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Fundamental guidance—including concepts, models, and methodology—for better understanding the dynamic behavior of materials and for designing for objects and structures under impact or intensive dynamic loading This book introduces readers to the dynamic response of structures with important emphasis on the material behavior under dynamic loadings. It utilizes theoretical modelling and analytical methods in order to provide readers with insight into the various phenomena. The content of the book is an introduction to the fundamental aspects, which underpin many important industrial areas. These areas include the safety of various transportation systems and a range of different structures when subjected to various impact and dynamic loadings, including terrorist attacks. Presented in three parts—Stress Waves in Solids, Dynamic Behaviors of Materials Under High Strain Rate, and Dynamic Response of Structures to Impact and Pulse Loading—Introduction to Impact Dynamics covers elastic waves, rate dependent behaviors of materials, effects of tensile force, inertial effects, and more. The book also features numerous case studies to aid in facilitating learning. The strength of the book is its clarity, balanced coverage, and practical examples, which allow students to learn the overall

knowledge of impact dynamics in a limited time whilst directing them to explore more advanced technical knowledge and skills. Considers both the dynamic behavior of materials and stress waves, and the dynamic structural response and energy absorption, emphasizing the interaction between material behavior and the structural response Provides a comprehensive description of the phenomenon of impact of structures, containing both fundamental issues of wave propagation and constitutive relation of materials, and the dynamic response of structures under impact loads Based on the authors' research and teaching experience as well as updated developments in the field Introduction to Impact Dynamics is the perfect textbook for graduate and postgraduate students, and will work as a reference for engineers in the fields of solid mechanics, automotive design, aerospace, mechanical, nuclear, marine, and defense. Limit and shakedown analysis for structures can provide a very useful tool for design and analysis of engineering structures. "Structural Plasticity - Limit, Shakedown and Dynamic Plastic Analyses of Structure" provides more general solutions of limit and shakedown analysis for structures by using a unified strength theory. A series of solutions of plates from circular, annular plates to rhombus plates and square plates, rotating discs and cylinders, pressure vessels are presented. These results encompass the Tresca-Mohr-Coulomb solution of structure as special cases. The unified solution, which cannot be obtained by using a single criterion, is suitable to more materials and structures. Maohong Yu is professor of Department of Civil Engineering at Xi'an Jiaotong University, China. He has authored 12 books including "Unified Strength Theory and Its Applications" and "Generalized Plasticity". Adiabatic shear bands are found in a variety of metals and other materials; they cause rapid weakening due to energy concentration in narrow regions of the material. This is the very first book on this important topic and the only true introduction to the subject. An enhanced and updated student-friendly edition of the authors' 1992 book Adiabatic Shear Localization: Occurrence, Theories and Applications, this seminal text now includes essential Further Reading sections in some chapters. It explains adiabatic shear bands in a descriptive rather than a mathematical way, with a 'quick reference' section for readers wanting a more rapid introduction. Entirely comprehensive, the reader can dip into the chapters as suits his or her course material or research. If you are a postgraduate materials scientist, engineer, physicist, metallurgist, or indeed any researcher in materials that undergo rapid deformation and failure, this text is not to be missed. The building materials covered by the Concise Encyclopedia of Building and Construction Materials are classified in three groups: structural materials, semistructural materials, and auxiliary materials. Proceedings of a symposium sponsored by the Shaping and Forming Committee of the Materials Processing and Manufacturing Division (MPMD) and the Mechanical Behavior Committee (Jt. SMD/ASM-MSCTS) of the Structural Materials Division (SMD) of TMS (The Minerals, Metals & Materials Society) and held during the 2002 TMS Annual Meeting in Seattle, Washington February 17-21, 2002. The book is targeted at engineers, university lecturers, postgraduates, and final year undergraduate students involved in computational modelling and experimental and theoretical analysis of the high-temperature behavior