Shape Memory Alloys Modeling And Engineering Applications

Shape Memory Alloys: Properties, Technologies, OpportunitiesModelling of the Machining Process of a Nickel-Titanium Based Shape Memory AlloyPseudoelasticity of Shape Memory AlloysCreep and Hygrothermal Effects in Concrete StructuresShape Memory Alloys 2017Shape Memory MicroactuatorsShape-memory AlloyThermodynamics of Shape Memory Alloy WireFabrication and Processing of Shape Memory AlloysSustainable Automotive Technologies 2012Developments in Corrosion ProtectionShape Memory AlloysShape Memory MaterialsSmart Structures TheoryRoboCup 2010: Robot Soccer World Cup XIVAlloys and Intermetallic CompoundsAnalysis of Shells, Plates, and BeamsShape Memory Alloy ActuatorsCritical Stresses for Twinning, Slip and Transformation in Shape Memory Alloys: Modeling and ExperimentsShape Memory Effects in AlloysIUTAM Symposium on Smart Structures and Structronic SystemsInterdisciplinary MechatronicsSmart MaterialsDesign of Shape Memory Alloy (SMA) ActuatorsShape Memory and Superelastic AlloysFirst Principles Modelling of Shape Memory AlloysAdvances in Shape Memory MaterialsShape Memory AlloysEngineering Aspects of Shape Memory AlloysMechanics of Composite Structural ElementsShape Memory AlloysNumerical Modeling of Shape Memory Alloy Plates Considering Tension/compression Asymmetry and Its Verification Under Pure BendingShape Memory AlloysSuperalloysShape Memory Polymers for Aerospace ApplicationsShape Memory Alloy ActuatorsShape Memory Alloy EngineeringShape Memory Alloy ValvesShape-Memory Alloys HandbookShape Memory Alloys

Shape Memory Alloys: Properties, Technologies, Opportunities

The collective monograph consists of five parts: Theory and modeling of martensitic transformation and functional properties; Martensitic transformations and shape memory effects; Controlling the functional properties of shape memory alloys; Shape memory alloys with complex structure; Application of shape memory alloys) covering of all aspects of shape memory alloys from theory and modelling to applications. It presents the scientific results obtained by leading scientific teams studying shape memory alloys in the former Soviet Republics together with their colleagues from other countries during the last decade.

Modelling of the Machining Process of a Nickel-Titanium Based Shape Memory Alloy

This book consists of two chapters. The first chapter deals with the thermomechanical macroscopic theory describing the transformation and deformation behavior of shape memory alloys. The second chapter deals with the extensive and fundamental review of the experimental works which include crystallography, transformations and mechanical characteristics in Ti-Ni, Cu-base and ferrous shape memory alloys.

Pseudoelasticity of Shape Memory Alloys

Shape memory and superelastic alloys possess properties not present in ordinary metals meaning that they can be used for a variety of applications. Shape memory and superelastic alloys: Applications and technologies explores these applications discussing their key features and commercial performance. Readers will gain invaluable information and insight into the current and potential future applications of shape memory alloys. Part one covers the properties and processing of shape memory effect and superelasticity in alloys for practical users with chapters covering the basic characteristics of Ti-Ni-based and Ti-Nb-based shape memory and superelastic (SM/SE) alloys, the development and commercialisation of TiNi and Cu-based alloys, industrial processing and device elements, design of SMA coil springs for actuators before a final overview on the development of SM and SE applications. Part two introduces SMA application technologies with chapters investigating SMAs in electrical applications, hot-water supply, construction and housing, automobiles and railways and aerospace engineering before looking at the properties, processing and applications of Ferrous (Fe)-based SMAs. Part three focuses on the applications of superelastic alloys and explores their functions in the medical, telecommunications, clothing, sports and leisure industries. The appendix briefly describes the history and activity of the Association of Shape Memory Alloys (ASMA). With its distinguished editors and team of expert contributors, Shape memory and superelastic alloys: Applications and technologies is be a valuable reference tool for metallurgists as well as for designers, engineers and students involved in one of the many industries in which shape memory effect and superelasticity are used such as construction, automotive, medical, aerospace, telecommunications, water/heating, clothing, sports and leisure. Explores important applications of shape memory and superelastic alloys discussing their key features and commercial performance Assesses the properties and processing of shape memory effect and superelasticity in alloys for practical users with chapters covering the basic characteristics Introduces SMA application technologies investigating SMAs in electrical applications, hot-water supply, construction and housing, automobiles and railways and aerospace engineering

