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Computational Plasticity in Powder Forming Processes

Butterworth-Heinemann

This book presents state-of-the-art research on forming processes and formed metal product development aided by the Finite Element Method (FEM). Using extensive and informative illustrations, tables and photographs, it systematically presents real-life case studies and established findings regarding various forming processes and methods aided by FEM simulation, and addresses various issues related to metal formed part design, process determination, die design and die service life analysis and prolongation, as well as product quality assurance and improvement. Metal forming has been widely used in many industries. This traditional manufacturing process, however, has long been linked to many years of apprenticeship and skilled craftsmanship, and its conventional design and development paradigm appeared to involve more know-how and trial-and-error than in-depth scientific calculation, analysis and simulation. The design paradigm for forming processes and metal formed product development thus cannot meet the current demands for short development lead-times, low production costs and high product quality. With the advent of numerical simulation technologies, the design and development of forming processes and metal formed products are carried out with the aid of FEM simulation, allowing all the potential design spaces to be identified and evaluated, and the best design to ultimately be determined and implemented. Such a design and development paradigm aims at ensuring "designing right the first time" and reducing the need for trial-and-error in the workshop. This book provides postgraduates, manufacturing engineers and professionals in this field with an in-depth understanding of the design process and sufficient knowledge to support metal formed part design, forming process determination, tooling design, and product quality assurance and control via FEM simulation. "/p>

Flexible Metal Forming Technologies Springer Science & Business Media

This book systematically introduces the principles of flexible forming technologies to manufacture thin-walled complex-shaped components, the mechanism of controlling the material flow, the design and the configuration of flexible forming technologies' equipment and tools. It covers new technologies and new processes for forming hollow components, and relevant research on forming mechanisms, deformation laws, and defect control with examples from practical applications. It will be a useful reference for researchers, engineers, graduate and undergraduate students in aerospace, nuclear, railway, vehicle and petrochemical engineering, etc.

Sheet Metal Forming Optimization National Academies Press

In this collection, scientists and engineers from across industry, academia, and government present their latest improvements and innovations in all aspects of metal forming science and technology, with the intent of facilitating linkages and collaborations among these groups. Chapters cover the breadth of metal forming topics, from fundamental science to industrial application.

Micro Metal Forming Springer Science & Business Media
Micro Metal Forming, i. e. forming of parts and features with dimensions below 1 mm, is a young area of research in the wide field of metal forming technologies, expanding the limits for applying metal forming towards micro technology. The essential challenges arise from the reduced geometrical size and the increased lot size. In order to enable potential users to apply micro metal forming in production, information about the following topics are given: tribological behavior: friction between tool and work piece as well as tool wear mechanical behavior: strength and formability of the work piece material, durability of the work pieces size effects: basic description of effects occurring due to the fact, that the quantitative relation between different features changes with decreasing size process windows and limits for forming processes tool making methods numerical modeling of processes and process chains quality assurance and metrology All topics are discussed with respect to the questions relevant to micro metal forming. The description comprises information from actual research and the young history of this technology branch to be used by students, scientists and engineers in industry who

already have a background in metal forming and like to expand their knowledge towards miniaturization. tribological behavior: friction between tool and work piece as well as tool wear mechanical behavior: strength and formability of the work piece material, durability of the work pieces size effects: basic description of effects occurring due to the fact, that the quantitative relation between different features changes with decreasing size process windows and limits for forming processes tool making methods numerical modeling of processes and process chains quality assurance and metrology All topics are discussed with respect to the questions relevant to micro metal forming. The description comprises information from actual research and the young history of this technology branch to be used by students, scientists and engineers in industry who already have a background in metal forming and like to expand their knowledge towards miniaturization.

