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## Elasticity And Plasticity Of Large Deformations An Introduction

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mechanisms highlighted in this study mechanisms of elastic and inelastic deformation of mineralized collagen fibrils the fibrils were tested by tensile loading until 100 strain a

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4.7.2 Fractional Gradient Plasticity and Fractal Plasticity In

this section, we briefly consider nonlinear field equations with fractional derivatives of noninteger order to describe nonlinear elasticity or deformation theory of plasticity for fractional continua, with power-law nonlocality and weak

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Deformation Theory of Plasticity - an overview ...

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In physics and materials science, plasticity, also known as plastic deformation, is the ability of a solid material to undergo permanent deformation, a non-reversible change

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of shape in response to applied forces. For example, a solid piece of metal being bent or pounded into a new shape displays plasticity as permanent changes occur within the material itself.

Based on three decades of teaching experience in the field, this careful and detailed introduction to non-linear continuum mechanics and to elasticity and plasticity, with a unique mathematical foundation, brings readers to the forefront of today's knowledge.

This book presents an introduction to material theory and,

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in particular, to elasticity, plasticity and viscoelasticity, to bring the reader close to the frontiers of today ' s knowledge in these particular fields. It starts right from the beginning without assuming much knowledge of the subject. Hence, the book is generally comprehensible to all engineers, physicists, mathematicians, and others. At the beginning of each new section, a brief Comment on the Literature contains recommendations for further reading. This book includes an updated reference list and over 100 changes throughout the book. It contains the latest knowledge on the subject. Two new chapters have been added in this new edition. Now finite viscoelasticity is included, and an Essay on gradient materials, which have recently drawn much attention.

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Nonlinear Continuum Mechanics is a rapidly growing field of research. Since the last edition of this book, many important results in this field have been published. This new edition refers to the most important results. The part on hyperelastic models and anisotropic yield criteria has been enlarged and an outlook on Material Plasticity has been added.

This careful and detailed introduction to non-linear continuum mechanics and to elasticity and plasticity, with a unique mathematical foundation, starts right from the basics. The general theory of mechanical behaviour is particularized for the broad and important classes of

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elasticity and plasticity. Brings the reader to the forefront of today's knowledge. A list of notations and an index help the reader finding specific topics.

Theory of Elasticity and Plasticity is designed as a textbook for both undergraduate and postgraduate students of engineering in civil, mechanical and aeronautical disciplines. This book has been written with the objective of bringing the concepts of elasticity and plasticity to the students in a simplified and comprehensive manner. The basic concepts, definitions, theory as well as practical applications are discussed in a clear, logical and concise manner for better understanding. Starting with, general relationships between stress, strain and deformations, the book deals with specific

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problems on plane stress, plane strain and torsion in non-circular sections. Advanced topics such as membrane analogy, beams on elastic foundations and plastic analysis of pressure vessels are also discussed elaborately. For better comprehension, the text is well supported with: Large number of worked-out examples in each chapter. Well-labelled illustrations. Numerous Review Questions that reinforce the understanding of the subject. As all the concepts are covered extensively with a blend of theory and practice, this book will be a useful resource to the students.

The scientists of the seventeenth and eighteenth centuries, led by Jas. Bernoulli and Euler, created a coherent theory of the mechanics of strings and rods undergoing planar



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deformations. They introduced the basic concepts of strain, both extensional and flexural, of contact force with its components of tension and shear force, and of contact couple. They extended Newton's Law of Motion for a mass point to a law valid for any deformable body. Euler formulated its independent and much subtler complement, the Angular Momentum Principle. (Euler also gave effective variational characterizations of the governing equations.) These scientists breathed life into the theory by proposing, formulating, and solving the problems of the suspension bridge, the catenary, the velaria, the elastica, and the small transverse vibrations of an elastic string. (The level of difficulty of some of these problems is such that even today their descriptions are seldom vouchsafed to

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undergraduates. The realization that such profound and beautiful results could be deduced by mathematical reasoning from fundamental physical principles furnished a significant contribution to the intellectual climate of the Age of Reason. ) At first, those who solved these problems did not distinguish between linear and nonlinear equations, and so were not intimidated by the latter. By the middle of the nineteenth century, Cauchy had constructed the basic framework of three-dimensional continuum mechanics on the foundations built by his eighteenth-century predecessors.

Modern computer simulations make stress analysis easy. As they continue to replace classical mathematical methods of

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analysis, these software programs require users to have a solid understanding of the fundamental principles on which they are based. Develop Intuitive Ability to Identify and Avoid Physically Meaningless Predictions Applied Mechanics

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Nonlinear Continuum Mechanics for Finite Elasticity-Plasticity empowers readers to fully understand the constitutive equation of finite strain, 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 plasticity, then segues into more sophisticated topics such as multiplicative decomposition of deformation gradient

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tensor with the isoclinic concept and the underlying subloading surface concept. The 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 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 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. Mathematical Basics 2. General (Curvilinear) Coordinate System 3. Description of Deformation/Rotation

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in Convected Coordinate System 4. Deformation/Rotation (Rate) Tensors 5. Conservation Laws and Stress Tensors 6. Hyperelastic Equations 7. Development of Elastoplastic Constitutive Equations 8. Multiplicative Decomposition of Deformation Gradient Tensor 9. Multiplicative Hyperelastic-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 advanced topics such as the subloading surface model and the multiplicative decomposition among others Approaches finite elastoplasticity and viscoplasticity theory based on multiplicative decomposition and the subloading surface model Provides a thorough introduction to the general

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tensor formulation details for the embedded curvilinear coordinate system and the multiplicative decomposition of the deformation gradient

Plasticity of Metallic Materials presents a rigorous framework for description of plasticity phenomena, classic and recent models for isotropic and anisotropic materials, new original analytical solutions to various elastic/plastic boundary value problems and new interpretations of mechanical data based on these recent models. The book covers models for metals with both cubic and hexagonal crystal structures, presents the mechanical tests required to determine the model parameters, various identification procedures, verification, and validation tests, and numerous

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applications to metal forming. Outlines latest research on plastic anisotropy and its role in metal forming Presents characterization and validation tests for metals with various crystal structures Compares the predictive capabilities of various models for a variety of loadings

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 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 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 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 metals. Requisite mathematical tools appear in the final chapter for easy reference.



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Continuum Mechanics: Elasticity, Plasticity, Viscoelasticity builds a strong understanding of the principles, equations, and finite element formulations needed to solve real engineering problems.

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