Metal Forming Analysis Cambridge University Press

The physical modelling of metal forming processes has been widely used both in University and in Industry for many years. Relatively simple numerical models, such as the Slab Method and the Upper Bound Method, were first used and many such models are implemented in the industry for practical design or regulation of forming processes. These are also under investigation in the University, mainly for treat models ments which require low cost calculations or very fast answers for on-line integration. More recently, sophisticated numerical methods have been used for the simulation of metal flow during forming operations. Since the early works in 1973 and 1974, mainly in U. K. and U. S. A. , the applications of the finite element method to metal processing have been developed in many laboratories all over the world. Now the numerical approach seems to be widely re cognized as a powerful tool for comprehension oriented studies, for predic ting the main technological parameters, and for the design and the optlmi zation of new forming sequences. There is also a very recent trend for the introduction of physical laws in the thermo-mechanical models, in order to predict the local evolution of internal variable representing the micro structure of the metal. To day more and more practicians of the Industry are asking for compu ter models for design of their forming processes.

This is the second part of a four part series that covers discussion of computer design tools throughout the design process. Through this book, the reader will... ...understand basic design principles and all digital design paradigms. ...understand CAD/CAE/CAM tools available for various design related tasks. ...understand how to put an integrated system together to conduct All Digital Design (ADD). ...understand industrial practices in employing ADD and tools for product development. Provides a comprehensive and thorough coverage of essential elements for product manufacturing and cost estimating using the computer aided engineering paradigm Covers CAD/CAE in virtual manufacturing, tool path generation, rapid prototyping, and cost estimating; each chapter includes both analytical methods and computer-aided design methods, reflecting the use of modern computational tools in engineering design and practice A case study and tutorial example at the end of each chapter provides hands-on practice in implementing off-the-shelf computer design tools Provides two projects at the end of the book showing the use of Pro/ENGINEER® and SolidWorks® to implement concepts discussed in the book

This collection of papers focus on advanced methods for predicting and avoiding the occurrence of defects in manufactured products. A new feature is included, namely, the influence of the processing-induced defects on the integrity of structures. The following topics are developed: damage modeling; damage evaluation and rupture; strain localization and instability analysis; formability characterization; prediction of shape inaccuracies; influence of defects on structural integrity. The main manufacturing operations are covered and various materials are examined, such as new and conventional metal alloys, ceramics, polymers and composites.

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>

Fundamentals of Engineering Plasticity
ASCAT 2022
Sheet Metal Forming Optimization
Design and Development of Metal-Forming Processes and Products Aided by Finite Element Simulation
Proceedings of First Asian Symposium on Cellular Automata Technology
Formability, Simulation, and Tool Design

This work addresses the analysis of a sequential chain of processing steps, which is particularly important for the manufacture of robust product components. In each processing step, the material properties may have changed and distributions of related characteristics, for example, strains, may become inhomogeneous. For this reason, the history of the process including design-parameter uncertainties becomes relevant for subsequent processing steps. Therefore, we have developed a methodology, called PRO-CHAIN, which enables an efficient analysis, quantification, and propagation of uncertainties for complex process chains locally on the entire mesh. This innovative methodology has the objective to improve the overall forecast quality, specifically, in local regions of interest, while minimizing the computational effort of subsequent analysis steps. We have demonstrated the benefits and efficiency of the methodology proposed by means of real applications from the automotive industry.

A professional reference for advanced courses in two of the most common manufacturing processes: metal forming and metal cutting.

Thorough reference to numerical techniques used for simulating metal forming operations.

The book presents a collection of 25 papers (including one review paper) on state-of-the art achievements in the theory and practice of crystals plasticity. The articles cover a wide scope of research on materials behavior subjected to external loadings, starting from atomic-scale simulations, and a new methodological aspect, to experiments on a structure and mechanical response upon a large-scale processing. Thus, a presented contribution of researchers from 18 different countries can be virtually divided into three groups, namely (i) "modelling and simulation"; (ii) "methodological aspects"; and (iii) "experiments on process/structure/properties relationship". Furthermore, a large variety of materials are investigated including more conventional (steels, copper, titanium, nickel, aluminum, and magnesium alloys) and advanced ones (composites or high entropy alloys). The book should be interested for senior students, researchers and engineers working within discipline of materials science and solid state physics of crystalline materials.