Metal Forming and the Finite-Element Method Springer Nature

It is the objective of the series IIMaterials Research and EngineeringII to publish information on technical facts and processes together with specific scientific models and theories. Fundamental considerations assist in the recognition of the origin of properties and the roots of processes. By providing a higher level of understanding, such considerations form the basis for further improving the quality of both traditional and future engineering materials, as well as the efficiency of industrial operations. In a more general sense, theory helps to integrate facts into a framework which ties relations between physical equilibria and mechanisms on the one hand, product development and economic competition on the other. Aspects of environmental compatibility, conservation of resources and of socio-cultural interaction form the final horizon - a subject treated in the first II volume of this series, IIMaterials in World Perspective . The four authors of the present book endeavor to present a comprehensive picture of process modelling in the important field of metal forming and thermomechanical treatment. The reader will be introduced to the rapidly-growing new field of application of computer-aided numerical methods to the quantitative simulation of complex technical processes. Extensive use is made of the state of scientific knowledge related

to materials behavior under mechanical stress and thermal treatment.

Tribological Technology in Sheet Metal Forming Springer
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, wire drawing, 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.

Cold and Hot Forging National Academies Press

Following the long tradition of the Schuler Company, the Metal Forming Handbook presents the scientific fundamentals of metal forming technology in a way which is both compact and easily understood. Thus, this book makes the theory and practice of this field accessible to teaching and practical implementation. The first Schuler "Metal Forming Handbook" was published in 1930. The last edition of 1966, already revised four times, was translated into a number of languages, and met with resounding approval around the globe. Over the last 30 years, the field of forming technology has been radically changed by a number of innovations. New forming techniques and extended product design possibilities have been developed and introduced. This Metal Forming Handbook has been fundamentally revised to take account of these technological changes. It is both a text book and a reference work whose initial chapters are concerned to provide a survey of the fundamental processes of forming technology and press design. The book then goes on to provide an in-depth study of the major fields of sheet metal forming, cutting, hydroforming and solid forming. A large number of relevant calculations offers state of the art solutions in the field of metal forming technology. In presenting technical explanations, particular emphasis was placed on easily understandable graphic visualization. All illustrations and diagrams were compiled using a standardized

system of functionally oriented color codes with a view to aiding the reader's understanding.

Memorial Tributes Elsevier

Written by authorities in the subject, this book provides a complete treatment of metal forming and machining by using the computational techniques FEM, fuzzy set theory and neural networks as modelling tools. The algorithms and solved examples included make this book of value to postgraduates, senior undergraduates, and lecturers and researchers in these fields. Research and development engineers and consultants for the manufacturing industry will also find it of use.

Sheet Metal Forming Processes and Die Design Elsevier

This publication has been written to honour the contribution to science and education made by the Distinguished Professor Emeritus Professor Schey on his eightieth birthday. The contributors to his book are among the countless researchers who have read, studied and learned from Professor Schey's work, which includes books, research monographs, invited papers, keynote papers, scientific journals and conferences. The topics include manufacturing, sheet and bulk metal forming and tribology, amongst others. The topics included in this book include: John Schey and value-added manufacturing; Surface finish and friction in cold-metal rolling; Direct observation of interface for tribology in metal forming; An examination of the coefficient of friction; Studies on microplasto hydrodynamic lubrication in metal forming; Numerical simulation of sheet metal forming; Geometric and mechanics model of sheet forming; Modelling and optimisation of metal forming processes; The mathematical modelling of hot rolling steel; Identification of rheological and tribological parameters; Oxide behaviour in hot rolling; Friction, lubrication and surface response in wire drawing; and Modelling and control of temper rolling and skin pass rolling.

