of Composite Solids Pitman Publishing
The complete primer to micromechanics Fundamentals of Micromechanics of Solids is the first book integrating various approaches in micromechanics into a unified mathematical framework, complete with coverage of both linear and nonlinear behaviors. Based on this unified framework, results from the authors' own research, as well as existing results in the literature are re-derived in a logical, pedagogical, and understandable approach. It enables readers to follow the various developments of micromechanics theories and quickly understand its wide range of applications of micromechanics. This helpful guide is a powerful tool for learning the most fundamental ideas and approaches, basic concepts, principles, and methodologies of micromechanics. Readers will find: * Vigorous derivations of the mathematical framework * Introductions to both linear and nonlinear material behavior * Unique coverage of brittle damage, shape memory alloys, and TRIP steels * Large numbers of problems and exercises to support teaching and learning the concepts * Lists of references and suggested readings in each chapter
Trends in Applications of Pure Mathematics to Mechanics Springer
Mathematics is undoubtedly the key to state-of-the-art high technology. It is aninternationaltechnicallanguageandprovestobeaneternallyyoungscience to those who have learned its ways. Long an indispensable part of research thanks to modeling and simulation, mathematics is enjoying particular vit- ity now more than ever. Nevertheless, this stormy development is resulting in increasingly high requirements for students in technical disciplines, while general interest in mathematics continues to wane at the same time. This book and its appendices on the Internet seek to deal with this issue, helping students master the di?cult transition from the receptive to the productive phase of their education. The author has repeatedly held a three-semester introductory course - titled Higher Mathematics at the University of Stuttgart and used a series of “handouts” to show further aspects, make the course contents more motiv- ing, and connect with the mechanics lectures taking place at the same time. One part of the book has more or less evolved from this on its own. True to the original objective, this part treats a variety of separate topics of varying degrees of di?culty; nevertheless, all these topics are oriented to mechanics. Anotherpartofthisbookseekstoo?eraselectionofunderstandablereal- ticmodelsthatcanbeimplementeddirectlyfromthemultitudeofmathema- calresources.Theauthordoesnotattempttohidehispreferenceof Numerical Mathematics and thus places importance on careful theoretical preparation.
Recent Developments in Micromechanics Springer
This unprecedented book offers all the details of the mathematical mechanics underlying state-of-the-art modeling of skeletal muscle contraction. The aim is to provide an integrated vision of mathematics, physics, chemistry and biology for this one understanding. The method is to take advantage of modern mathematical technology — Eilenberg-Mac Lane category theory, Robinson infinitesimal calculus and Kolmogorov probability theory — to examine a succession of distinguishable universes of particles, and continuous, thermodynamic, chemical, and molecular bodies, all with a focus on proofs by algebraic calculation without set theory. Also provided are metaphors and analogies, and careful distinction between representational pictures, mental model drawings, and mathematical diagrams.High school mathematics teachers, undergraduate and graduate college students, and researchers in mathematics, physics, chemistry, and biology may use this integrated publication to broaden their perspective on science, and to experience the precision that mathematical mechanics brings to understanding the muscular mechanism of nearly

all animal behavior.
Heterogeneous Media Springer
The strength of metallic materials determines the usability and reliability of all the machines, tools and equipment around us. Yet, the question about which mechanisms control the strength and damage resistance of materials and how they can be optimised remains largely unanswered. How do real, heterogeneous ma- rials deform and fail? Why can a small modification of the microstructure increase the strength and damage resistance of materials manifold? How can the strength of heterogeneous materials be predicted? The purpose of this book is to present different experimental and computational analysis methods of micromechanics of damage and strength of materials and to demonstrate their applications to various micromechanical problems. This book summarizes at a glance some of the publications of the Computational Mechanics Group at the IMWF/MPA Stuttgart, dealing with atomistic, micro- and meso- chanical modelling and experimental analysis of strength and damage of metallic materials. In chapter 1, the micromechanisms of damage and fracture in different groups of materials are investigated experimentally, using direct observations and inverse analysis. The interaction of microstructural elements with the evolving damage is studied in these experiments. Chapter 2 presents different approaches to the - cromechanical simulation of composite materials: embedded unit cells, multiphase finite elements and multiparticle unit cells. Examples of the application of these models to the analysis of deformation and damage in different materials are given. Chapter 3 deals with the methods of numerical modelling of damage evolution and crack growth in heterogeneous materials.