of engineering structures. It will also be of interest to researchers developing the thermal strength theory as a branch of continuum mechanics. Thermal integrity is a multidisciplinary field combining the expertise of mechanical engineers, material scientists and applied mathematicians, each approaching the problem from their specific viewpoint. This monograph draws on the research of a broad scientific community including the author's contribution. The scope of thermal strength analysis was considerably extended thanks to modern computers and the implementation of FEM codes. However, the author believes that some material models adopted in the advanced high-performance software, are not sufficiently justified due to lack of easy-to-follow books on the theoretical and experimental aspects of thermal integrity. The author endeavors to provide a thorough yet sufficiently simple presentation of the underlying concepts, making the book compelling to a wide audience. From the point of view of mechanics, this monograph systematically demonstrates the theory of plastic bending and its engineering applications; most of the contents of the book are based on the authors' research in the past decade. The monograph not only expounds the contributions of the authors to the fundamental theory of plastic bending, but also presents various applications of the theory in sheet metal forming, particularly in the analysis and prediction of springback and wrinkling of strips and plates subjected to bending or stamping. In addition to theoretical modelling, attention has also been paid to the development of related numerical methods; comparisons with experimental results are also presented. The Finite Element Method for Solid and Structural Mechanics is the key text and reference for engineers, researchers and senior students dealing with the analysis and modeling of structures, from large civil engineering projects such as dams to aircraft structures and small engineered components. This edition brings a thorough update and rearrangement of the book's content, including new chapters on: Material constitution using representative volume elements Differential geometry and calculus on manifolds Background mathematics and linear shell theory Focusing on the core knowledge, mathematical and analytical tools needed for successful structural analysis and modeling, The Finite Element Method for Solid and Structural Mechanics is the authoritative resource of choice for graduate level students, researchers and professional engineers. A proven keystone reference in the library of any engineer needing to apply the finite element method to solid mechanics and structural design. Founded by an influential pioneer in the field and updated in this seventh edition by an author team incorporating academic authority and industrial simulation experience. Features new chapters on topics including material constitution using representative volume elements, as well as consolidated and expanded sections on rod and shell models. In our present era of nanoscience and nanotechnology, new materials are poised to take center stage in dramatically improving friction and wear behavior under extreme conditions. Compiled by two eminent experts, Self-Organization During Friction: Advanced Surface-Engineered Materials and Systems Design details the latest advances and developments i Structural Impact is concerned with the behaviour of structures and components subjected to large dynamic, impact and explosive loads which produce inelastic deformations. It is of interest for safety calculations, hazard assessments and energy absorbing systems throughout industry. The first five chapters introduce the rigid plastic methods of analysis for the static behaviour and the dynamic response of beams, plates and shells. The influence of transverse shear, rotatory inertia, finite displacements and dynamic material properties are introduced and studied in some detail. Dynamic progressive buckling, which develops in several energy absorbing systems, and the phenomenon of dynamic plastic buckling are introduced. Scaling laws are discussed which are important for relating the response of small-scale experimental tests to the dynamic behaviour of full-scale prototypes. This text is invaluable to undergraduates, graduates and professionals learning about the behaviour of structures subjected to large impact, dynamic and blast loadings producing an inelastic response. More than six years ago, several of Rabotnov's close friends and colleagues from the USSR and USA decided to contribute a volume on Plasticity and Failure of Solids in honor of his 70th birthday. The celebration was interrupted unexpectedly by his death on May 13, 1985 at which time another decision was made still to publish the work, but as a memorial volume. As in any field of scientific endeavor, research confronts the scientists with anomalies;

