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Elements of Continuum Mechanics and Thermodynamics World Scientific Publishing Company

The subject of computational plasticity encapsulates the numerical methods used for the finite element simulation of the behaviour of a wide range of engineering materials considered to be plastic – i.e. those that undergo a permanent change of shape in response to an applied force. Computational Methods for Plasticity: Theory and Applications describes the theory of the associated numerical methods for the simulation of a wide range of plastic engineering materials; from the simplest infinitesimal plasticity theory to more complex damage mechanics and finite strain crystal plasticity models. It is split into three parts - basic concepts, small strains and large strains. Beginning with elementary theory and progressing to advanced, complex theory and computer implementation, it is suitable for use at both introductory and advanced levels. The book: Offers a self-contained text that allows the reader to learn computational plasticity theory and its implementation from one volume. Includes many numerical examples that illustrate the application of the methodologies described. Provides introductory material on related disciplines and procedures such as tensor analysis, continuum mechanics and finite elements for non-linear solid mechanics. Is accompanied by purpose-developed finite element software that illustrates many of the techniques discussed in the text, downloadable from the book's companion website. This comprehensive text will appeal to postgraduate and graduate students of civil, mechanical, aerospace and materials engineering as well as applied mathematics and courses with computational mechanics components. It will also be of interest to research engineers, scientists and software developers working in the field of computational solid mechanics.

Computational Methods for Plasticity Cambridge University Press

The modeling and simulation of fluids, solids and other materials with significant coupling and thermal effects is becoming an increasingly important area of study in applied mathematics and engineering. Necessary for such studies is a fundamental understanding of the basic principles of continuum mechanics and thermodynamics. This book is a clear introduction to these principles. It is designed for a one- or two-quarter course for advanced undergraduate and beginning graduate students in the mathematical and engineering sciences, and is based on

over nine years of teaching experience. It is also sufficiently self-contained for use outside a classroom environment. Prerequisites include a basic knowledge of linear algebra, multivariable calculus, differential equations and physics. The authors begin by explaining tensor algebra and calculus in three-dimensional Euclidean space. Using both index and coordinate-free notation, they introduce the basic axioms of continuum mechanics pertaining to mass, force, motion, temperature, energy and entropy, and the concepts of frame-indifference and material constraints. They devote four chapters to different theories of fluids and solids, and, unusually at this level, they consider both isothermal and thermal theories in detail. The book contains a wealth of exercises that support the theory and illustrate various applications. Full solutions to odd-numbered exercises are given at the end of each chapter and a complete solutions manual for all exercises is available to instructors upon request. Each chapter also contains a bibliography with references covering different presentations, further applications and numerical aspects of the theory. Book jacket.

Continuum Mechanics John Wiley & Sons

A detailed and self-contained text written for beginners, Continuum Mechanics offers concise coverage of the basic concepts, general principles, and applications of continuum mechanics. Without sacrificing rigor, the clear and simple mathematical derivations are made accessible to a large number of students with little or no previous background in solid or fluid mechanics. With the inclusion of more than 250 fully worked-out examples and 500 worked exercises, this book is certain to become a standard introductory text for students as well as an indispensable reference for professionals. Key Features * Provides a clear and self-contained treatment of vectors, matrices, and tensors specifically tailored to the needs of continuum mechanics * Develops the concepts and principles common to all areas in solid and fluid mechanics with a common notation and terminology * Covers the fundamentals of elasticity theory and fluid mechanics

Courier Corporation

This special volume of the Journal of Elasticity represents the first in a new p- gram dedicated to the occasional publication of collections of invited, reviewed papers of topical interest. The purpose of this program is to spotlight the dev- opments and applications in the mechanics of materials within specific areas that can enhance growth and provide insight for the advancement of the field as well as promote fundamental understanding and basic discovery. Soft Tissue Mechanics is an area of biomechanics that draws heavily upon f- damental ideas and material models from nonlinear elasticity and viscoelasticity. A major goal of this research is to understand those mechanics properties of heart, artery, collagen and skeletal muscle tissue that can be used for the diagnosis of health problems and the improvement of human life. This volume illustrates how experiment, modeling and computation is currently employed in this emerging field. May 2001 ROGER FOSDICK Editor-in-Chief Journal of Elasticity 61: ix – xii, 2000. ix Preface There are two primary areas for the application of elasticity in the biomechanics of tissues: hard tissue mechanics (e.g., bone, teeth, horns, etc.) and soft tissue - chanics (e.g., skin, tendons, arteries, etc.). The distinguishing feature between these tissue types is the amount of physiological " normal " deformation they experience. While " hard " tissues only experience small deformations, soft tissues typically experience large deformations. From a biomechanics viewpoint soft tissues fall within the realm of finite elasticity.

