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Thermo-Mechanical Modeling of Additive Manufacturing

Butterworth-Heinemann **Thermo-mechanical Modeling of Additive Manufacturing** provides the background, methodology and description of modeling techniques to enable the reader to perform their own accurate and reliable simulations of any additive process. Part I provides an in depth introduction to the fundamentals of additive manufacturing modeling, a description of adaptive mesh strategies, a thorough description of thermal losses and a discussion of residual stress and distortion. Part II applies the engineering fundamentals to direct energy deposition processes including laser cladding, LENS builds, large electron beam parts and an exploration of residual stress and deformation mitigation strategies. Part III concerns the thermo-mechanical modeling of powder bed processes with a description of the heat input model, classical thermo-mechanical modeling, and part scale modeling. The book serves as an essential reference for engineers and technicians in both industry and academia, performing both research and full-scale production. Additive manufacturing processes are revolutionizing production throughout industry. These technologies enable the cost-effective manufacture of small lot parts, rapid repair of damaged components and construction of previously impossible-to-produce geometries. However, the large thermal gradients inherent in these processes incur large residual stresses and mechanical distortion, which can push the finished component out of engineering tolerance. Costly trial-and-error methods are commonly used for failure mitigation. Finite element modeling provides a compelling alternative, allowing for the prediction of residual stresses and distortion, and thus a tool to investigate methods of failure mitigation prior to building. Provides

understanding of important components in the finite element modeling of additive manufacturing processes necessary to obtain accurate results Offers a deeper understanding of how the thermal gradients inherent in additive manufacturing induce distortion and residual stresses, and how to mitigate these undesirable phenomena Includes a set of strategies for the modeler to improve computational efficiency when simulating various additive manufacturing processes Serves as an essential reference for engineers and technicians in both industry and academia

Modeling of Thermo-Electro-Mechanical Manufacturing Processes

Applications in Metal Forming and Resistance Welding

Springer Science & Business Media **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.

Thermo-Hydro-Mechanical Wood Processing

CRC Press **Describing the history and state-of-the-art of the thermo-hydrous manipulation of wood, this book provides either a desk reference or a field manual of wood science. It examines the polymeric components of wood and its multilevel hierarchical structure that confer its unique general-**

purpose character and faculty for transformation. Exceeding all other material in its capacity to deform under controlled conditions and for a proscribed outcome, wood, under thermo-hydrous conditions, permits a multitude of industrial processes. Discussing the processes at work and the industrial applications, this book is a must for all interested in the manipulation of wood.

Thermo-Mechanical Aspects Of Manufacturing And Materials Processing

CRC Press **Covering thermomechanical aspects of manufacturing and materials processing, this volume provides basic fundamentals for understanding and analyzing various manufacturing processes and materials processing. It covers metal casting, metal forming, metal cutting, and the experimental tools available for solving problems of practical significance. It explores areas of future research and identifies problem areas with a view to minimizing energy losses and maximizing cost effective manufacture of industrial goods.**

Thermal Process Modeling 2014: Proceedings from the Fifth International Conference on Thermal Process Modeling and Computer Simulation

ASM International **Thermal processes are key manufacturing steps in producing durable and useful products, with solidification, welding, heat treating, and surface engineering being primary steps. These papers represent the latest state-of-the-art in thermal process modeling. The breadth of topics covers the depth of the industry.**

Environmental considerations of

selected energy conserving
manufacturing process options

Manufacturing Processes Reference Guide

Industrial Press Inc. **An abridgement of a 17-volume set of instructional materials, this guide offers brief descriptions of some 130 manufacturing processes, tools, and materials in such areas a mechanical, thermal, and chemical reducing; consolidation; deformation; and thermal joining. Includes numerous tables and illustrations. Annotation copyright by Book News, Inc., Portland, OR**

