

Formability Of Metallic Materials Plastic Anisotropy Formability Testing Forming Limits Engineering Materials

The concept of virtual manufacturing has been developed in order to increase the industrial performances, being one of the most efficient ways of reducing the manufacturing times and improving the quality of the products. Numerical simulation of metal forming processes, as a component of the virtual manufacturing process, has a very important lead time. The finite element method is currently the most widely used numerical procedure for simulating sheet metal forming processes. The accuracy of the simulation programs used in industry is influenced by the constitutive models and the forming limit curves models incorporated in their structure. From the above discussion, we can deduce that virtual manufacturing as a general concept, finite element method as a numerical analysis instrument and constitutive laws, as well as forming limit curves as a specificity of the sheet metal forming processes. Consequently, the material modeling is strategic when models of reality have to be built. The book gives a synthetic presentation of 10 years of forming simulation during more than 20 years by the members of three international teams: the Research Centre on Sheet Metal Forming—CERTETA (Technical University of Cluj-Napoca, Romania); AutoForm Company from Zürich, Switzerland and VOLVO automotive company from Sweden. The first chapter presents an overview of different FEM models used for sheet metal forming simulation, now and in the past.

This volume records the proceedings of an international symposium on "MECHANICS OF SHEET METAL FORMING: Material Behavior and Deformation Analysis." It was sponsored and held at the General Motors Research Laboratories on October 17-18, 1977. This symposium was the twenty-first in an annual series. The objective of this symposium is to research frontiers in experimental and theoretical methods of sheet metal forming analysis and, also, to determine directions of future research to advance technology that would be useful in metal stamping plants. Metal deformation analyses which provide guide lines for metal flanging are already in use. Moreover, recent advances in constitutive equations and in measurements of material parameters are leading to dynamic models of many stamping operations. These models would accurately predict the stresses and strains in the sheet as a function of punch travel. They would provide the engineer with the knowledge he needs to improve die designs. The symposium papers were divided into three parts, constitutive relations of sheet metal, role of friction, sheet metal formability, and deformation analysis of stamping operations. We believe this volume not only summarizes the various viewpoints at the time of the symposium, but also provides an outlook for materials and mechanics research in the future.

60 novel approaches in metal forming are presented and explained in detail. Contributions from acknowledged international scientists representing the state-of-art in metal forming open a general view on recent results and a clear view on demands for new research initiatives.

Library of Congress Subject Headings: F-O

Equivalent Stress Concept for Limit State Analysis

Theory of Metal Forming Plasticity

Plastic Instability and Flow Localization

Metal Forming

Library of Congress Subject Headings

This book gives a unified presentation of the research performed in the field of multiscale modelling in sheet metal forming over the course of more than thirty years by the members of six teams from internationally acclaimed universities. The first chapter is devoted to the presentation of some recent phenomenological yield criteria (BBC 2005 and BBC 2008) developed at the CERTETA center from the Technical University of Cluj-Napoca. An overview on the crystallographic texture and plastic anisotropy is presented in Chapter 2. Chapter 3 is dedicated to multiscale modelling of plastic anisotropy. The authors describe a new hierarchical multi-scale framework that allows taking into account the evolution of plastic anisotropy during sheet forming processes. Chapter 4 is focused on modelling the evolution of voids in porous metals with applications to forming limit curves and ductile fracture. The chapter details the steps needed for the development of dissipation functions and Gurson-type models for non-quadratic anisotropic plasticity criteria like BBC 2005 and those based on linear transformations. Chapter 5 describes advanced models for the prediction of forming limit curves developed by the authors. Chapter 6 is devoted to anisotropic damage in elasto-plastic materials with structural defects. Finally, Chapter 7 deals with modelling of the Portevin-Le Chatelier (PLC) effect. This volume contains contributions from leading researchers from the Technical University of Cluj-Napoca, Romania, the Catholic University of Leuven, Belgium, Clausthal University of Technology, Germany, Amirkabir University of Technology, Iran, the University of Bucharest, Romania, and the Institute of Mathematics of the Romanian Academy, Romania. It will prove useful to postgraduate students, researchers and engineers who are interested in the mechanical modeling and numerical simulation of sheet metal forming processes.

