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The mechanics of electromagnetic materials and structures has been developing rapidly with extensive applications in, e. g. , electronics

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industry, nuclear engineering, and smart materials and structures.

Researchers in this interdisciplinary field are with diverse background and motivation. The Symposium on the Mechanics of Electromagnetic Materials and Structures of the Fourth International Conference on Nonlinear

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Mechanics in Shanghai, China in August 13-16, 2002 provided an opportunity for an intimate gathering of researchers and exchange of ideas. This volume contains papers based on most of the presentations at the symposium, and articles from a few invited contributors. These papers

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reflect some of the recent activities in the mechanics of electromagnetic materials and structures. The first twelve papers are in the order in which they were listed in the program of the conference. These are followed by six invited papers in alphabetical order of the last names of the first authors. We

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would like to extend our sincere thanks to Professor David Y. Gao of Virginia Tech for suggesting the symposium, and to the authors for their time and effort invested in preparing their manuscripts. We are also grateful to Professor Daining Fang of Tsinghua University for co-chairing the

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symposium with J. S. Yang. Our special thanks belong to Kluwer for preparing this book for publication. J. S. Yang G.

A. Maugin PIEZOELECTRIC

VIBRATORY GYROSCOPES J. S.

The essence of continuum mechanics — the internal response of materials to external loading — is often obscured by

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the complex mathematics of its formulation. By building gradually from one-dimensional to two- and three-dimensional formulations, this book provides an accessible introduction to the fundamentals of solid and fluid mechanics, covering stress and strain among other key topics. This

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undergraduate text presents several real-world case studies, such as the St. Francis Dam, to illustrate the mathematical connections between solid and fluid mechanics, with an emphasis on practical applications of these concepts to mechanical, civil, and electrical engineering structures and

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design.

A concise account of classic theories of fluids and solids, for graduate and advanced undergraduate courses in continuum mechanics.

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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

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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

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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

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and practicing professionals an excellent self-study guide to enhance their skills.

An Applied Mathematics Introduction
Mathematical Modeling in Continuum
Mechanics

A Continuum Approach
From Fundamental Concepts to

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Governing Equations

A Continuum Approach for Engineering

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

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comprehensive coverage of continuum mechanics, this volume includes information on "variational principles"--Significant, as this is the only method by which such material is actually utilized in engineering practice.

This book is designed for students

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in engineering, physics and mathematics. The material can be taught from the beginning of the third academic year. It could also be used for self study, given its pedagogical structure and the numerous solved problems which prepare for modern physics and

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technology. One of the original aspects of this work is the development together of the basic theory of tensors and the foundations of continuum mechanics. Why two books in one? Firstly, Tensor Analysis provides a thorough introduction of intrinsic

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mathematical entities, called tensors, which is essential for continuum mechanics. This way of proceeding greatly unifies the various subjects. Only some basic knowledge of linear algebra is necessary to start out on the topic of tensors. The essence of the

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mathematical foundations is introduced in a practical way. Tensor developments are often too abstract, since they are either aimed at algebraists only, or too quickly applied to physicists and engineers. Here a good balance has been found which allows these

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extremes to be brought closer together. Though the exposition of tensor theory forms a subject in itself, it is viewed not only as an autonomous mathematical discipline, but as a preparation for theories of physics and engineering. More specifically,

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because this part of the work deals with tensors in general coordinates and not solely in Cartesian coordinates, it will greatly help with many different disciplines such as differential geometry, analytical mechanics, continuum mechanics, special relativity, general relativity,

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cosmology, electromagnetism, quantum mechanics, etc ..