Thermomechanical Industrial Processes

Modeling and Numerical Simulation

John Wiley & Sons **The numerical simulation of manufacturing processes and of their mechanical consequences is of growing interest in industry. However, such simulations need the modeling of couplings between several physical phenomena such as heat transfer, material transformations and solid or fluid mechanics, as well as to be adapted to numerical methodologies. This book gathers a state of the art on how to simulate industrial processes, what data are needed and what numerical simulation can bring. Assembling processes such as welding and friction stir welding, material removal processes, elaboration processes of composite structures, sintering processes, surface-finishing techniques, and thermo-chemical treatments are investigated. This book is the work of a group of researchers who have been working together in this field for more than 12 years. It should prove useful for both those working in industry and those studying the numerical methods applied to multiphysics problems encountered in manufacturing processes.**

Methods for Modelling and Analysis

of Thermo-mechanical Manufacturing Processes Architecting Robust Co-Design of Materials, Products, and Manufacturing Processes

Springer Nature This book explores systems-based, co-design, introducing a “Decision-Based, Co-Design” (DBCD) approach for the co-design of materials, products, and processes. In recent years there have been significant advances in modeling and simulation of material behavior, from the smallest atomic scale to the macro scale. However, the uncertainties associated with these approaches and models across different scales need to be addressed to enable decision-making resulting in designs that are robust, that is, relatively insensitive to uncertainties. An approach that facilitates co-design is needed across material, product design and manufacturing processes. This book describes a cloud-based platform to support decisions in the design of engineered systems (CB-PDSIDES), which feature an architecture that promotes co-design through the servitization of decision-making, knowledge capture and use templates that allow previous solutions to be reused. Placing the platform in the cloud aids mass collaboration and open innovation. A valuable reference resource on all areas related to the design of materials, products and processes, the book appeals to material scientists, design engineers and all those involved in the emerging interdisciplinary field of integrated computational materials engineering (ICME).

Analysis and Design of Energy Systems

Thermodynamic Analysis of Industrial Processes : Presented at

the Winter Annual Meeting of the American Society of Mechanical Engineers, San Francisco, California, December 10-15, 1989 Advances in Hazardous Industrial Waste Treatment

CRC Press **As the global nature of pollution becomes increasingly obvious, successful hazardous waste treatment programs must take a total environmental control approach that encompasses all areas of pollution control. With its focus on new developments in innovative and alternative environmental technology, design criteria, effluent standards, managerial dec**

Fundamental Principles of Manufacturing Processes

Industrial Press Inc. **Provides a taxonomy of manufacturing processes and discusses general characteristics of the 10 fundamental families, such as mass-reducing, joining, hardening, and surface treatment. The individual processes themselves are described in the companion Reference Guide. Well illustrated. No bibliography. Annotation copyright by Book News, Inc., Portland, OR**

Kirk-Othmer Concise Encyclopedia of Chemical Technology, 2 Volume Set

John Wiley & Sons **This is an easily-accessible two-volume encyclopedia summarizing all the articles in the main volumes Kirk-Othmer Encyclopedia of Chemical Technology, Fifth Edition organized alphabetically. Written by prominent scholars from industry, academia, and research institutions, the Encyclopedia presents a wide scope of articles on chemical substances, properties, manufacturing, and uses; on industrial processes, unit**

operations in chemical engineering; and on fundamentals and scientific subjects related to the field.

Analysis and Design of Energy Systems: Thermodynamic analysis of industrial processes

Mechanics of Composite and Multifunctional Materials, Volume 7

Proceedings of the 2015 Annual Conference on Experimental and Applied Mechanics

Springer **Experimental Mechanics of Composite, Hybrid, and Multifunctional Materials, Volume 7 of the Proceedings of the 2015 SEM Annual Conference & Exposition on Experimental and Applied Mechanics, the seventh volume of nine from the Conference, brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on a wide range of areas, including: Multifunctional Materials Hybrid Materials Novel Composites Nano- and Particle-Reinforced Composites Additive Manufacturing of Composites Digital Imaging of Composites Damage Detection Non-Destructive Evaluation Fatigue and Fracture of Composites Manufacturing and Joining of Composites Advanced Composites Applications**