This book groups the main advances in material forming, considering different processes, both conventional and non-conventional. It focuses on polymers, composites and metals, which are analyzed from the state of the art. Special emphasis is devoted to the contributions of the European Scientific Association for Material Forming (ESAFORM) during the last decade and in particular the ones coming from its annual international conference.

This book provides in-depth knowledge about cross rolling of biomedical alloys, cellulose, magnetic iron oxide nanoparticles, magnesium-based nanocomposites, titanium, titanium alloys, stainless steel, and improved biodegradable implants materials for biomechanical applications like joint replacements, bone plates, bone cement, artificial ligaments and tendons, dental implants for tooth fixation, and hip implants. It comprehensively covers advancements in materials including graphene-reinforced magnesium metal matrix, magnesium and its alloys, and 2D nanomaterials. The text discusses important topics including advanced materials for biomechanical applications, design, and analysis of stainless steel 316L for femur bone fracture healing, design and manufacturing of prosthetic dental implants, a biomechanical study of a low-cost prosthetic leg, and an energy harvesting mechanism for walking applications.

The text will serve as a useful text for graduate students, academic researchers, and general practitioners in areas including materials science, manufacturing engineering, mechanical engineering, and biomechanical engineering.

Formability of Metallic Materials

Plastic Anisotropy, Formability Testing, Forming Limits

Formability of Metallic Materials - 2000 A.d.

Material Modeling and Structural Mechanics

Advanced Computational Materials Modeling

Aluminium Alloys

This collection represents a single volume of technical papers presented at the Annual International DIC Society Conference and SEM Fall Conference organized by the Society for Experimental Mechanics and Sandia National Laboratories and held in Philadelphia, PA, November 7-10, 2016. The volume presents early findings from experimental, standards development and various other investigations concerning digital image correlation - an important area within Experimental Mechanics. The area of Digital Image Correlation has been an integral track within the SEM Annual Conference spearheaded by Professor Michael Sutton from the University of South Carolina. In 2016, the SEM and Sandia joined their collaborative strengths to launch a standing fall meeting focusing specifically on developments in the area of Digital Image Correlation. The contributed papers within this volume span numerous technical aspects of DIC including standards development for the industry.

The intention of this book is to reveal and discuss some aspects of the metal forming plasticity theory. The modern theory describes deformation of metallic bodies in cold and hot regimes under combined thermal and mechanical loadings. Thermal and deformation fields appear in metal forming in various forms. A thermal field influences the material properties, modifies the extent of plastic zones, etc. and the deformation of metallic body induces changes in temperature distribution. The thermal effects in metal forming plasticity can be studied at two levels, depending on whether uncoupled or coupled theories of thermo-plastic response have to be applied. A majority of metal forming processes can be satisfactorily studied within an uncoupled theory. In such an approach the temperature enters the stress-strain relation through the material constants and through the thermal dilatation. The description of thermo-plastic deformation in metal forming is carried out on the ground of thermodynamics.

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

Metal Micro-forming

Sheet Metal Forming Processes

Introduction to the Mechanics of Plastic Forming of Metals

Encyclopedia of Aluminum and Its Alloys, Two-Volume Set (Print)

5th International and 26th All India Manufacturing Technology, Design and Research Conference, AIMTDR 2014

Material Behavior and Deformation Analysis

Applied Metal Forming: Including FEM Analysis describes metal forming theory and how experimental techniques can be used to study any metal forming operation with great accuracy. For each primary class of processes, such as forging, rolling, extrusion, wiredrawing, and sheet-metal forming, it explains how FEA (Finite Element Analysis) can be applied with great precision to characterize the forming condition and in this way optimize the processes. FEA has made it possible to build very realistic FEM-models of any metal forming process, including complex three-dimensional forming operations, in which complex products are shaped by complex dies. Thus, using FEA it is now possible to visualize any metal forming process and to study strain, stresses, and other forming conditions inside the parts being manufactured as they develop throughout the process.