This overview of the development of continuum mechanics throughout the twentieth century is unique and ambitious. Utilizing a historical perspective, it combines an exposition on the technical

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progress made in the field and a marked interest in the role played by remarkable individuals and scientific schools and institutions on a rapidly evolving social background. It underlines the newly raised technical questions and their answers, and the ongoing

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reflections on the bases of continuum mechanics associated, or in competition, with other branches of the physical sciences, including thermodynamics. The emphasis is placed on the development of a more realistic modeling of deformable solids and

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the exploitation of new mathematical tools. The book presents a balanced appraisal of advances made in various parts of the world. The author contributes his technical expertise, personal recollections, and international experience to this general overview,

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*which is very informative albeit
concise.*

*Continuum Mechanics Through the
Twentieth Century*

*Variational Principles of Continuum
Mechanics*

Continuum Mechanics

Continuum Damage Mechanics

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Introduction to Engineering Mechanics

*Nonlinear Continuum
Mechanics for Finite
Elasticity-Plasticity
empowers readers to fully
understand the constitutive
equation of finite strain,*

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an essential piece in assessing the deformation/strength of materials and safety of structures. The book starts by providing a foundational overview of continuum mechanics, elasticity and

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plasticity, then segues into more sophisticated topics such as multiplicative decomposition of deformation gradient tensor with the isoclinic concept and the underlying subloading surface concept. The

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subloading surface concept insists that the plastic strain rate is not induced suddenly at the moment when the stress reaches the yield surface but it develops continuously as the stress approaches the yield

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surface, which is crucially important for the precise description of cyclic loading behavior. Then, the exact formulations of the elastoplastic and viscoplastic constitutive equations based on the

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*multiplicative decomposition
are expounded in great
detail. The book concludes
with examples of these
concepts and modeling
techniques being deployed in
real-world applications.
Table of Contents: 1.*

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*Mathematical Basics 2.
General (Curvilinear)
Coordinate System 3.
Description of
Deformation/Rotation in
Convected Coordinate System
4. Deformation/Rotation
(Rate) Tensors 5.*

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*Conservation Laws and Stress
Tensors 6. Hyperelastic
Equations 7. Development of
Elastoplastic Constitutive
Equations 8. Multiplicative
Decomposition of Deformation
Gradient Tensor 9.
Multiplicative Hyperelastic-*

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*based Plastic and
Viscoplastic Constitutive
Equations 10. Friction
Model: Finite Sliding Theory
Covers both the fundamentals
of continuum mechanics and
elastoplasticity while also
introducing readers to more*

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*advanced topics such as the
subloading surface model and
the multiplicative
decomposition among others
Approaches finite
elastoplasticity and
viscoplasticity theory based
on multiplicative*

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*decomposition and the
subloading surface model
Provides a thorough
introduction to the general
tensor formulation details
for the embedded curvilinear
coordinate system and the
multiplicative decomposition*

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*of the deformation gradient
Integrated Mechanics
Knowledge Essential for Any
Engineer Introduction to
Engineering Mechanics: A
Continuum Approach, Second
Edition uses continuum
mechanics to showcase the*

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connections between engineering structure and design and between solids and fluids and helps readers learn how to predict the effects of forces, stresses, and strains. T This is an intermediate book

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for beginning postgraduate students and junior researchers, and offers up-to-date content on both continuum mechanics and elasticity. The material is self-contained and should provide readers sufficient

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working knowledge in both areas. Though the focus is primarily on vector and tensor calculus (the so-called coordinate-free approach), the more traditional index notation is used whenever it is

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deemed more sensible. With the increasing demand for continuum modeling in such diverse areas as mathematical biology and geology, it is imperative to have various approaches to continuum mechanics and

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elasticity. This book presents these subjects from an applied mathematics perspective. In particular, it extensively uses linear algebra and vector calculus to develop the fundamentals of both subjects in a way

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that requires minimal use of coordinates (so that beginning graduate students and junior researchers come to appreciate the power of the tensor notation).

Temam and Miranville present core topics within the

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general themes of fluid and solid mechanics. The brisk style allows the text to cover a wide range of topics including viscous flow, magnetohydrodynamics, atmospheric flows, shock equations, turbulence,

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nonlinear solid mechanics, solitons, and the nonlinear Schrödinger equation. This second edition will be a unique resource for those studying continuum mechanics at the advanced undergraduate and beginning

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graduate level whether in engineering, mathematics, physics or the applied sciences. Exercises and hints for solutions have been added to the majority of chapters, and the final part on solid mechanics has

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been substantially expanded. These additions have now made it appropriate for use as a textbook, but it also remains an ideal reference book for students and anyone interested in continuum mechanics.