Mechanics of Microstructured Materials Walter de Gruyter GmbH & Co KG
This book on micromechanics explores both traditional aspects and the advances made in the last 10–15 years. The viewpoint it assumes is that the rapidly developing field of micromechanics, apart from being of fundamental scientific importance, is motivated by materials science applications. The introductory chapter provides the necessary background together with some less traditional material, examining e.g. approximate elastic symmetries, Rice’s technique of internal variables and multipole expansions. The remainder of the book is divided into the following parts: (A) classic results, which consist of Rift Valley Energy (RVE), Hill’s results, Eshelby’s results for ellipsoidal inhomogeneities, and approximate schemes for the effective properties; (B) results aimed at overcoming these limitations, such as volumes smaller than RVE, quantitative characterization of “irregular” microstructures, non-ellipsoidal inhomogeneities, and cross-property connections; (C) local fields and effects of interactions on them; and lastly (D) – the largest section – which explores applications to eight classes of materials that illustrate how to apply the micromechanics methodology to specific materials.
Complex Variables for Engineers with Mathematica North Holland
Three subjects of major interest in one textbook: linear elasticity, mechanics of structures in linear isotropic elasticity, and nonlinear mechanics including computational algorithms. After the simplest possible, intuitive approach there follows the mathematical formulation and analysis, with computational methods occupying a good portion of the book. There are several worked-out problems in each chapter and additional exercises at the end of the book, plus mathematical expressions are bery often given in more than one notation. The book is intended primarily for students and practising engineers in mechanical and civil engineering, although students and experts from applied mathematics, materials science and other related fields will also find it useful.
C Programming and Numerical Analysis Springer Science & Business Media
This book stems from a course on Micromechanics that I started about fifteen years ago at Northwestern University. At that time, micromechanics was a rather unfamiliar subject. Although I repeated the course every year, I was never convinced that my notes have quite developed into a final manuscript because new topics emerged constantly requiring revisions, and additions. I finally came to realize that if this is continued, then I will never complete the book to my total satisfaction. Meanwhile, T. Mori and I had coauthored a book in Japanese, entitled Micromechanics, published by Baifu-kan, Tokyo, in 1975. It received an extremely favorable response from students and re searchers in Japan. This encouraged me to go ahead and publish my course notes in their latest version, as this book, which contains further development of the subject and is more comprehensive than the one published in Japanese. Micromechanics encompasses mechanics related to microstructures of materials. The method employed is a continuum theory of elasticity yet its applications cover a broad area relating to the mechanical behavior of materi als: plasticity, fracture and fatigue, constitutive equations, composite materi als, polycrystals, etc. These subjects are treated in this book by means of a powerful and unified method which is called the 'eigenstrain method. ' In particular, problems relating to inclusions and dislocations are most effectively analyzed by this method, and therefore, special emphasis is placed on these topics.