This edited book contains extended research papers from AIMTDR 2014. This includes recent research work in the fields of friction stir welding, sheet forming, joining and forming, modeling and simulation, efficient prediction strategies, micro-manufacturing, sustainable and green manufacturing issues etc. This will prove useful to students, researchers and practitioners in the field of materials forming and manufacturing.

With its discussion of strategies for modeling complex materials using new numerical techniques, mainly those based on the finite element method, this monograph covers a range of topics including computational plasticity, multi-scale formulations, optimization and parameter identification, damage mechanics and nonlinear finite elements. Esaform 10 years on

Esaform 10 years on

Modeling and Applications to Forming

Advanced Materials for Biomechanical Applications

Superplastic Forming of Advanced Metallic Materials

Classical and Advanced Topics

Advances in Material Forming and Joining

The miniaturization of industrial products is a global trend. Metal forming technology is not only suitable for mass production and excellent in productivity and cost reduction, but it is also a key processing method that is essential for products that utilize advantage of the mechanical and functional properties of metals. However, it is not easy to realize the processing even if the conventional metal forming technology is directly scaled down. This is because the characteristics of materials, processing methods, die and tools, etc., vary greatly with miniaturization. In metal micro forming technology, the size effect of major issues for micro forming have also been clarified academically. New processing methods for metal micro forming have also been developed by introducing new special processing techniques, and it is a new wave of innovation toward high precision, high degree of processing, and high flexibility. To date, several special issues and books have been published on micro-forming technology. This book contains 11 of the latest research results on metal micro forming technology. The editor believes that it will be very useful for understanding the state-of-the-art of metal micro forming technology and for understanding future trends.

This book is a printed edition of the Special Issue "Advances in Plastic Forming of Metals" that was published in Metals

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 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

International Digital Imaging Correlation Society

Plasticity of Metallic Materials

Theory and Applications

Constitutive Modelling and Numerical Simulation

Proceedings of the First Annual Conference, 2016

Multiscale Modelling in Sheet Metal Forming

This book is addressed to both research scientists at universities and technical institutes and to engineers in the metal forming industry. It is based upon the author's experience as head of the Materials Science Department of the Institut für Umformtechnik at the University of Stuttgart. The book deals with materials testing for the special demands of the metal forming industry. The general forming, are not considered in detail since many books are available on this subject. Emphasis is put on the determination of processing properties of metallic materials in metal forming, i. e. the forming behavior. This includes the evaluation of stress-strain curves by tensile, upsetting or torsion tests as well as determining the limits of formability. Among these subjects, special emphasis has been put on the testing. The transferability of test results is discussed. Some testing methods for the functional properties of workpieces in the final state after metal forming are described. Finally, methods of testing tool materials for bulk metal forming are treated. Testing methods for surface properties and tribological parameters have not been included. The emphasis is put on the deformation of the specimen as the use of computers are only considered in very few cases deemed necessary.

Thermo-Mechanical Processing of Metallic Materials describes the science and technology behind modern thermo-mechanical processing (TMP), including detailed descriptions of successful examples of its application in the industry. This graduate-level introductory resource aims to fill the gap between two scientific approaches and illustrate their successful linkage by the use of suitable modern basics of metallic materials processing. The first section covers the microstructural science base of the subject, including the microstructure determined mechanical properties of metals. The second section deals with the current mechanical technology of plastic forming of metals. The concluding section demonstrates the interaction of the first two disciplines in a series of case studies of success in the field. This text is designed for use by graduate students coming into the field, for a graduate course textbook, and for Materials and Mechanical Engineers working in this area in the industry. * Covers both physical metallurgy and metals processing * Links basic science to real everyday applications * Written by four internationally-known experts in the field

The present book enhances in detail the scope and objective of various developmental activities of the aluminium alloys. A lot of research on aluminium alloys has been performed. Currently, the research efforts are connected to the relatively new methods and processes. We hope that people new to the aluminium alloys investigation will find this book to be of assistance for the industry and university aluminium alloys research.