Metal Forming Science and Practice Springer

Monitoring and control of microstructure evolution in metal processing is essential in developing the right properties in a metal. Microstructure evolution in metal forming processes summarises the wealth of recent research on the mechanisms, modelling and control of microstructure evolution during metal forming processes. Part one reviews the general principles involved in understanding and controlling microstructure evolution in metal forming. Techniques for modelling

microstructure and optimising processes are explored, along with recrystallisation, grain growth, and severe plastic deformation. Microstructure evolution in the processing of steel is the focus of part two, which reviews the modelling of phase transformations in steel, unified constitutive equations and work hardening in microalloyed steels. Part three examines microstructure evolution in the processing of other metals, including ageing behaviour in the processing of aluminium and microstructure control in processing nickel, titanium and other special alloys. With its distinguished editors and international team of expert contributors, Microstructure evolution in metal forming processes is an invaluable reference tool for metal processors and those using steels and other metals, as well as an essential guide for academics and students involved in fundamental metal research. Summarises the wealth of recent research on the mechanisms, modelling and control of microstructure evolution during metal forming processes. Comprehensively discusses microstructure evolution in the processing of steel and reviews the modelling of phase transformations in steel, unified constitutive equations and work hardening in microalloyed steels. Examines microstructure evolution in the processing of other materials, including ageing behaviour in the processing of aluminium.

Mechanics of Sheet Metal Forming Oxford University Press on Demand

One of the most important manufacturing processes, metal forming is essential for engineers working in the manufacturing and related sectors. This book covers fundamental aspects and recent technological developments in the area: from fundamentals of plasticity, friction in metal forming, and metal extrusion to forming process optimization, sheet metal forming, flange wrinkling in deep drawing, formability of tailor welded blanks, and much more.

Flexible Metal Forming Technologies CRC Press

This open access book contains the research report of the Collaborative Research Center "Micro Cold Forming" (SFB 747) of the University of Bremen, Germany. The topical research focus lies on new methods and processes for a mastered mass production of micro parts which are smaller than 1mm (by forming in batch size higher than one million). The target audience primarily comprises research experts and practitioners in production engineering, but the book may also be of interest to

graduate students alike.

Metal Forming Handbook Elsevier

This book systematically introduces the principles of flexible forming technologies to manufacture thin-walled complex-shaped components, the mechanism of controlling the material flow, the design and the configuration of flexible forming technologies' equipment and tools. It covers new technologies and new processes for forming hollow components, and relevant research on forming mechanisms, deformation laws, and defect control with examples from practical applications. It will be a useful reference for researchers, engineers, graduate and undergraduate students in aerospace, nuclear, railway, vehicle and petrochemical engineering, etc.

Metal Forming Academic Press

Incremental Sheet Forming (ISF) exempts use of dies and reduces cost for manufacturing complex parts. Sheet metal forming is used for producing high-quality components in automotive, aerospace, and medical industries. This book covers the benefits of this new technology, including the process parameters along with various techniques. Each variant of this novel process is discussed along with the requirements of machinery and hardware. In addition, appropriate guidelines are also suggested regarding the relationship between process parameters and aspects of ISF process in order to ensure the applicability of the process on the industrial scale. This book will be a useful asset for researchers, engineers in manufacturing industries, and postgraduate level courses.

Cold Micro Metal Forming Springer Science & Business Media

Sustainable Manufacturing Processes provides best practice advice on sustainable manufacturing methods, with examples from industry as well as important supporting theory. In the current manufacturing industry, processes and materials are developed with close reference to sustainability issues, and with an outward look to optimum production efficiency and reduced environmental impact. Important topics like the use of renewable energy, reducing material waste and recycling, reduction in energy and water consumption, and reduction in emissions are all discussed, along with broad coverage of deformation and joining technologies, computational techniques and digital engineering. In addition, a wide range of traditional and innovative manufacturing technologies are covered, including friction stir

welding, micro forming, additive manufacturing, extrusion, and hot forming. Features practical case studies from industry experts Explains methods for reducing waste in additive manufacturing Provides a detailed examination on how sustainability is measured in manufacturing

Sheet Metal Forming Processes Springer Science & Business Media

The purpose of this project is to determine the inherent limitations of sheet metal forming processes, to develop the knowledge to significantly advance these, and to recommend the manner in which this can be accomplished. Principal areas of investigation are concerned with the effect that primary process variables such as velocity, temperature and pressure have on various classes of metals and alloys. This report presents the results of the experimental part of the program covering the first sixteen months. This experimental work was performed for tensile testing, free bulging of tubing and domes, and forming of parts with dies using a projectile impact tensile test fixture, low explosive - closed system, high explosive open system, electrohydraulic open system, electromagnetic system, and conventional presses. In addition, high-pressure rubber forming was investigated, utilizing both static and impact presses in conjunction with heat. (Author).