Applied Metal Forming
Mechanics and Metallurgy
Sheet Metal 2007
Damage Mechanics in Metal Forming
Bioinspired Approaches
Manufacturing and Management

Bringing together the world's leading researchers and practitioners of computational mechanics, these new volumes meet and build on the eight key challenges for research and development in computational mechanics. Researchers have recently identified eight critical research tasks facing the field of computational mechanics. These tasks have come about because it appears possible to reach a new level of mathematical modelling and numerical solution that will lead to a much deeper understanding of nature and to great improvements in engineering design. The eight tasks are: The automatic solution of mathematical models Effective numerical schemes for fluid flows The development of an effective mesh-free numerical solution method The development of numerical procedures for multiphysics problems The development of numerical procedures for multiscale problems The modelling of uncertainties The analysis of complete life cycles of systems Education - teaching sound engineering and scientific judgement Readers of Computational Fluid and Solid Mechanics 2003 will be able to apply the combined experience of many of the world's leading researchers to their own research needs. Those in academic environments will gain a better insight into the needs and constraints of the industries they are involved with; those in industry will gain a competitive advantage by gaining insight into the cutting edge research being carried out by colleagues in academia. Features Bridges the gap between academic researchers and practitioners in industry Outlines the eight main challenges facing Research and Design in Computational mechanics and offers new insights into the shifting the research agenda Provides a vision of how strong, basic and exciting education at university can be harmonized with life-long learning to obtain maximum value from the new powerful tools of analysis

Publisher Description

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

This book helps the engineer understand the principles of metal forming and analyze forming problems--both the mechanics of forming processes and how the properties of metals interact with the processes. In this third edition, an entire chapter has been devoted to forming limit diagrams and various aspects of stamping and another on other sheet forming operations. Sheet testing is covered in a separate chapter. Coverage of sheet metal properties has been expanded. Interesting end-of-chapter notes have been added throughout, as well as references. More than 200 end-of-chapter problems are also included.

The Computer Aided Engineering Design Series
Advances in Mechanics of High-Temperature Materials
Finite-element Plasticity and Metalforming Analysis
Computational and Numerical Simulations
Mechanics of Sheet Metal Forming
13th International Conference on Aluminum Alloys (ICAA 13)

Computational and Numerical Simulations is an edited book including 20 chapters. Book handles the recent research devoted to numerical simulations of physical and engineering systems. It presents both new theories and their applications, showing bridge between theoretical investigations and possibility to apply them by engineers of different branches of science. Numerical simulations play a key role in both theoretical and application oriented research.

The theory of plasticity is a branch of solid mechanics that investigates the relationship between permanent deformation and load, and the distribution of stress and strains of materials and structures beyond their elastic limit. Engineering plasticity underpins the safety of many modern systems and structures. Realizing the full potential of materials as well as designing precise metal processing and energy absorption structures requires mastery of engineering plasticity. Introduction to Engineering Plasticity: Fundamentals with Applications in Metal Forming, Limit Analysis and Energy Absorption presents both fundamental theory on plasticity and emphasizes the latest engineering applications. The title combines theory and engineering applications of plasticity, elaborating on problem solving in real-world engineering tasks such as in metal forming, limit analysis of structures, and understanding the energy absorption of structures and materials. The five main parts of the book cover: Plastic properties of materials and their characterization; Fundamental theory in plasticity; Elastic-plastic problems and typical solutions; and Rigid-plastic problems under plane-stress conditions. This title provides students and engineers alike with the fundamentals and advanced tools needed in engineering plasticity. Brings together plasticity theory with engineering applications and problem solving Elaborates problem solving methods and demonstrates plasticity in various engineering fields Covers the recent decades of research on metal forming and limit analysis Includes energy absorption of new structures and materials where plasticity dominates analysis and design Gives a systematic account of the theory of plasticity alongside its engineering applications

Rolling is an important metal forming process which involves the passing of metal stock through a pair of rollers. It is categorized depending on the recrystallization temperature of the metal rolled. This book covers the entire gamut of rolling technology in one volume. It begins with a brief history of rolling, and goes on to discuss different rolling processes, the deformation of materials, and the classification of rolling mills and stands. The book discusses rolling applications of steel blooms, slabs, bars, plates, rods, heavy sections and non-ferrous metals in detail. It covers important rolling process parameters, including rolling friction, stress and strain across rolled strip thickness, rolling torque and power and roll separation force. It also provides details on the design and applications of various rolling equipment, including mill rolls, neck bearings, spindles, coilers and decoilers.