F-O

An Engineering Approach and a Practical Guide

Advances in Plastic Forming of Metals

Advanced Methods in Material Forming

Including FEM Analysis

Advances in Material Forming

Tailor welded blanks are metallic sheets made from different strengths, materials, and/or thicknesses pre-welded together before forming into the final component geometry. By combining various sheets into a welded blank, engineers are able to 'tailor' the blank so that the properties are located precisely where they are needed and cost-effective, low weight components are produced. Tailor welded blanks for advanced manufacturing examines the manufacturing of tailor welded blanks and explores their current and potential future applications. Part one investigates processing and modelling issues in tailor welded blank manufacturing. Chapters discuss weld integrity, deformation during forming and the analytical and numerical simulation modelling of tailor welded blanks for advanced manufacturing. Part two looks at the current and potential future applications of tailor welded blanks. Chapters review tailor welded blanks of lightweight metals and of advanced high-strength steel and finally discuss the uses of tailor-welded blanks in the automotive and aerospace industries. With its distinguished editors and international team of expert contributors, Tailor welded blanks for advanced manufacturing proves an invaluable resource for metal fabricators, product designers, welders, welding companies, suppliers of welding machinery and anyone working in industries that use advanced materials such as in automotive and aerospace engineering. Engineers and academics involved in manufacturing and metallurgy may also find this book a useful reference. Examines the

manufacturing of tailor welded blanks and explores their current and potential future applications Investigates processing and quality issues in tailor welded blank manufacturing including weld integrity and deformation Reviews both current and potential future applications of tailor welded blanks as well as specific applications in the automotive and aerospace industries Ultra fine-grained metals can show exceptional ductility, known as superplasticity, during sheet forming. The higher ductility of superplastic metals makes it possible to form large and complex components in a single operation without joints or rivets. The result is less waste, lower weight and manufacturing costs, high precision and lack of residual stress associated with welding which makes components ideal for aerospace, automotive and other applications. Superplastic forming of advanced metallic materials summarises key recent research on this important process. Part one reviews types of superplastic metals, standards for superplastic forming, processes and equipment. Part two discusses ways of modelling superplastic forming processes whilst the final part of the book considers applications, including superplastic forming of titanium, aluminium and magnesium alloys. With its distinguished editor and international team of contributors, Superplastic forming of advanced metallic materials is a valuable reference for metallurgists and engineers in such sectors as aerospace and automotive engineering. Note: The Publishers wish to point out an error in the authorship of Chapter 3 which was originally listed as: G. Bernhart, Clément Ader Institute, France. The correct authorship is: G Bernhart, P. Lours, T. Cutard, V. Velay, Ecole des Mines Albi, France and F. Nazaret, Aurock, France. The Publishers apologise to the authors for this error. Reviews types of superplastic metals and standards for superplastic forming Discusses the modelling of superplastic forming, including mathematical and finite element modelling Examines various applications, including superplastic forming of titanium, aluminium and magnesium alloys The plastic forming of metallic materials is the most efficient and an important manufacturing technology in today's industry. Lightweight materials, such as titanium alloys, aluminum alloys, and ultra-high-strength steels, are used extensively in the automotive, aerospace, transportation, and construction industries, leading to increased demand for advanced innovative forming technologies. Today, numeric simulations are highly focused and provide a better understanding of the innovative forming processes. Computational methods and numerical analysis coupled with the modelling of the structural evolution allow us to reduce time costs and eliminate experimental tests. The subjects of research articles published in this nook are multidisciplinary, including friction and lubrication in sheet metal forming, hot strip rolling and tandem strip rolling, application of numeric methods to simulate metal forming processes, development of new creep performance materials, the single point incremental forming process, and the fatigue fracture characteristics of Alclad 7075-T6 aluminum alloy sheets joined by refill friction stir spot welding. Review articles summarize the approaches on the innovative numerical algorithms, experimental methods, and theoretical contributions that have recently been proposed for sheet metal forming by researchers and business research centers.