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*A Concise Historical
Perspective
Fundamentals of Continuum
Mechanics
Continuum Mechanics for
Engineers
Continuum Mechanics for
Engineers, Third Edition*

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Concise Theory and Problems

For comprehensive—and comprehensible—coverage of both theory and real-world applications, you can't find a better study guide than Schaum's Outline of

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Continuum Mechanics. It gives you everything you need to get ready for tests and earn better grades! You get plenty of worked problems—solved for you step by step—along with

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hundreds of practice problems. From the mathematical foundations to fluid mechanics and viscoelasticity, this guide covers all the fundamentals—plus it shows

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you how theory is applied. This is the study guide to choose if you want to ace continuum mechanics! Continuum mechanics studies the response of materials to different loading

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conditions. The concept of tensors is introduced through the idea of linear transformation in a self-contained chapter, and the interrelation of direct notation, indicial notation

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and matrix operations is clearly presented. A wide range of idealized materials are considered through simple static and dynamic problems, and the book contains an abundance of

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illustrative examples and problems, many with solutions. Through the addition of more advanced material (solution of classical elasticity problems, constitutive equations for

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viscoelastic fluids, and finite deformation theory), this popular introduction to modern continuum mechanics has been fully revised to serve a dual purpose: for introductory

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courses in undergraduate engineering curricula, and for beginning graduate courses.

This new edition provides a complete, concise, and accessible introduction to

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advanced engineering mechanics. It explores the basic concepts behind continuum mechanics, linear and nonlinear elasticity, and viscoelasticity, and demonstrates their

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application in engineering practice.

An updated and expanded edition of the popular guide to basic continuum mechanics and computational techniques

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This updated third edition of the popular reference covers state-of-the-art computational techniques for basic continuum mechanics modeling of both small and large deformations.

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Approaches to developing complex models are described in detail, and numerous examples are presented demonstrating how computational algorithms can be developed

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using basic continuum mechanics approaches. The integration of geometry and analysis for the study of the motion and behaviors of materials under varying conditions is an increasingly

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popular approach in continuum mechanics, and absolute nodal coordinate formulation (ANCF) is rapidly emerging as the best way to achieve that integration. At the same time, simulation

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software is undergoing significant changes which will lead to the seamless fusion of CAD, finite element, and multibody system computer codes in one computational environment.

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Computational Continuum Mechanics, Third Edition is the only book to provide in-depth coverage of the formulations required to achieve this integration. Provides detailed coverage

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of the absolute nodal coordinate formulation (ANCF), a popular new approach to the integration of geometry and analysis Provides detailed coverage of the floating frame of

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reference (FFR) formulation, a popular well-established approach for solving small deformation problems

Supplies numerous examples of how complex models have been developed to solve an

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array of real-world problems
Covers modeling of both
small and large deformations
in detail Demonstrates how
to develop computational
algorithms using basic
continuum mechanics

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approaches Computational Continuum Mechanics, Third Edition is designed to function equally well as a text for advanced undergraduates and first-year graduate students and

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as a working reference for researchers, practicing engineers, and scientists working in computational mechanics, bio-mechanics, computational biology, multibody system dynamics,

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and other fields of science and engineering using the general continuum mechanics theory.

I. Fundamentals

Continuum Mechanics and Theory of Materials

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Nonlinear Continuum
Mechanics for Finite
Elasticity-Plasticity
Continuum Mechanics and
Linear Elasticity

**Fundamentals of Continuum
Mechanics provides a clear**

Page 73/187

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**and rigorous presentation of
continuum mechanics for
engineers, physicists,
applied mathematicians, and
materials scientists. This
book emphasizes the role of
thermodynamics in**

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constitutive modeling, with detailed application to nonlinear elastic solids, viscous fluids, and modern smart materials. While emphasizing advanced material modeling, special

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attention is also devoted to developing novel theories for incompressible and thermally expanding materials. A wealth of carefully chosen examples and exercises illuminate the