An Introduction to Computational Micromechanics Springer
This book presents the latest developments and applications of micromechanics and nanomechanics. It particularly focuses on some recent applications and impact areas of micromechanics and nanomechanics that have not been discussed in traditional micromechanics and nanomechanics books on metamaterials, micromechanics of ferroelectric/piezoelectric,
Mathematical Methods for Mechanics Springer Science & Business Media
This volume consists of the state-of-the-art reports on new developments in micromechanics and the modeling of nanoscale effects, and is a companion book to the recent Kluwer volume on nanomechanics and mul- scale modeling (it is entitled Trends in Nanoscale Mechanics). The two volumes grew out of a series of discussions held at NASA Langley Research Center (LaRC), lectures and other events shared by many researchers from the national research laboratories and academia. The key events include the 2001 Summer Series of Round-Table Discussions on Nanotechnology at ICASE Institute (NASA LaRC) organized by Drs. V. M. Harik and M. D. Salas and the 2002 NASA LaRC Workshop on Multi-scale Modeling. The goal of these interactions was to foster collaborations between academic researchers and the ICASE Institute (NASA LaRC), a universi- based institute, which has pioneered world-class computational, theoretical and experimental research in the disciplines that are important to NASA. Editors gratefully acknowledge help of Ms. E. Todd (ICASE, NASA LaRC), the ICASE Director M. D. Salas and all reviewers, in particular, Dr. B. Diskin (ICASE/NIA, NASA LaRC), Prof. R. Haftka (University of Florida), Dr. V. M. Harik (ICASE/Swales Aerospace, NASA LaRC), Prof.
Mathematics and Mechanics - The Interplay WIT Press
Mathematics plays an important role in mechanics and other human endeavours. Validating examples in this first volume include, for instance: the connection between the golden ratio (the “divine proportion" used by Phidias and many other artists and enshrined in Leonardo's Vitruvian Man, shown on the front cover), and the Fibonacci spiral (observable in botany, e.g., in the placement of sunflower seeds); is the coast of Tuscany infinitely long?; the equal-time free fall of a feather and a lead ball in a vacuum; a simple diagnostic for changing your car's shocks; the Kepler laws of the planets; the dynamics of the Sun-Earth-Moon system; the tides' mechanism; the laws of friction and a wheel rolling down a partially icy slope; and many more. The style is colloquial. The emphasis is on intuition - lengthy but intuitive proofs are preferred to simple non-intuitive ones. The mathematical/mechanical sophistication gradually increases, making the volume widely accessible. Intuition is not at the expense of rigor. Except for grammar-school material, every statement that is later used is rigorously proven. Guidelines that facilitate the reading of the book are presented. The interplay between mathematics and mechanics is presented within a historical context, to show that often mechanics stimulated mathematical developments - Newton comes to mind. Sometimes mathematics was introduced independently of its mechanics applications, such as the absolute calculus for Einstein's general theory of relativity. Bio-sketches of all the scientists encountered are included and show that many of them dealt with both mathematics and mechanics.
Micromechanics: Overall Properties of Heterogeneous Materials Springer Nature
In this, its second corrected printing, Zohdi and Wriggers’ illuminating text presents a comprehensive introduction to the subject. The authors include in their scope basic homogenization theory, microstructural optimization and multifield analysis of heterogeneous materials. This volume is ideal for researchers and engineers, and can be used in a first-year course for graduate students with an interest in the computational micromechanical analysis of new materials.
Mechanics of Deformable Solids John Wiley & Sons
Complex variable theory is attractive for engineers as it offers elegant approaches for certain types of differential equations in engineering including heat transfer, solid mechanics, and fluid mechanics. However, a gap exists between books written by mathematicians and books written by engineers in their specific fields. Naturally, mathematicians tend to emphasize rigorousness and consistency while less emphasizing applications. On the other hand, books written by engineers often jump directly to the specific topics assuming that the readers already have sufficient background of complex variables and the pathway from theory to the application is not clearly elucidated. This book closes the gap in the literature. providing a smooth transition from basic theory to the application is accomplished. Although it is not possible to cover all the topics in engineering exhaustively, the readers can at least find the logic of how and why complex variables are effective for some of the engineering problems. Another motivation for writing this book is to demonstrate that the readers can take advantage of a computer algebra system, Mathematica, to facilitate tedious algebra and visualize complex functions so that they can focus on principles instead of spending endless hours on algebra by hand. Unlike numerical tools such as MATLAB and FORTRAN, Mathematica can expand, differentiate, and integrate complex-valued functions symbolically. Mathematica can be used as a stand-alone symbolic calculator or a programming tool using the Wolfram Language. If Mathematica is not available locally, Wolfram Cloud Basic can be used online as a free service to execute Mathematica statements.