Formability and Workability of Metals

Inelasticity of Materials

60 Excellent Inventions in Metal Forming

Handbook of Workability and Process Design

Formability of Metallic Materials-2000 A.D.

Formability, Simulation, and Tool Design

The plastic forming of metals is a branch of technology, in which great progress has been achieved mainly by collecting practical data resulting from long-time experience. The contribution of theoretical analysis to this progress is not significant. The common argument was, that such an analysis is too difficult and often even impossible. However, the constantly increasing significance of coldwork processing in industrial practice and the progress in the automatic control of these processes, demanding a broad knowledge of the influence of various parameters, and also the need to improve the mechanical behaviour of coldworked elements have proved beyond doubt that better understanding of the theory of plastic forming processes is necessary. This general trend has become evident in several recent publications in recent years, even though these represent only the engineering, approximate approach to theoretical analysis. Recent significant progress in the mathematical theory of plasticity allows to build an analysis of plastic forming processes on a more sound basis. In particular there have been developed graphical methods by means of which slip-line and hodograph meshes are constructed for plane strain and axially symmetric problems. These graphical methods yield not only the required forces but also the. mode of plastic deformation, even for very complex problems. Numerical procedures also give good results if the digital computer technique is employed.

Smithells is the only single volume work which provides data on all key aspects of metallic materials. Smithells has been in continuous publication for over 50 years. This 8th Edition represents a major revision. Four new chapters have been added for this edition. these focus on; * Non conventional and emerging materials - metallic foams, amorphous metals (including bulk metallic glasses), structural intermetallic compounds and micr/nano-scale materials. * Techniques for the modelling and simulation of metallic materials. * Supporting technologies for the processing of metals and alloys. * An Extensive bibliography of selected sources of further metallurgical information, including books, journals, conference series, professional societies, metallurgical databases and specialist search tools. * One of the best known and most trusted sources of reference since its first publication more than 50 years ago * The only single volume containing all the data needed by researchers and professional metallurgists * Fully updated to the latest revisions of international standards

This book presents various questions of continuum mechanical modeling in the context of experimental and numerical methods, in particular, multi-field problems that go beyond the standard models of continuum mechanics. In addition, it discusses dynamic problems and practical solutions in the field of numerical methods. It focuses on continuum mechanics, which is often overlooked in the traditional division of mechanics into statics, strength of materials and kinetics. The book is dedicated to Prof. Volker Ulbricht, who passed away on April 9, 2021.

Mechanics of Sheet Metal Forming

Forming Processes of Modern Metallic Materials

Materials Testing for the Metal Forming Industry

Formability Topics - Metallic Materials

Methods and Applications

This encyclopedia, written by authoritative experts under the guidance of an international panel of key researchers from academia, national laboratories, and industry, is a comprehensive reference covering all major aspects of metallurgical science and engineering of aluminum and its alloys. Topics covered include extractive metallurgy, powder metallurgy (including processing), physical metallurgy, production engineering, corrosion engineering, thermal processing (processes such as metalworking and welding, heat treatment, rolling, casting, hot and cold forming), surface engineering and structure such as crystallography and metallography.

This book discusses arbitrary multiaxial stress states using the concept of equivalent stress. It highlights the most useful criteria, which can be applied to various classes of isotropic materials. Due to its simplicity and clarity, this concept is now widely used in component design, and many strength and yield criteria based on the equivalent stress concept have been formulated. Choosing the appropriate criterion for a given material remains the main challenge in applications. The most useful criteria can be applied best when the plausibility assumptions are known. Accordingly, the book introduces fitting methods based on mathematical, physical, and geometrical objective functions. It also features a wealth of examples that demonstrate the application of different approaches in modeling certain limit behaviors.