Handbook of Thermal Process Modeling Steels

CRC Press **An Emerging Tool for Pioneering Engineers Co-published by the International Federation of Heat Treatment and Surface Engineering. Thermal processing is a highly precise science that does not easily lend itself to improvements through modeling, as the computations required to attain an accurate prediction of the microstructure and properties of work**

Handbook of Food Processing Equipment

Springer This text covers the design of food processing equipment based on key unit operations, such as heating, cooling, and drying. In addition, mechanical processing operations such as separations, transport, storage, and packaging of food materials, as well as an introduction to food processes and food processing plants are discussed. Handbook of Food Processing Equipment is an essential reference for food engineers and food technologists working in the food process industries, as well as for designers of process plants. The book also serves as a basic reference for food process engineering students. The chapters cover engineering and economic issues for all important steps in food processing. This research is based on the physical properties of food, the analytical expressions of transport phenomena, and the description of typical equipment used in food processing. Illustrations that explain the structure and operation of industrial food processing equipment are presented. **style="font-size: 13.3333330154419px;">**The materials of construction and fabrication of food processing equipment are covered here, as well as the selection of the appropriate equipment for various food processing operations. Mechanical processing equipment such as size reduction, size enlargement, homogenization, and mixing are discussed. Mechanical separations equipment such as filters, centrifuges, presses, and solids/air systems, plus equipment for industrial food processing such as heat transfer, evaporation, dehydration, refrigeration, freezing, thermal processing, and dehydration, are presented. Equipment for novel food processes such as high pressure processing, are discussed. The appendices include conversion of units, selected thermophysical properties, plant utilities, and an extensive list of manufacturers and suppliers of food equipment.

Process Modelling of Metal Forming and Thermomechanical Treatment

Springer Science & Business Media It is the objective of the series **II Materials Research and Engineering II** 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, *Materials 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.

Mechanics of Materials in Modern Manufacturing Methods and Processing Techniques

Elsevier Mechanics of Materials in Modern Manufacturing Methods and Processing Techniques provides a detailed overview of the latest developments in the mechanics of modern metal forming manufacturing. Focused on mechanics as opposed to process, it looks at the mechanical behavior of materials exposed to loading and environmental conditions related to modern manufacturing processes, covering deformation as well as damage and fracture processes. The book progresses from forming to machining and surface-treatment processes, and concludes with a series of chapters looking at recent and emerging technologies. Other topics covered include simulations in autofrettage processes, modeling strategies related to cutting simulations, residual stress caused by high thermomechanical gradients and pultrusion, as well as the mechanics of the curing process, forging, and cold spraying, among others. Some non-metallic materials, such as ceramics and composites, are covered as well. Synthesizes the latest research in the mechanics of modern metal forming processes Suggests theoretical models and numerical codes to predict mechanical responses Covers mechanics of shot peening, pultrusion, hydroforming, magnetic pulse forming Considers applicability of different materials and processes for optimum performance

Advances in Manufacturing Processes

Select Proceedings of RAM 2020

Springer Nature This book presents the select proceedings of the International Conference on Recent Advances in Manufacturing (RAM 2020). This volume, in particular, provides insights into current research trends and opportunities within the manufacturing processes domain such as conventional and unconventional manufacturing, micro and nano manufacturing, chemical and biochemical manufacturing, and computer-integrated manufacturing (CIM). The topics covered include emerging areas of the fourth industrial revolution such as additive manufacturing, sustainable and energy-efficient manufacturing, smart manufacturing, artificial intelligence in manufacturing application, and computer-integrated manufacturing. This book will be useful for to researchers and practitioners alike.