SHEET METAL FORMING TECHNOLOGY. VOLUME I. Springer Science & Business Media

Incremental Sheet Forming (ISF) exempts use of dies and reduces cost for manufacturing complex parts. Sheet metal forming is used for producing high-quality components in automotive, aerospace, and medical industries. This book covers the benefits of this new technology, including the process parameters along with various techniques. Each variant of this novel process is discussed along with the requirements of machinery and hardware. In addition, appropriate guidelines are also suggested regarding the relationship between process parameters and aspects of ISF process in order to ensure the applicability of the process on the industrial scale. This book will be a useful asset for researchers, engineers in manufacturing industries, and postgraduate level courses.

Modeling of Metal Forming and Machining Processes Asm International

This comprehensive text presents the subject of metalworking by

offering a clear account of the theory and applications of metal forming processes relevant to engineering practice. It is designed to serve as a textbook for undergraduate and postgraduate students of mechanical engineering, production engineering, industrial engineering, and metallurgical engineering. The first seven chapters are devoted to basic concepts to equip the students with the background material on mechanics, material sciences and to provide them with a sound foundation in the theory of plasticity. In addition, the importance of friction and lubrication in metal forming processes is adequately highlighted. In the next nine chapters the reader is exposed to a richly detailed discussion of specific forming processes (including the lubricated metal forming processes) and new and powerful techniques are presented (load bounding and slip line field) for solving engineering problems in metal forming. The book then moves on to forming of polymers and also covers metal powder preforms, highlighting recent developments. In the concluding portions of the book, the important factors such as force, power requirements, formability and machinability in the study of individual processes, are briefly discussed. Finally, the application of computer-aided analysis in the metalworking processes has been demonstrated, being the demand in this competitive scenario. Several chapter-end exercises are included to aid better understanding of the theory.

Advanced Methods in Material Forming CRC Press

Automotive and aerospace components, utensils, and many other products are manufactured by a forming/drawing process on press machines of very thin sheet metal, 0.8 to 1.2 mm. It is imperative to study the effect of all involved parameters on output of this type of manufacturing process. This book offers the readers with application and suitability of various evolutionary, swarm, and bio-inspired optimization algorithms for sheet metal forming processes. Book initiates by presenting basics of metal forming, formability followed by discussion of process parameters in detail, prominent modes of failure, basics of optimization and various bioinspired approaches followed by optimization studies on various industrial components applying bioinspired optimization algorithms. Key Features: • Focus on description of basic investigation of metal forming, as well as evolutionary optimization • Presentation of innovative optimization methodologies to close the gap between those formulations and

industrial problems, aimed at industrial professionals • Includes mathematical modeling of drawing/forming process • Discusses key performance parameters, such as Thinning, Fracture, and Wrinkling • Includes both numerical and experimental analysis
Metal Forming Practise Elsevier
This book describes different types of rubber-pad forming processes currently being studied for their experimental and

numerical advantages and disadvantages. Rubber forming adopts a rubber pad contained in a rigid box in which one of the tools (die or punch) is replaced by the rubber pad. Up to 60% of all sheet metal parts in aircraft industry such as frames, seat parts, ribs, windows and doors are fabricated using rubber-pad forming processes. Key process parameters such as rubber material, stamping velocity, rubber-pad hardness and thickness and friction

conditions are investigated. The potential role of rubber as a flexible punch in metal working processes is to give insight to engineers about different parts that can be produced using this process The procedure of suitable die design for each process is presented in detail Full defect analysis is undertaken with a thorough report presented to optimize rubber-pad forming processes