our chosen area is no exception. The ways in which failure criteria and plasticity theory are combined can differ widely among the researchers; they will never yield quite the same results. Each of the invited contributors has, therefore, been encouraged to express his views and to expound on his personal opinion. The contributors are free of enumeration from the authority and/or consensus of any scientific society or community. What impedes scientific process is the esoteric tradition of accepting ideas and theories by consensus among members of societies and communities. The absence of such a trend is refreshing; the collaboration between the authors from the USSR and the USA had to be one of the contributing factors. Finally, the editors wish to acknowledge the authors who have made the publication of this volume possible. a. c. Sib S. T. Mileiko AJ. Ishlinsky xi The late Professor Yuriy Nickolaevich Rabotnov (February 24, 1914 - May 13, 1985) xii Scientific biography of the late academician Yu. N. This textbook provides a comprehensive guide to fracture mechanics and its applications, providing an in-depth discussion of linear elastic fracture mechanics and a brief introduction to nonlinear fracture mechanics. It is an essential companion to the study of several disciplines such as aerospace, biomedical, civil, materials and mechanical engineering. This interdisciplinary textbook is also useful for professionals in several industries dealing with design and manufacturing of engineering materials and structures. Beginning with four foundational chapters, discussing the theory in depth, the book also presents specific aspects of how fracture mechanics is used to address fatigue crack growth, environment assisted cracking, and creep and creep-fatigue crack growth. Other topics include mixed-mode fracture and materials testing and selection for damage tolerant design, alongside in-depth discussions of ensuring structural integrity of components through real-world examples. There is a strong focus throughout the book on the practical applications of fracture mechanics. It provides a clear description of the theoretical aspects of fracture mechanics and also its limitations. Appendices provide additional background to ensure a comprehensive understanding and every chapter includes solved example problems and unsolved end of chapter problems. Additional instructor support materials are also available. Understanding the elastoplastic deformation of metals and geomaterials, including the constitutive description of the materials and analysis of structure undergoing plastic deformation, is an essential part of the background required by mechanical, civil, and geotechnical engineers as well as materials scientists. However, most books address the subject at an introductory level and within the infinitesimal strain context. Elastoplasticity Theory takes a different approach in an advanced treatment presented entirely within the framework of finite deformation. This comprehensive, self-contained text includes an introduction to nonlinear continuum mechanics and nonlinear elasticity. In addition to in-depth analysis of the mathematical and physical theories of plasticity, it furnishes an up-to-date look at contemporary topics, such as plastic stability and localization, monocrystalline plasticity, micro-to-macro transition, and polycrystalline plasticity models. Elastoplasticity Theory reflects recent trends and advances made in the theory of plasticity over the last four decades. It will not only help stimulate further research in the field, but will enable its readers to confidently select the appropriate constitutive models for the materials or structural members relevant to their own applications. This important study focuses on the way in which structures and materials can be best designed to absorb kinetic energy in a controllable and predictable manner. Understanding of energy absorption of structures and materials is important in calculating the damage to structures caused by accidental collision, assessing the residual strength of structures after initial damage and in designing packaging to protect its contents in the event of impact. Whilst a great deal of recent research has taken place into the energy absorption behaviour of structures and materials and significant progress has been made, this knowledge is diffuse and widely scattered. This book offers a synthesis of the most recent developments and forms a detailed and comprehensive view of the area. It is an essential reference for all engineers concerned with materials engineering in relation to the theory of plasticity, structural mechanics and impact dynamics. Important new study of energy absorption of engineering structures and materials Shows how they can be designed to withstand sudden loading in a safe, controllable and predictable way Illuminating case studies back up the theoretical analysis The principal aim of this text is to encourage the development and application of numerical modelling techniques as an aid to achieving greater efficiency and optimization of metal-forming processes. The contents of this book have therefore been carefully planned to provide both an introduction to the fundamental theory of material deformation simulation, and also a comprehensive survey of the "state-of-the-art" of deformation modelling techniques and their application to specific and industrially relevant processes. To this end, leading international figures in the field of material deformation research have been invited to contribute chapters on subjects on which they are acknowledged experts. The information in this book has been arranged in four parts: Part I deals with plasticity theory, Part II with various numerical modelling techniques, Part III with specific process applications and material phenomena and Part IV with integrated computer systems. The objective of Part I is to establish the underlying theory of material deformation on which the following chapters can build. It begins with a chapter which reviews the basic theories of classical plasticity and describes their analytical representations. The second chapter moves on to look at the theory of deforming materials and shows how these expressions may be used in numerical techniques. The last two chapters of Part I provide a review of isotropic plasticity and anisotropic plasticity. Presenting the use of photonics techniques for measurement in mechanics, this book provides a state-of-the-art review of this active and rapidly growing field. It serves as an invaluable resource for readers to explore the current status and includes a wealth of information on the essential principles and methods. It provides a substantial background in a concise and simple way to enable physicists and engineers to assess, analyze and implement experimental systems needed to solve their specific measurement problems. It is a mechanics book written for materials scientists. It provides very simple basic principle written for audience with non mechanics background, so that readers who plan to adopt and integrate the mechanics in their research areas can do it the smart way. The book also has plenty examples on the simple applications of mechanics in various materials science areas: in metallurgy, in coating, in design and in materials science in general. This book is filling the gap between the concept of mechanics used in the 'mechanics world' and the concept of mechanics 'outside mechanics world'. It is perfect for researchers outside mechanics, especially in materials science, who want to incorporate the concept of mechanics in their works. It is originally a script used by a research group in materials science with no mechanics background. 1. Introduction. 2. Metal Forming Process. 3. Analysis and Technology in Metal Forming. 4. Plasticity and Viscoplasticity. 5. Methods of Analysis. 6. The Finite Element Method--Part I. 7. The Finite Element Method--Part II. 8. Plane-Strain Problems. 9. Axisymmetric Isothermal Forging. 10. Steady State Processes of Extrusion and Drawing. 11. Sheet Metal Forming. 12. Thermo-Viscoplastic Analysis. 13. Compaction and Forging of Porous Metals. 14. Three Dimensional Problems. 15. Preform Design in Metal Forming. 16. Solid Formulation, Comparison of Two Formulations, and Concluding Remarks. The surface coating field is a rapidly developing area of science and technology that offers new methods and techniques to control friction and wear. New coating types are continually