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subject matter and facilitate self-study. Uses direct notation for a clear and straightforward presentation of the mathematics, leading to a better understanding of the

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**underlying physics Covers
high-interest research areas
such as small- and large-
deformation continuum
electrodynamics, with
application to smart
materials used in intelligent**

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**systems and structures
Offers a unique approach to
modeling incompressibility
and thermal expansion,
based on the authors' own
research
Multi-scale modelling of**

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composites is a very relevant topic in composites science. This is illustrated by the numerous sessions in the recent European and International Conferences on Composite Materials, but

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**also by the fast
developments in multi-scale
modelling software tools,
developed by large
industrial players such as
Siemens (Virtual Material
Characterization toolkit and**

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MultiMechanics virtual testing software), MSC/e-Xstream (Digimat software), Simulia (micromechanics plug-in in Abaqus), HyperSizer (Multi-scale design of composites), Altair

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**(Altair Multiscale Designer)
This book is intended to be
an ideal reference on the
latest advances in multi-
scale modelling of fibre-
reinforced polymer
composites, that is**

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accessible for both (young) researchers and end users of modelling software. We target three main groups: This book aims at a complete introduction and overview of the state-of-the-

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**art in multi-scale modelling
of composites in three axes:**

- ranging from prediction of
homogenized elastic
properties to nonlinear
material behaviour •
ranging from geometrical**

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**models for random packing
of unidirectional fibres over
meso-scale geometries for
textile composites to
orientation tensors for short
fibre composites • ranging
from damage modelling of**

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**unidirectionally reinforced
composites over textile
composites to short fibre-
reinforced composites The
book covers the three most
important scales in multi-
scale modelling of**

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composites: (i) micro-scale, (ii) meso-scale and (iii) macro-scale. The nano-scale and related atomistic and molecular modelling approaches are deliberately excluded, since the book

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wants to focus on continuum mechanics and there are already a lot of dedicated books about polymer nanocomposites. A strong focus is put on physics-based damage modelling, in

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the sense that the chapters devote attention to modelling the different damage mechanisms (matrix cracking, fibre/matrix debonding, delamination, fibre fracture,...) in such a

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way that the underlying physics of the initiation and growth of these damage modes is respected. The book also gives room to not only discuss the finite element based approaches

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**for multi-scale modelling,
but also much faster
methods that are popular in
industrial software, such as
Mean Field Homogenization
methods (based on Mori-
Tanaka and Eshelby**

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solutions) and variational methods (shear lag theory and more advanced theories). Since the book targets a wide audience, the focus is put on the most common numerical

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approaches that are used in multi-scale modelling. Very specialized numerical methods like peridynamics modelling, Material Point Method, eXtended Finite Element Method (XFEM),

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isogeometric analysis, SPH (Smoothed Particle Hydrodynamics),... are excluded. Outline of the book The book is divided in three large parts, well balanced with each a similar

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number of chapters:

The field of rock mechanics and rock engineering utilizes the basic laws of continuum mechanics and the techniques developed in computational mechanics.

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This book describes the basic concepts behind these fundamental laws and their utilization in practice irrespective of whether rock/rock mass contains discontinuities. This book

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consists of nine chapters and six appendices. The first four chapters are concerned with continuum mechanics aspects, which include the basic operations, definition of stress and strain tensors,

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**and derivation of four
fundamental conservation
laws in the simplest yet
precise manner. The next
two chapters are the
preparation for
computational mechanics,**

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**which require constitutive
laws of geomaterials
relevant to each
conservation law and the
procedures for how to
determine required
parameters of the**

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constitutive laws. Computational mechanics solves the resulting ordinary and partial differential equations. In Chapter 7, the methods of exact (closed-form) solutions are

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explained and they are applied to ordinary/partial differential equations with solvable boundary and initial conditions. In Chapter 8, the fundamentals of approximate solution

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methods are explained for one dimension first and then how to extend them to multi-dimensional problems. The readers are expected to learn and clearly understand how they are derived and

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**applied to various problems
in geomechanics. The final
chapter involves the
applications of the
approximate methods to the
actual problems in practice
for geomechanical**

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engineers, which cover the continuum to discontinuum, including the stress state of the earth as well as the ground motions induced by earthquakes. Six appendices are provided to have a clear

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**understanding of continuum
mechanics operations and
procedures for how to deal
with
discontinuities/interfaces
often encountered in rock
mechanics and rock**

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engineering.