Encyclopedia of Environmental Management, Four Volume Set

CRC Press Winner of an Outstanding Academic Title Award from CHOICE Magazine Encyclopedia of Environmental Management gives a comprehensive overview of environmental problems, their sources, their assessment, and their solutions. Through in-depth entries and a topical table of contents, readers will quickly find answers to questions about specific pollution and management issues. Edited by the esteemed Sven Erik Jørgensen and an advisory board of renowned specialists, this four-volume set shares insights from more than 500 contributors—all experts in their fields. The encyclopedia provides basic knowledge for an integrated and ecologically sound management system. Nearly 400 alphabetical entries cover everything from air, soil, and water pollution to agriculture, energy, global pollution, toxic substances, and general pollution problems. Using a topical table of contents, readers can also search for entries according to the type of problem and the methodology. This allows readers to see the overall picture at a glance and find answers to the core questions: What is the pollution problem, and what are its sources? What is the "big picture," or what background knowledge do we need? How can we diagnose the problem, both qualitatively and quantitatively, using monitoring and ecological models, indicators, and services? How can we solve the problem with environmental technology, ecotechnology, cleaner technology, and environmental legislation? How do we address the problem as part of an integrated management strategy? This accessible encyclopedia examines the entire spectrum of tools available for environmental management. An indispensable resource, it guides environmental managers to find the best possible solutions to the myriad pollution problems they face. 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 us to inquire about subscription options and print/online combination packages. US: (Tel) 1.888.318.2367 / (email) e-reference@taylorandfrancis.com International: (Tel) +44 (0) 20 7017 6062 / (email) online.sales@tandf.co.uk

Nontraditional Machining Processes Research Advances

Springer Science & Business Media **Nontraditional machining employs processes that remove material by various methods involving thermal, electrical, chemical and mechanical energy or even combinations of these. Nontraditional Machining Processes covers recent research and development in techniques and processes which focus on achieving high accuracies and good surface finishes, parts machined without burrs or residual stresses especially with materials that cannot be machined by conventional methods. With applications to the automotive, aircraft and mould and die industries, Nontraditional Machining Processes explores different aspects and processes through dedicated chapters. The seven chapters explore recent research into a range of topics including laser assisted manufacturing, abrasive water jet milling and hybrid processes. Students and researchers will find the practical examples and new processes useful for both reference and for developing further processes. Industry professionals and materials engineers will also find Nontraditional Machining Processes to be a source of ideas and processes for development and industrial application.**

Refractories for the Chemical Industries

Springer Nature **The book provides process engineers, an insight into refractories focusing on its importance and requirements in chemical process industries such as refinery and petrochemicals, syngas manufacturing, coal gasification, limestone calcinations, carbon black, glass, and cement production. Additionally the book discusses the refractory requirements for the CFBC boiler, and waste heat utilization process to generate steam. The book describes characterization of refractory material and selection process of the refractory for lining different equipments pertaining to the chemical process industry. The book covers refractory installation techniques, and the precautions to be taken during installation are discussed in detail along with the theoretical**

background. It explains the physical and chemical factors that influence the performances of refractory, mechanism of its degradation in service and emphasizes on the thermo-chemical and thermo-mechanical aspects and their role in that process. The content lays out different methods of monitoring Refractory lining conditions while the furnace is in operation and also elucidates few methods to repair the worn out lining without taking a shutdown. The scheme of investigation of a refractory failure is an added feature.

Scientific and Technical Aerospace Reports

Select Thermodynamic Models for Process Simulation

A Practical Guide Using a Three Steps Methodology

Editions TECHNIP The selection of the most adequate thermodynamic model in a process simulation is an issue that most process engineer has to face sooner or later. This book, conceived as a practical guide, aims at providing adequate answers by analysing the questions to be looked at. The analysis (first chapter) yields three keys that are further discussed in three different chapters. (1) A good understanding of the properties required in the process, and their method of calculation is the first key. The second chapter provides to that end in a synthetic manner the most important equations that are derived from the fundamental principles of thermodynamics. (2) An adequate description of the mixture, which is a combination of models and parameters, is the second key. The third chapter makes the link between components and models, both from a numerical (parameterisation) and physical (molecular interactions) point of view. Finally, (3) a correct view of the phase behaviour and trends in regard of the process conditions is the third key. The fourth chapter illustrates the phase behaviour and makes model recommendations for the most significant industrial systems. A decision tree is provided at the end of this chapter. In the last chapter, the key questions are reviewed for a number of typical processes. This book is intended for process engineers, who are not specialists of thermodynamics but are confronted with this kind of problems and need a reference book, as well as process engineering students who will find an original approach to