This book helps the engineer understand the principles of metal forming and analyze forming problems - both the mechanics of forming processes and how the properties of metals interact with the processes. In this fourth edition, an entire chapter has been devoted to forming limit diagrams and various aspects of stamping and another on other sheet forming operations. Sheet testing is covered in a separate chapter. Coverage of sheet metal properties has been expanded. Interesting end-of-chapter notes have been added throughout, as well as references. More than 200 end-of-chapter problems are also included.

Computational Fluid and Solid Mechanics 2003
Handbook of Metallurgical Process Design
Introduction to Engineering Plasticity
Modelling of Metal Forming Processes
Applications in Metal Forming and Resistance Welding
Nonlinear Continuum Mechanics for Finite Element Analysis

This book presents a collection of contributions on advanced approaches to the mechanics of materials and mechanics of structures for high-temperature applications, such as power plant components, engines and turbochargers. The contributions highlight advanced constitutive models for high-temperature materials, as well as new approaches to the efficient modeling and analysis of engineering structures operating in high-temperature environments.

Finite Element Plasticity and Metalforming Analysis is specifically devoted to the finite element method and its use in plasticity problems. It details the theoretical background, assuming little previous knowledge, and how it can be used to examine realistic metalforming processes. Forging, rolling and extrusion are typical processes covered in the text, in addition to more specific problems. It is the first text that describes in detail elastic-plastic finite-element theory and how it is used in forming analyses. For the most realistic problems large capacity computing facilities are required, but the text describes simplified versions of the program that can be run on microcomputers and includes a full listing of a program that can be used for demonstration purposes. A full bibliography of books and research papers, with 700 entries, is provided to aid those investigating the subject.

Modeling of Thermo-Electro-Mechanical Manufacturing Processes with Applications in Metal Forming and Resistance Welding provides readers with a basic understanding of the fundamental ingredients in plasticity, heat transfer and electricity that are necessary to develop and proper utilize computer programs based on the finite element flow formulation. Computer implementation of a wide range of theoretical and numerical subjects related to mesh generation, contact algorithms, elasticity, anisotropic constitutive equations, solution procedures and parallelization of equation solvers is comprehensively described. Illustrated and enriched with selected examples obtained from industrial applications, Modeling of Thermo-Electro-Mechanical Manufacturing Processes with Applications in Metal Forming and Resistance Welding works to diminish the gap between the developers of finite element computer programs and the professional engineers with expertise in industrial joining technologies by metal forming and resistance welding.

A comprehensive survey of the welding methods in use today provides information on all types of welding methods and tools, including manual metal arc welding, gas shielded metal arc welding, tungsten inert gas shielded welding, plasma arc, and cutting.

Conference Proceedings
Tribology for Scientists and Engineers
Applied Plasticity, Second Edition

by Finite Element and Soft Computing Methods
Advanced Methods in Materials Processing Defects

This book contains 14 invited contributions written by distinguished authors who participated in the VIII International Conference on Computational Plasticity held at CIMNE/UPC (www.cimne.com) from 5-8 September 2005, in Barcelona, Spain. The chapters present recent progress and future research directions in the field of computational plasticity.

Volume is indexed by Thomson Reuters CPCI-S (WoS). Collections of peer-reviewed papers always make excellent sources of knowledge and new ideas for researchers coming from both universities and industry. The present collection in particular provides interdisciplinary and international resources, thus encouraging the close cooperation of material scientists, manufacturing and computer engineers and promoting the diffusion of research results, and technology transfer, in all areas of Sheet Metal Processing and Characterization.

Designing engineering components that make optimal use of materials requires consideration of the nonlinear characteristics associated with both manufacturing and working environments. The modeling of these characteristics can only be done through numerical formulation and simulation, and this requires an understanding of both the theoretical background and associated computer solution techniques. By presenting both nonlinear continuum analysis and associated finite element techniques under one roof, Bonet and Wood provide, in this edition of this successful text, a complete, clear, and unified treatment of these important subjects. New chapters dealing with hyperelastic plastic behavior are included, and the authors have thoroughly updated the FLagSHyP program, freely accessible at www.flagshyp.com. Worked examples and exercises complete each chapter, making the text an essential resource for postgraduates studying nonlinear continuum mechanics. It is also ideal for those in industry requiring an appreciation of the way in which their computer simulation programs work.