This book explores the foundation of continuum mechanics and constitutive theories of materials using understandable notations. Written using clear language

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**to explore this
mathematically demanding
area of mechanical
engineering, the book
provides a thorough guide
to continuum mechanics.
Updated throughout for the**

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second edition, the book adds new material aimed at defining classical continuum mechanics, discussing its limitations, and illustrating key concepts. New to the second edition is a chapter

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**on advanced topics in
classical continuum
mechanics, defining and
illustrating the type of
physics that can be
considered under calculus of
variations and energy**

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methods. Placing special emphasis on both matrix and vector notations, it presents material using these notations whenever possible. Establishing the tensorial nature of strain

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measures and influence of rotation of frames on various measures, the book illustrates the physical meaning of the components of strains, presents the polar decomposition of

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deformation, and provides the definitions and measures of stress. The book will be of interest to graduate students, with the objective of preparing them for advanced research or for

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**advanced applications of
continuum mechanics.
Additionally, the new edition
includes a solutions manual,
aiding lecturers and those
pursuing self-study.
Schaum's Outline of**

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**Continuum Mechanics
Multi-Scale Continuum
Mechanics Modelling of
Fibre-Reinforced Polymer
Composites
Computational Continuum
Mechanics of Nanoscopic**

Page 115/187

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Structures

**Multiplicative Decomposition
with Subloading Surface
Model**

**Encyclopedia of Continuum
Mechanics**

DIVComprehensive treatment

Page 116/187

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offers 115 solved problems and exercises to promote understanding of vector and tensor theory, basic kinematics, balance laws, field equations, jump conditions, and constitutive equations. /div

This self-contained graduate-level

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text introduces classical continuum models within a modern framework. Its numerous exercises illustrate the governing principles, linearizations, and other approximations that constitute classical continuum models. Starting with an

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overview of one-dimensional continuum mechanics, the text advances to examinations of the kinematics of motion, the governing equations of balance, and the entropy inequality for a continuum. The main portion of the book involves models of

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material behavior and presents complete formulations of various general continuum models. The final chapter contains an introductory discussion of materials with internal state variables. Two substantial appendixes cover all of the

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mathematical background necessary to understand the text as well as results of representation theorems. Suitable for independent study, this volume features 280 exercises and 170 references. A concise introductory course

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*text on continuum mechanics
Fundamentals of Continuum
Mechanics focuses on the
fundamentals of the subject and
provides the background for
formulation of numerical
methods for large deformations
and a wide range of material*

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behaviours. It aims to provide the foundations for further study, not just of these subjects, but also the formulations for much more complex material behaviour and their implementation computationally. This book is divided into 5 parts, covering

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*mathematical preliminaries,
stress, motion and deformation,
balance of mass, momentum and
energy, and ideal constitutive
relations and is a suitable
textbook for introductory
graduate courses for students in
mechanical and civil engineering,*

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as well as those studying material science, geology and geophysics and biomechanics. A concise introductory course text on continuum mechanics Covers the fundamentals of continuum mechanics Uses modern tensor notation Contains problems and

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*accompanied by a companion
website hosting solutions
Suitable as a textbook for
introductory graduate courses for
students in mechanical and civil
engineering
The new edition includes
additional analytical methods in*

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the classical theory of viscoelasticity. This leads to a new theory of finite linear viscoelasticity of incompressible isotropic materials. Anisotropic viscoplasticity is completely reformulated and extended to a general constitutive theory that

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covers crystal plasticity as a special case.