thermodynamics, complementary of traditional lectures

The Proceedings of the International Conference on Information Engineering, Management and Security 2014 ICIEMS 2014

Association of Scientists, Developers and Faculties **The Proceedings of the International Conference on Information Engineering, Management and Security 2014** which happened at Christu Jyoti Institute of Technology.

Trends in Manufacturing Processes Select Proceedings of ICFTMM 2018

Springer Nature **This book comprises select proceedings of the International Conference on Futuristic Trends in Materials and Manufacturing (ICFTMM 2018). The volume covers current research findings in conventional and non-conventional manufacturing processes. Different fabrication processes of polymer based materials and advanced materials are discussed in this book. In addition, the book also discusses computer based manufacturing processes, and sustainable and green manufacturing technologies. The contents of this book will be useful for students, academicians, and researchers working in the field of manufacturing related fields.**

Ceramic Processing

Industrial Practices

CRC Press **This book gives a comprehensive account on the manufacturing techniques to synchronize the desired properties of both traditional and advanced ceramics. Offers exclusive and up to date information on industrial ceramic processing equipment and approaches and discusses actual industrial practices taking a product-oriented approach It should serve as a text to answer the processing of ceramics and achieve targeted product in industrial environment.**

Thermo-mechanical Analysis of Wire and Arc Additive Manufacturing Process

Conventional manufacturing processes often require a large amount of machining and cannot satisfy the continuously increasing requirements of a sustainable, low cost, and environmentally friendly modern industry. Thus, Additive Manufacturing (AM) has become an important industrial process for the manufacture of custom-made metal workpieces. Among the different AM processes, Wire and Arc Additive Manufacture (WAAM) has the ability to manufacture large, low volume metal work-pieces due to its high deposition rate. In this process, 3D metallic components are built by depositing beads of weld metal in a layer by layer fashion. However, the non-uniform expansion and contraction of the material during the thermal cycle results in residual stresses and distortion. To obtain a better understanding of the thermo-mechanical performance of the WAAM process, a study based on FE simulation was undertaken in this thesis. The mechanism of the stress generation during the deposition process was analysed via a 3D transient thermo-mechanical FE model which is verified with experimental results. To be capable of analysing the thermo-mechanical behaviour of large-scale WAAM components, an efficient FE approach was developed which can significantly reduce the computational time. The accuracy of this model was validated against the transient model as well as experimental measurements. With the help of the FE models studies on different deposition parameters, deposition sequences and deposition strategies were carried out. It has been proved that the residual stresses and the distortions are possible to be reduced by using optimised deposition parameters and sequences. In addition, a robot path generation prototype has been developed to help efficiently integrate these optimised process settings in the real-wold WAAM process.

Industrial Waste Stream Generation

Prentice Hall's six volume Environmental Technology series of textbooks is specifically designed to meet the Partners for Environmental Technology Education (PETE) curriculum guidelines now established for courses in the Environmental Hazardous Materials Technology (EHMT) and Environmental Technology Associates Degree Programs. Volume 6 provides the reader with general concepts of pollution prevention and then supports those concepts with case studies of fourteen common industrial waste streams. The list of waste streams includes: General Manufacturing, Metal Finishing, Electroplating, Printed Circuit Board Production, Construction Waste

Streams, Printing and Reprographics, Laboratory & Composite Wastes, Nuclear Energy Production, Cosmetics and Pharmaceutical Manufacturing, Chemical Manufacturing, Pesticide Production and End Users, The Paper & Pulp Industry, Hospital Waste Streams, and Wood Preserving.