being developed and the potential applications in different industrial fields are ever growing, ranging from machine components and consumer products to medical instruments and prostheses. This book provides an extensive review of the latest technology in the field, addressing techniques such as physical and chemical vapour deposition, the tribological properties of coatings, and coating characterization and performance evaluation techniques. Eleven different cases are examined in close detail to demonstrate the improvement of tribological properties and a guide to selecting coatings is also provided. This second edition is still the only monograph in the field to give a holistic view of the subject and presents all aspects, including test and performance data as well as insights into mechanisms and interactions, thus providing the level of understanding vital for the practical application of coatings. *

An extensive review of the latest developments in the field of surface coatings * Presents both theory and practical applications *

Includes a guide for selecting coatings

Mechanics of Solids and Materials intends to provide a modern and integrated treatment of the foundations of solid mechanics as applied to the mathematical description of material behavior. The 2006 book blends both innovative (large strain, strain rate, temperature, time dependent deformation and localized plastic deformation in crystalline solids, deformation of biological networks) and traditional (elastic theory of torsion, elastic beam and plate theories, contact mechanics) topics in a coherent theoretical framework. The extensive use of transform methods to generate solutions makes the book also of interest to structural, mechanical, and aerospace engineers. Plasticity theories, micromechanics, crystal plasticity, energetics of elastic systems, as well as an overall review of math and thermodynamics are also covered in the book. Metal Forming: Formability, Simulation, and Tool Design focuses on metal formability, finite element modeling, and tool design, providing readers with an integrated overview of the theory, experimentation and practice of metal forming. The book includes formability and finite element topics, including insights on plastic instability, necking, nucleation and coalescence of voids. Chapters discuss the finite element method, including its accuracy, reliability and validity and finite element flow formulation, helping readers understand finite element formulations, iterative solution methods, friction and contact between objects, and other factors. The book's final sections discuss tool design for cold, warm and hot forming processes. Examples of tools, design guidelines, and information related to tool materials, lubricants, finishes, and tool failure are included as well. Provides fundamental, integrated knowledge on metal formability, finite element topics and tool design

Outlines user perspectives on accuracy, reliability and validity of finite element modeling

Discusses examples of tools, their design guidelines, tool lubricants, and tool failure

Considers the role played by stress triaxiality and shear and introduces uncoupled ductile damage criteria

Includes applications, worked examples and detailed techniques

This book contains 25 papers from the NATO Advanced Research Workshop on Recent Advances of Computer Modeling of Powder Metallurgy Processes. The papers address cold compaction, sintering, high-temperature compaction, processing modeling, and processes and materials. The integration of mechanical and physical aspects of P/M processes is emphasized. Contributors include researchers from Europe, the United States, Korea, and Japan. Author index only. c. Book News Inc

This book covers recent research and trends in Manufacturing Engineering. The chapters emphasize different aspects of the transformation from materials to products. It provides the reader with fundamental materials treatments and the integration of processes. Concepts such as green and lean manufacturing are also covered in this book. An important collection of review papers by internationally recognized experts on the broad area of the mechanics of solids. The present book deals with the finite-part singular integral equations, the multidimensional singular integral equations and the non-linear singular integral equations, which are currently used in many fields of engineering mechanics with applied character, like elasticity, plasticity, thermoelastoplasticity, viscoelasticity, viscoplasticity, fracture mechanics, structural analysis, fluid mechanics, aerodynamics and elastodynamics. These types of singular integral equations form the latest high technology on the solution of very important problems of solid and fluid mechanics and therefore special attention should be given by the reader of the present book, who is interested for the new technology of the twentieth-one century. Chapter 1 is devoted with a historical report and an extended outline of References, for the finite-part singular integral equations, the multidimensional singular integral equations and the non-linear singular integral equations. Chapter 2 provides a finite-part singular integral representation analysis in L_p spaces and in general Hilbert spaces. In the same Chapter are investigated all possible approximation methods for the numerical evaluation of the finite-part singular integral equations, as closed form solutions for the above type of integral equations are available only in simple cases. Also, Chapter 2 provides further a generalization of the well known Sokhotski-Plemelj formulae and the Nother theorems, for the case of a finite-part singular integral equation. This book follows a model of modern pedagogy. It is interdisciplinary and uses specific examples to teach general principles. This text is organized into three main sections. The first section reviews aspects of solid mechanics, with topics normally covered in standard materials courses but also dealing with purer mechanics concepts of relevance in materials science. The second section deals with analytical and computational ideas. The third section is called Experimental Method though it is really a series of examples based on Prof. Prawoto's personal experience. This type of presentation- the use of particular examples to demonstrate broader concepts - is powerful.