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A Continuum Approach, Second Edition

Continuum and Computational

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*Mechanics for Geomechanical
Engineers*

*Classical Continuum Mechanics
Elasticity, Plasticity,
Viscoelasticity*

*There are about 500 books on v
ariational principles. Th*

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*eyareconcernedmostlywith
the mathematical aspects
of the topic. The major
goal of this book is to
discuss the physical
origin of the
variational principles*

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and the intrinsic interrelations between them. For example, the Gibbs principles appear not as the first principles of the theory of thermodynamic

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*equilibrium but as a
consequence of the
Einstein formula for
thermodynamic
uctuations. The
mathematical issues are
considered as long as*

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they shed light on the physical outcomes and/or provide a useful technique for direct study of variational problems. The book is a completely rewritten version of

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the author's monograph Variational Principles of Continuum Mechanics which appeared in Russian in 1983. I have been postponing the English translation

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*because I wished to
include the variational
pr- ciples of
irreversible processes
in the new edition.*

*Reaching an
understanding of this*

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subject took longer than I expected. In its final form, this book covers all aspects of the story. The part concerned with irreversible processes

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is tiny, but it determines the accents put on all the results presented. The other new issues included in the book are: entropy of

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variational principles of vortex line dynamics, variational principles and integration in functional spaces, some stochastic variational problems, variational

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*principle for
probability densities of
local elds in composites
with random structure,
variational theory of
turbulence; these topics
have not been covered*

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*previously in
monographic literature.
Undergraduate text
offers an analysis of
deformation and stress,
covers laws of
conservation of mass,*

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*momentum, and energy,
and surveys the
formulation of
mechanical constitutive
equations. 1992 edition.
This book offers a
comprehensive treatment*

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*of nonlocal elasticity
theory as applied to the
prediction of the
mechanical
characteristics of
various types of
biological and non-*

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*biological nanoscopic
structures with
different morphologies
and functional
behaviour. It combines
fundamental notions and
advanced concepts,*

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covering both the theory of nonlocal elasticity and the mechanics of nanoscopic structures and systems. By reporting on recent findings and discussing

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future challenges, the book seeks to foster the application of nonlocal elasticity based approaches to the emerging fields of nanoscience and

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nanotechnology. It is a self-contained guide, and covers all relevant background information, the requisite mathematical and computational

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techniques, theoretical assumptions, physical methods and possible limitations of the nonlocal approach, including some practical applications. Mainly

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*written for researchers
in the fields of
physics, biophysics,
mechanics, and
nanoscience, as well as
computational engineers,
the book can also be*

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used as a reference guide for senior undergraduate and graduate students, as well as practicing engineers working in a range of areas, such as

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*computational condensed
matter physics,
computational materials
science, computational
nanoscience and
nanotechnology, and
nanomechanics.*

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Engineers* CRC Press

*A Continuum Mechanics
Approach to the Analysis
of Damage and Fracture
With Applications to
Continuum Mechanics*

Page 151/187

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*Tensor Analysis and
Continuum Mechanics
With Applications to
Mechanical,
Thermomechanical, and
Smart Materials
A First Course in*
Page 152/187

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Continuum Mechanics

There is a large gap between engineering courses in tensor algebra on one hand, and the treatment of linear transformations within classical linear algebra on the other. This book addresses primarily engineering

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students with some initial knowledge of matrix algebra. Thereby, mathematical formalism is applied as far as it is absolutely necessary.

Numerous exercises provided in the book are accompanied by solutions enabling autonomous study. The last

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chapters deal with modern developments in the theory of isotropic and anisotropic tensor functions and their applications to continuum mechanics and might therefore be of high interest for PhD-students and scientists working in this

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area.

Most books on continuum mechanics focus on elasticity and fluid mechanics. But whether student or practicing professional, modern engineers need a more thorough treatment to understand the behavior

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of the complex materials and systems in use today. Continuum Mechanics: Elasticity, Plasticity, Viscoelasticity offers a complete tour of the subject that includes not only elasticity and fluid mechanics but also covers plasticity, viscoelasticity, and the

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continuum model for fatigue and fracture mechanics. In addition to a broader scope, this book also supplies a review of the necessary mathematical tools and results for a self-contained treatment. The author provides finite element formulations

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of the equations encountered throughout the chapters and uses an approach with just the right amount of mathematical rigor without being too theoretical for practical use. Working systematically from the continuum model for the

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thermomechanics of materials, coverage moves through linear and nonlinear elasticity using both tensor and matrix notation, plasticity, viscoelasticity, and concludes by introducing the fundamentals of fracture mechanics and fatigue of

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metals. Requisite mathematical tools appear in the final chapter for easy reference. Continuum Mechanics: Elasticity, Plasticity, Viscoelasticity builds a strong understanding of the principles, equations, and finite element formulations needed to solve

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real engineering problems.