Functional Analysis, Sobolev Spaces and Partial Differential Equations Springer Science &

Business Media
There have been many excellent books written on the subject of plastic deformation in solids, but rarely can one find a textbook on this subject. “Plasticity Modeling & Computation” is a textbook written specifically for students who want to learn the theoretical, mathematical, and computational aspects of inelastic deformation in solids. It adopts a simple narrative style that is not mathematically overbearing, and has been written to emulate a professor giving a lecture on this subject inside a classroom. Each section is written to provide a balance between the relevant equations and the explanations behind them. Where relevant, sections end with one or more exercises designed to reinforce the understanding of the “lecture.” Color figures enhance the presentation and make the book very pleasant to read. For professors planning to use this textbook for their classes, the contents are sufficient for Parts A and B that can be taught in sequence over a period of two semesters or quarters.

Continuum Mechanics and Thermodynamics CRC Press
Almost all books available on fracture mechanics cover the majority of topics presented in this book, and often much, much more. While great as references, this makes teaching from them more difficult because the materials are not typically presented in the order that most professors cover them in their lectures and more than half the information p

Introduction to Micromechanics and Nanomechanics Springer Science & Business Media
B. Coleman, M.E. Gurtin: Thermodynamics and wave propagation in Elastic and Viscoelastic media.- L. De Vito: Sui fondamenti della meccanica di sistemi continui (II).- G. Fichera: Problemi elastostatici con ambigue condizioni al contorno.- G. Grioli: Sistemi a trasformazioni reversibili.- W. Noll: the foundations of mechanics.- R.A. Toupin: Elasticity and electromagnetic.- C.C. Wang: Subfluids.

Non-linear Continuum Theories Springer Nature
This revised, updated edition provides a comprehensive and rigorous description of the application of Hamilton’s principle to continuous media. To introduce terminology and initial concepts, it begins with what is called the first problem of the calculus of variations. For both historical and pedagogical reasons, it first discusses the application of the principle to systems of particles, including conservative and non-conservative systems and systems with constraints. The foundations of

mechanics of continua are introduced in the context of inner product spaces. With this basis, the application of Hamilton's principle to the classical theories of fluid and solid mechanics are covered. Then recent developments are described, including materials with microstructure, mixtures, and continua with singular surfaces.

Cardiovascular Soft Tissue Mechanics Cambridge University Press

This textbook is intended to introduce engineering graduate students to the essentials of modern continuum mechanics. The objective of an introductory course is to establish certain classical continuum models within a modern framework. Engineering students need a firm understanding of classical models such as linear viscous fluids (Navier-Stokes theory) and infinitesimal elasticity. This understanding should include an appreciation for the status of the classical models as special cases of general nonlinear continuum models. The relationship of the classical models to nonlinear models is essential in light of the increasing reliance, by engineering designers and researchers, on prepackaged computer codes. These codes are based upon models which have a specific and limited range of validity. Given the danger associated with the use of these computer codes in circumstances where the model is not valid, engineers have a need for an in-depth understanding of continuum mechanics and the continuum models which can be formu lated by use of continuum mechanics techniques. Classical continuum models and others involve a utilization of the balance equations of continuum mechanics, the second law of thermo dynamics, and the principles of material frame indifference and material symmetry. In addition, they involve linearizations of various types. In this text, an effort is made to explain carefully how the governing principles, linearizations, and other approximations combine to yield classical con tinuum models. A fundamental understanding of how these models evolve is most helpful when one attempts to study models which account for a wider array of physical phenomena.