VI SOCRATES: I think that we ought to stress that we will write only about things that we have first hand experience in, in a coherent way that will be useful to engineers and other scientists and stressing the formulation without being too mathematical. We should write with integrity and honesty, giving reference to other authors where reference is due, but avoiding mentioning everybody just to be certain that our book is widely advertised. Above all, the book should be clear and useful.

PLATO: I think we should include a good discussion of fundamental ideas, of how integral equations are formed, pointing out that they are like two dimensional shadows of three dimensional objects, ...

SOCRATES: Stop there! Remember you are not 'the' Plato!

PLATO: Sorry, I was carried away.

ARISTOTLE: I think that the book should have many applications so that the reader can learn by looking at them how to use the method.

SOCRATES: I agree. But we should be careful. It is easy to include many illustrations and examples in a book in order to disguise its meagre contents. All examples should be relevant.

ARISTOTLE: And we should also include a full computer program to give the reader if so he wishes, a working experience of the technique. The major goal of this book is to present the implementation of some damage models with finite elements. The damage models are based on the principles of continuum damage mechanics and the effective stress concept. Several books have appeared recently on damage mechanics but are mostly theoretical in nature. Alternatively, this book provides a complete finite element program that includes the effects of damage. The book consists of two parts. Part I includes two chapters mainly review ing topics from finite element analysis and continuum damage mechanics. The reader is cautioned that the material contained in this part is introductor- other references must be consulted for the theoretical aspects of these topics. For a complete theoretical treatment of the subject, the reader is referred to the book Advances in Damage Mechanics: Metals and Metal Matrix Composites by Voyiadjis and Kattan, published in 1999. In Part II the

finite element program DNA is introduced in three chapters. DNA stands for "Damage Nonlinear Analysis". The program can be used for the analysis of elasto plastic material behavior including the effects of damage within the frame work of damage mechanics. Two versions of DNA are presented - one for small strain analysis and one for finite strain analysis. The program makes extensive calls to a library of tensor operations developed by the authors. The tensor library is extensively outlined in the last chapter of the book.

"Computational Plasticity with Emphasis on the Application of the Unified Strength Theory" explores a new and important branch of computational mechanics and is the third book in a plasticity series published by Springer. The other two are: Generalized Plasticity, Springer: Berlin, 2006; and Structural Plasticity, Springer and Zhejiang University Press: Hangzhou, 2009. This monograph describes the unified strength theory and associated flow rule, the implementation of these basic theories in computational programs, and shows how a series of results can be obtained by using them. The unified strength theory has been implemented in several special nonlinear finite-element programs and commercial Finite Element Codes by individual users and corporations. Many new and interesting findings for beams, plates, underground caves, excavations, strip foundations, circular foundations, slop, underground structures of hydraulic power stations, pumped-storage power stations, underground mining, high-velocity penetration of concrete structures, ancient structures, and rocket components, along with relevant computational results, are presented. This book is intended for graduate students, researchers and engineers working in solid mechanics, engineering and materials science. The theories and methods provided in this book can also be used for other computer codes and different structures. More results can be obtained, which put the potential strength of the material to better use, thus offering material-saving and energy-saving solutions. Mao-Hong Yu is a professor at the Department of Civil Engineering at Xi'an Jiaotong University, Xi'an, China. Superplasticity is the ability of polycrystalline materials under certain conditions to exhibit extreme tensile elongation in a nearly homogeneous/isotropic manner. Historically, this phenomenon was discovered and systematically studied by metallurgists and physicists. They, along with practising engineers, used materials in the superplastic state for materials forming applications. Metallurgists concluded that they had the necessary information on superplasticity and so theoretical studies focussed mostly on understanding the physical and metallurgical properties of superplastic materials. Practical applications, in contrast, were led by empirical approaches, rules of thumb and creative design. It has become clear that mathematical models of superplastic deformation as well as analyses for metal working processes that exploit the superplastic state are not adequate. A systematic approach based on the methods of mechanics of solids is likely to prove useful in improving the situation. The present book aims at the following.

1. Outline briefly the techniques of mechanics of solids, particularly as it applies to strain rate sensitive materials.
2. Assess the present level of investigations on the mechanical behaviour of superplastics.
3. Formulate the main issues and challenges in mechanics of superplasticity.
4. Analyse the mathematical models/constitutive equations for superplastic flow from the viewpoint of mechanics.
5. Review the models of superplastic metal working processes.
6. Indicate with examples new results that may be obtained using the methods of mechanics of solids.

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