Polymer degradation is a change in the properties -- tensile strength, colour, shape, etc -- of a polymer or polymer based product under the influence of one or more environmental factors such as heat, light or chemicals. These changes may be undesirable, such as changes during use, or desirable, as in biodegradation or deliberately lowering the molecular weight of a polymer. Such changes occur primarily because of the effect of these factors on the chemical composition of the polymer. In a finished product such a change is to be prevented or delayed. However, the degradation process can be useful from the view points of understanding the structure of a polymer or recycling/reusing the polymer waste to prevent or reduce environmental pollution. Polymers molecules are very large on the molecular scale which derive their unique and useful properties from their size.

Metal Forming Analysis
Metal Forming
Computational Plasticity
Mechanical Behavior of Materials
Approximation Methods for High Dimensional Simulation Results - Parameter Sensitivity Analysis and Propagation of Variations for Process Chains
Modeling of Metal Forming and Machining Processes

William Hosford's book is ideal for those involved in designing sheet metal forming processes. Knowledge of plasticity is essential for the computer simulation of metal forming processes and understanding the advances in plasticity theory is key to formulating sound analyses. The author makes the subject simple by avoiding notations used by specialists in mechanics. R. Hill's authoritative book, Mathematical Theory of Plasticity (1950), presented a comprehensive treatment of continuum plasticity theory up to that time; much of the treatment in this book covers the same ground, but focuses on more practical topics. Hosford has included recent developments in continuum theory, including a newer treatment of anisotropy that has resulted from calculations of yielding based on

crystallography, analysis of the role of defects, and forming limit diagrams. A much greater emphasis is placed on deformation mechanisms and the book also includes chapters on slip and dislocation theory and twinning.

Reviewing an extensive array of procedures in hot and cold forming, casting, heat treatment, machining, and surface engineering of steel and aluminum, this comprehensive reference explores a vast range of processes relating to metallurgical component design-enhancing the production and the properties of engineered components while reducing manufacturing costs. It surveys the role of computer simulation in alloy design and its impact on material structure and mechanical properties such as fatigue and wear. It also discusses alloy design for various materials, including steel, iron, aluminum, magnesium, titanium, super alloy compositions and copper.

This book begins with the fundamentals of the mathematical theory of plasticity. The discussion then turns to the theory of plastic stress and its applications to structural analysis. It concludes with a wide range of topics in dynamic plasticity including wave propagation, armor penetration, and structural impact in the plastic range. In view of the rapidly growing interest in computational methods, an appendix presents the fundamentals of a finite-element analysis of metal-forming problems.

This is a collection of papers presented at the 13th International Conference on Aluminum Alloys (ICAA-13), the premier global conference for exchanging emerging knowledge on the structure and properties of aluminum materials. The papers are organized around the topics of the science of aluminum alloy design for a range of market applications; the accurate prediction of material properties; novel aluminum products and processes; and emerging developments in recycling and applications using both monolithic and multi-material solutions.

Fundamentals with Applications in Metal Forming, Limit Analysis and Energy Absorption

Product Manufacturing and Cost Estimating using CAD/CAE

Principles and Applications of Metal Rolling

Crystal Plasticity

Advanced Modeling and Numerical Simulation

Including FEM Analysis

This is a textbook on the mechanical behavior of materials for mechanical and materials engineering. It emphasizes quantitative problem solving. This new edition includes treatment of the effects of texture on properties and microstructure in Chapter 7, a new chapter (12) on discontinuous and inhomogeneous deformation, and treatment of foams in Chapter 21.

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.

This book describes available tribology technologies and introdces a comprehensive overview of tribology. General, up-to-date knowledge on how tribology is approached in various related areas of research, both experimental and computational is provided.

This volume records the proceedings of an international symposium on "ME CHANICS OF SHEET METAL FORMING: Material Behavior and Deformation Analysis." It was sponsored and held at the General Motors Research Labora tories on October 17-18, 1977. This symposium was the twenty-first in an annual series. The objective of this symposium was to discuss the 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 computer techniques for solving plastic flow 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 organized into five sessions: the state of the art, 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 pro vides an outlook for materials and mechanics research in the future.