Mathematical Reviews Cambridge University Press

This book presents a systematic treatise on micromechanics and nanomechanics, which encompasses many important research and development areas such as composite materials and homogenizations, mechanics of quantum dots, multiscale analysis and mechanics, defect mechanics of solids including fracture and dislocation mechanics, etc. In this second edition, some previous chapters are revised, and some new chapters added — crystal plasticity, multiscale crystal defect dynamics, quantum force and stress, micromechanics of metamaterials, and micromorphic theory. The book serves primarily as a graduate textbook and intended as a reference book for the next generation of scientists and engineers. It also has a unique pedagogical style that is specially suitable for self-

study and self-learning for many researchers and professionals who do not have time attending classes and lectures.

A First Course in Rational Continuum Mechanics Academic Press
This best-selling textbook presents the concepts of continuum mechanics, and the second edition includes additional explanations, examples and exercises.

Plasticity Springer Science & Business Media
Designing engineering components that make optimal use of materials requires consideration of the nonlinear characteristics associated with both manufacturing and working environments. The modeling of these characteristics can only be done through numerical formulation and simulation, and this requires an understanding of both the theoretical background and associated computer solution techniques. By presenting both nonlinear continuum analysis and associated finite element techniques under one roof, Bonet and Wood provide, in this edition of this successful text, a complete, clear, and unified treatment of these important subjects. New chapters dealing with hyperelastic plastic behavior are included, and the authors have thoroughly updated the FLagSHyP program, freely accessible at www.flagshyp.com. Worked examples and exercises complete each chapter, making the text an essential resource for postgraduates studying nonlinear continuum mechanics. It is also ideal for those in industry requiring an appreciation of the way in which their computer simulation programs work.

Applied Mechanics Reviews Springer
I want to thank R. L. Fosdick, M. E. Gurtin and W. O. Williams for their detailed criticism of the manuscript. I also thank F. Davi, M. Lembo, P. Nardinocchi and M. Vianello for valuable remarks prompted by their reading of one or another of the many previous drafts, from 1988 to date. Since it has taken me so long to bring this writing to its present form, many other colleagues and students have episodically offered useful comments and caught mistakes: a list would risk to be incomplete, but I am heartily grateful to them all. Finally, I thank V. Nicotra for skillfully transforming my hand sketches into book-quality figures. P. PODIO-GUIDUGLI Roma, April 2000 Journal of Elasticity 58: 1-104,2000. 1 P. Podio-Guidugli, A Primer in Elasticity. © 2000 Kluwer Academic Publishers. CHAPTER I Strain 1. Deformation. Displacement Let 8 be a 3-dimensional Euclidean space, and let V be the vector space associated with 8. We distinguish a point p E 8 both from its position vector p(p):= (p-o) E V with respect to a chosen origin 0 E 8 and from any triplet (~1, ~2, ~3) E R3

of coordinates that we may use to label p. Moreover, we endow V with the usual inner product structure, and orient it in one of the two possible manners. It then makes sense to consider the inner product a .

Continuum Mechanics of Solids Cambridge University Press

This publication is aimed at students, teachers, and researchers of Continuum Mechanics and focused extensively on stating and developing Initial Boundary Value equations used to solve physical problems. With respect to notation, the tensorial, indicial and Voigt notations have been used indiscriminately. The book is divided into twelve chapters with the following topics: Tensors, Continuum Kinematics, Stress, The Objectivity of Tensors, The Fundamental Equations of Continuum Mechanics, An Introduction to Constitutive Equations, Linear Elasticity, Hyperelasticity, Plasticity (small and large deformations), Thermoelasticity (small and large deformations), Damage Mechanics (small and large deformations), and An Introduction to Fluids. Moreover, the text is supplemented with over 280 figures, over 100 solved problems, and 130 references.