After a brief introduction into crystal plasticity,the fun- damentals of crystallographic textures and plastic anisotro- py, a main topic of this book, are outlined. A large chapter is devoted to formability testing both for bulk metal and sheet metal forming. For the first time testing methods for plastic anisotropy of round bars and tubes are included. A profound survey is given of literature about yield criteria for anisotropic materials up to most recent developments and the calculation of forming limits of anisotropic sheet me- tal. Other chapters are concerned with properties of workpieces after metal forming as well as the fundamentals of the theory of plasticity and finite element simulation of metal forming processes. The book is completed by a collection of tables of international standards for formability testing and of flow curves of metals which are most commonly used in metal forming. It is addressed both to university and industrial readers.

Smithells Metals Reference Book

From Classical to Multi-Scale Techniques

Tailor Welded Blanks for Advanced Manufacturing

Library of Congress Subject Headings: P-Z

Applied Metal Forming

Thermo-Mechanical Processing of Metallic Materials

With the advent of a host of new materials ranging from shape memory alloys to biomaterials to multiphase alloys, acquiring the capacity to model inelastic behavior and to choose the right model in a commercial analysis software has become a pressing need for practicing engineers. Even with the traditional materials, there is a continued emphasis on optimizing and extending their full range of capability in the applications. This textbook builds upon the existing knowledge of elasticity and thermodynamics, and allows the reader to gain confidence in extending one's skills in understanding and analyzing problems in inelasticity. By reading this textbook and working through the assigned exercises, the reader will gain a level of comfort and competence in developing and using inelasticity models. Thus, the book serves as a valuable book for practicing engineers and senior-level undergraduate/graduate-level students in the mechanical, civil, aeronautical, metallurgical and other disciplines. The book is written in three parts. Part I is primarily focused on lumped parameter models and simple structural elements such as trusses and beams. This is suitable for an advanced undergraduate class with just a strength of materials background. Part II is focused on small deformation multi-dimensional inelasticity and is suitable for a beginning graduate class. Sufficient material is included on how to numerically implement an inelastic model and solve either using a simple stress function type of approach or using commercial software. Case studies are included as examples. There is also an extensive discussion of thermodynamics in the context of small deformations. Part III focuses on more advanced situations such as finite deformation inelasticity, thermodynamical ideas and crystal plasticity. More advanced case studies are included in this part. ¶ This textbook takes a new, task- or scenario-based approach to teaching and learning inelasticity. The book is written in an active learning style that appeals to engineers and students who wish to design or analyze structures and components that are subject to inelasticity. ¶ The book incorporates thermodynamical considerations into the modeling right from an early stage. Extensive discussions are provided throughout the book on the thermodynamical underpinnings of the models. ¶ This textbook is the first to make extensive use of MATLAB to implement many inelasticity models. It includes the use of concepts such as Airy stress functions to solve plane problems for inelastic materials. The MATLAB codes are listed in the appendix for one to modify with their own models and requirements. ¶ Step-by-step procedures for formulations and calculations are provided for the reader to readily adapt to the inelastic problems that he or she attempts to solve. ¶ A large number of problems, exercises and projects for one to teach or learn from are included. These can be assigned as homework, in-class exercises or projects. ¶ The book is written in a modular fashion, which provides adequate flexibility for adaptation in classes that cater to different audiences such as senior-level students, graduate students, research scholars, and practicing engineers.

This book contains the most relevant papers presented in the International Conference on Materials Forming, ESAFORM 2005. It gathers selected plenary and keynote papers presented in the conference, offering an up-to-date synthesis of the academic and industrial research in the fields of physical and numerical modeling of materials forming processes.

Formability of Metallic MaterialsPlastic Anisotropy, Formability Testing, Forming LimitsSpringer Science & Business Media