Proceedings of the Euromech 233 Colloquium, Sophia Antipolis, France, August 29–31, 1988

The Science and Practice of Welding: Volume 2

Progress in Polymer Degradation and Stability Research

Modeling of Thermo-Electro-Mechanical Manufacturing Processes

From Basics to Advanced Concepts

Using FEM Analysis

The first of many important works featured in CRC Press' Metals and Alloys Encyclopedia Collection, the Encyclopedia of Iron, Steel, and Their Alloys covers all the fundamental, theoretical, and application-related aspects of the metallurgical science, engineering, and technology of iron, steel, and their alloys. This Five-Volume Set addresses topics such as extractive metallurgy, powder metallurgy and processing, physical metallurgy, production engineering, corrosion engineering, thermal processing, metalworking, welding, iron- and steelmaking, heat treating, rolling, casting, hot and cold forming, surface finishing and coating, crystallography, metallography, computational metallurgy, metal-matrix composites, intermetallics, nano- and micro-structured metals and alloys, nano- and micro-alloying effects, special steels, and mining. A valuable reference for materials scientists and engineers, chemists, manufacturers, miners, researchers, and students, this must-have encyclopedia: Provides extensive coverage of properties and recommended practices Includes a wealth of helpful charts, nomograms, and figures Contains cross referencing for quick and easy search Each entry is written by a subject-matter expert and reviewed by an international panel of renowned researchers from academia, government, and industry. Also Available Online This Taylor & Francis encyclopedia is also available through online subscription, offering a variety of extra benefits for researchers, students, and librarians, including: Citation tracking and alerts Active reference linking Saved searches and marked lists HTML and PDF format options Contact Taylor and Francis for more information or to inquire about subscription options and print/online combination packages. US: (Tel) 1.888.318.2367; (E-mail) e-reference@taylorandfrancis.com International: (Tel) +44 (0) 20 7017 6062; (E-mail) online.sales@tandf.co.uk

The aim of this book is to summarize the current most effective methods for modeling, simulating, and optimizing metal forming processes, and to present the main features of new, innovative methods currently being developed which will no doubt be the industrial tools of tomorrow. It discusses damage (or defect) prediction in virtual metal forming, using advanced multiphysical and multiscale fully coupled constitutive equations. Theoretical formulation, numerical aspects as well as application to various sheet and bulk metal forming are presented in detail. Virtual metal forming is nowadays inescapable when looking to optimize numerically various metal forming processes in order to design advanced mechanical components. To do this, highly predictive constitutive equations accounting for the full coupling between various physical phenomena at various scales under large deformation including the ductile damage occurrence are required. In addition, fully 3D adaptive numerical methods related to time and space discretization are required in order to solve accurately the associated initial and boundary value problems. This book focuses on these two main and complementary aspects with application to a wide range of metal forming and machining processes. Contents 1. Elements of Continuum Mechanics and Thermodynamics. 2. Thermomechanically-Consistent Modeling of the Metals Behavior with Ductile Damage. 3. Numerical Methods for Solving Metal Forming Problems. 4. Application to Virtual Metal Forming.

Full coverage of manufacturing and management in mechanicalengineering Mechanical Engineers' Handbook, Fourth Edition provides aquick guide to specialized areas that engineers may encounter intheir work, providing access to the basics of each and pointingtoward trusted resources for further reading, if needed. The book'saccessible information offers discussions, examples, and analysesof the topics covered, rather than the straight data, formulas, andcalculations found in other handbooks. No single engineer can be aspecialist in all areas that they are called upon to work in. It'sa discipline that covers a broad range of topics that are used asthe building blocks for specialized areas, including aerospace,chemical, materials, nuclear, electrical, and generalengineering. This third volume of Mechanical Engineers' Handbookcovers Manufacturing & Management, and provides accessible andin-depth access to the topics encountered regularly in thediscipline: environmentally benign manufacturing, productionplanning, production processes and equipment, manufacturing systemsevaluation, coatings and surface engineering, physical vapordeposition, mechanical fasteners, seal technology, statisticalquality control, nondestructive inspection, intelligent control ofmaterial handling systems, and much more. Presents the most comprehensive coverage of the entirediscipline of Mechanical Engineering Focuses on the explanation and analysis of the conceptspresented as opposed to a straight listing of formulas and datafound in other handbooks Offers the option of being purchased as a four-book set or assingle books Comes in a subscription format through the Wiley Online Libraryand in electronic and other custom formats Engineers at all levels of industry, government, or privateconsulting practice will find Mechanical Engineers' Handbook,Volume 3 an "off-the-shelf" reference they'll turn to again andagain.

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

Mechanical Engineers' Handbook, Volume 3

Material Behavior and Deformation Analysis

Handbook of Workability and Process Design

Encyclopedia of Iron, Steel, and Their Alloys (Online Version)

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.