Hamilton’s Principle in Continuum Mechanics Elsevier

"Ian Murdoch's Physical Foundations of Continuum Mechanics will interest engineers, mathematicians and physicists who study macroscopic behaviour (for example, solid mechanics or fluid dynamics) or engage in molecular dynamical simulations. Unlike other works on the subject, Murdoch's book examines physical assumptions implicit in continuum modelling from a molecular perspective. By doing so, this book clarifies physical interpretations of concepts and fields by emphasising their microscopic origin and sensitivity to scale. Murdoch expertly applies these concepts to theories of mixtures, generalised continua and fluid flow through porous media. This unique and thorough work is an authoritative reference for both students and experts in the field"--

A First Course in Rational Continuum Mechanics: General concepts An Introduction to Continuum Mechanics

A bestselling textbook in its first three editions, Continuum Mechanics for Engineers, Fourth Edition provides engineering students with a complete, concise, and accessible introduction to advanced engineering mechanics. It provides information that is useful in emerging engineering areas, such as micro-mechanics and biomechanics. Through a mastery of this volume’s contents and additional rigorous finite element training, readers will develop the mechanics foundation necessary to skillfully use modern, advanced design tools. Features: Provides a basic, understandable approach to the concepts, mathematics, and engineering applications of continuum mechanics Updated throughout, and adds a new chapter on plasticity Features an expanded coverage of fluids

Includes numerous all new end-of-chapter problems With an abundance of worked examples and chapter problems, it carefully explains necessary mathematics and presents numerous illustrations, giving students and practicing professionals an excellent self-study guide to enhance their skills.

Fundamentals of Fracture Mechanics Springer Science & Business Media

Treats subjects directly related to nonlinear materials modeling for graduate students and researchers in physics, materials science, chemistry and engineering.

A Primer in Elasticity CRC Press

A clear and complete postgraduate introduction to the theory and computer programming for the complex simulation of material behavior.

General Continuum Mechanics Cambridge University Press

A First Course in Rational Continuum Mechanics, Volume 1: General Concepts describes general concepts in rational continuum mechanics and covers topics ranging from bodies and forces to motions and energies, kinematics, and the stress tensor. Constitutive relations are also discussed, and some definitions and theorems of algebra, geometry, and calculus are included. Exercises and their solutions are given as well. Comprised of four chapters, this volume begins with an introduction to rational mechanics by focusing on the mathematical concepts of bodies, forces, motions, and energies. Systems that provide possible universes for mechanics are described. The next chapter explores kinematics, with emphasis on bodies, placements, and motions as well as other relevant concepts like local deformation and homogeneous transplacement. The book also considers the stress tensor and Cauchy's fundamental theorem before concluding with a discussion on constitutive relations. This monograph is designed for students taking a course in mathematics or physics.

Physical Foundations of Continuum Mechanics Springer Science & Business Media

Presents a self-contained introduction to continuum mechanics that illustrates how many of the important partial differential equations of applied mathematics arise from continuum modeling principles Written as an accessible introduction, Continuum Mechanics: The Birthplace of Mathematical Models provides a comprehensive foundation for mathematical models used in fluid mechanics, solid mechanics, and heat transfer. The book features derivations of commonly used differential equations based on the fundamental continuum mechanical concepts encountered in various fields, such as engineering, physics, and

geophysics. The book begins with geometric, algebraic, and analytical foundations before introducing topics in kinematics. The book then addresses balance laws, constitutive relations, and constitutive theory. Finally, the book presents an approach to multiconstituent continua based on mixture theory to illustrate how phenomena, such as diffusion and porous-media flow, obey continuum-mechanical principles. Continuum Mechanics: The Birthplace of Mathematical Models features: Direct vector and tensor notation to minimize the reliance on particular coordinate systems when presenting the theory Terminology that is aligned with standard courses in vector calculus and linear algebra The use of Cartesian coordinates in the examples and problems to provide readers with a familiar setting Over 200 exercises and problems with hints and solutions in an appendix Introductions to constitutive theory and multiconstituent continua, which are distinctive for books at this level Continuum Mechanics: The Birthplace of Mathematical Models is an ideal textbook for courses on continuum mechanics for upper-undergraduate mathematics majors and graduate students in applied mathematics, mechanical engineering, civil engineering, physics, and geophysics. The book is also an excellent reference for professional mathematicians, physical scientists, and engineers.