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

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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

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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

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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-

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depth understanding of continuum mechanics and the continuum models which can be formulated by use of continuum mechanics techniques. Classical continuum models and others involve a utilization of the balance equations of

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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

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carefully how the governing principles, linearizations, and other approximations combine to yield classical continuum models. A fundamental understanding of how these models evolve is most helpful when one attempts to study models

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which account for a wider array of physical phenomena.

This book offers a broad overview of the potential of continuum mechanics to describe a wide range of macroscopic phenomena in real-world problems. Building on the

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fundamentals presented in the authors ' previous book, Continuum Mechanics using Mathematica® , this new work explores interesting models of continuum mechanics, with an emphasis on exploring the flexibility

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of their applications in a wide variety
of fields.

Tensor Algebra and Tensor Analysis
for Engineers

Computational Continuum
Mechanics

Continuum Mechanics and

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Thermodynamics

Mechanics of Electromagnetic Solids

An Introduction to Continuum
Mechanics

*This best-selling textbook presents
the concepts of continuum
mechanics, and the second edition*

Page 172/187

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includes additional explanations, examples and exercises.

This book presents an introduction to the classical theories of continuum mechanics; in particular, to the theories of ideal, compressible, and viscous fluids,

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and to the linear and nonlinear theories of elasticity. These theories are important, not only because they are applicable to a majority of the problems in continuum mechanics arising in practice, but because they form a solid base

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*upon which one can readily
construct more complex theories of
material behavior. Further,
although attention is limited to the
classical theories, the treatment is
modern with a major emphasis on
foundations and structure*

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Recent developments in engineering and technology have brought about serious and enlarged demands for reliability, safety and economy in wide range of fields such as aeronautics, nuclear engineering, civil and structural

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engineering, automotive and production industry. This, in turn, has caused more interest in continuum damage mechanics and its engineering applications. This book aims to give a concise overview of the current state of

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damage mechanics, and then to show the fascinating possibility of this promising branch of mechanics, and to provide researchers, engineers and graduate students with an intelligible and self-contained

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textbook. The book consists of two parts and an appendix. Part I is concerned with the foundation of continuum damage mechanics. Basic concepts of material damage and the mechanical representation of damage state of various kinds

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are described in Chapters 1 and 2. In Chapters 3-5, irreversible thermodynamics, thermodynamic constitutive theory and its application to the modeling of the constitutive and the evolution equations of damaged materials are

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described as a systematic basis for the subsequent development throughout the book. Part II describes the application of the fundamental theories developed in Part I to typical damage and fracture problems encountered in

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various fields of the current engineering. Important engineering aspects of elastic-plastic or ductile damage, their damage mechanics modeling and their further refinement are first discussed in Chapter 6. Chapters 7

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and 8 are concerned with the modeling of fatigue, creep, creep-fatigue and their engineering application. Damage mechanics modeling of complicated crack closure behavior in elastic-brittle and composite materials are

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discussed in Chapters 9 and 10. In Chapter 11, applicability of the local approach to fracture by means of damage mechanics and finite element method, and the ensuing mathematical and numerical problems are briefly

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discussed. A proper understanding of the subject matter requires knowledge of tensor algebra and tensor calculus. At the end of this book, therefore, the foundations of tensor analysis are presented in the Appendix, especially for readers

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*with insufficient mathematical
background, but with keen interest
in this exciting field of mechanics.*

*Introduction to Continuum
Mechanics*

Nonlocal Elasticity Approaches

Introduction to Continuum

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Mechanics for Engineers
Nonlinear Solid Mechanics
Advanced Topics and Research
Trends