Advanced Machining Processes

Allied Publishers

THERMAL DESALINATION PROCESSES - Volume II

Thermal Desalination Processes is a component of Encyclopedia of Water Sciences, Engineering and Technology Resources in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty one Encyclopedias. These volumes discuss matters of great relevance to our world on desalination which is a critically important as clearly the only possible means of producing fresh water from the sea for many parts of the world. The two volumes present state-of-the art subject matter of various aspects of Thermal desalination processes such as: Multi-Stage Flash evaporation (MSF) and Multi Effect Distillation (MED) and Mechanical / Thermal Vapor Compression, in addition to the Hybrid Desalination Systems. Chemical Dosing For Desalination; Control Scheme of the Plants; Steady-State Model; Steady-State Simulation; Dynamic Model; Economics and Performance of Desalination Plants. These volumes are aimed at the following five major target audiences: University and College Students Educators, Professional Practitioners, Research Personnel and Policy and Decision Makers.

Report of the Secretary of Agriculture ...

House Documents, Otherwise Publ.
as Executive Documents

13th Congress, 2d Session-49th

Congress, 1st Session

Industrial Hemp

Food and Nutraceutical Applications

Academic Press **Industrial Hemp: Food and Nutraceutical Applications** is a comprehensive overview of different value chains for the industrial hemp industry. This excellent reference supports multi-disciplines and presents industrial hemp as a multi-purpose crop, with special attention paid to its food and nutraceutical applications. By combining and presenting multidisciplinary knowledge, readers will be introduced to recent progress in hemp production, processing, utilization and marketing. The book provides a systematic overview of alternative hemp applications, but also serves as a guide to the challenges needed for hemp revitalization to reach its fullness. Provides information on the biological activity of hemp extracts, their roles in disease prevention, and potential applications in the functional food and nutraceutical sectors Discusses hemp as an alternative protein source used to create innovative hemp-based foods Presents case studies that describe opportunities in hemp research, hemp agriculture and hemp processing

Handbook of Applied Thermal
Design

CRC Press Gives a foundation to the four principle facets of thermal design: heat transfer analysis, materials performance, heating and cooling technology, and instrumentation and control. The focus is on providing practical thermal design and development guidance across the spectrum of problem analysis, material applications, equipment specification, and sensor and control selection.

Journal of Engineering for Industry

Advances in Fire Retardant
Materials

Elsevier This important book provides a comprehensive account of the advances that have occurred in fire science in relation to a broad range of materials. The manufacture of fire retardant materials is an active area of

research, the understanding of which can improve safety as well as the marketability of a product. The first part of the book reviews the advances that have occurred in improving the fire retardancy of specific materials, ranging from developments in phosphorus and halogen-free flame retardants to the use of nanocomposites as novel flame retardant systems. Key environmental issues are also addressed. The second group of chapters examines fire testing issues and regulations. A final group of chapters addresses the application of fire retardant materials in such areas as composites, automotive materials, military fabrics and aviation materials. With its distinguished editors and array of international contributors, this book is an essential reference for producers, manufacturers, retailers and all those wishing to improve fire retardancy in materials. It is also suitable for researchers in industry or academia. Reviews advances in improving the retardancy of materials Addresses key environmental issues Examines fire testing issues and regulations and the challenges involved

Light Metals 2020

Springer Nature The Light Metals symposia at the TMS Annual Meeting & Exhibition present the most recent developments, discoveries, and practices in primary aluminum science and technology. The annual Light Metals volume has become the definitive reference in the field of aluminum production and related light metal technologies. The 2020 collection includes papers from the following symposia: • Alumina and Bauxite • Aluminum Alloys, Processing and Characterization • Aluminum Reduction Technology • Cast Shop Technology • Cast Shop Technology: Recycling and Sustainability Joint Session • Electrode Technology for Aluminum Production