Creep and Hygrothermal Effects in Concrete Structures

This book is a result of contributions of experts from international scientific community working in different aspects of shape memory alloys (SMAs) and reports on the state-of-the-art research and development findings on this topic through original and innovative research studies. Through its five chapters, the reader will have access to works related to ferromagnetic SMAs, while it introduces some specific applications like development of faster SMA actuators and application of nanostructural SMAs in medical devices. The book contains up-to-date publications of leading experts, and the edition is intended to furnish valuable recent information to the professionals involved in shape memory alloys analysis and applications. The text is addressed not only to researchers but also to professional engineers, students, and other experts in a variety of disciplines, both academic and industrial, seeking to gain a better understanding of what has been done in the field recently and what kind of open problems are in this area.

Shape Memory Alloys 2017

Proceedings of the IUTAM Symposium on Smart Structures and Structronic

Systems, held in Magdeburg, Germany, 26-29 September 2000

Shape Memory Microactuators

Abstract: In this work, a numerical model of a SMA plate reflecting the tension/compression asymmetry of axial stress under pure bending was developed and verified experimentally. To achieve the goal, ABAQUS user-material (UMAT) based on the Brinson model with modified martensite transformation kinetics was proposed with the Drucker–Prager yield criterion to realize the tension/compression symmetry of SMA. To demonstrate the performance of the proposed model, we conducted several predictions on the recovery bending moment with temperature variation with diverse thicknesses under various strain conditions. These results were compared with pure bending test results obtained by a test device that can simulate a pure bending state for maximum 4% axial strain with uniform deformation curvature.

Shape-memory Alloy

A shape memory alloy (SMA, also known as a smart metal, memory alloy, or muscle wire) is an alloy that "remembers" its shape, and can be returned to that shape after being deformed, by applying heat to the alloy. When the shape memory effect is correctly harnessed, this material becomes a lightweight, solid-state alternative to conventional actuators such as hydraulic, pneumatic, and motor-based systems. Shape memory alloys have numerous applications in the medical and aerospace industries. This book presents the latest research in the field from around the globe.

Thermodynamics of Shape Memory Alloy Wire

Volume is indexed by Thomson Reuters CPCI-S (WoS). This book reviews recent developments in the field of shape memory materials, which are becoming more and more important as 'smart (intelligent)' materials. The fundamental principles and properties are discussed, as well as the associated experimental and processing methods. Special emphasis is placed on the present, and potential future, applications of SMMs. Superelastic wires are already being used for the antennae of cellular phones, and medical stents and guide wires promise to become big business as well. Rapid progress is also being made in fundamental aspects, such as the kinetics of martensitic transformations, premartensitic behavior, aging problems, thin-film SMA, etc. Moreover, new experimental techniques are becoming available: such as imaging plane, TEM with energy filter, AFM, grazing-angle x-ray reflection, etc.

Fabrication and Processing of Shape Memory Alloys

Overview of recent achievements, describing the microactuator development of microvalves and liner actuators comprehensively from concept through prototype. Further key aspects included are three-dimensional models for handling complex SMA actuator geometries and coupled simulation routines that take multifunctional properties into account. Mechanical and thermal optimization criteria are

introduced for actuator design, allowing an optimum use of the shape memory effect. It is shown that some of the prototypes presented, e.g. SMA microgrippers, already outperform conventional components.

Sustainable Automotive Technologies 2012

This comprehensive treatise covers in detail practical methods of analysis as well as advanced mathematical models for structures highly sensitive to creep and shrinkage. Effective computational algorithms for century-long creep effects in structures, moisture diffusion and high temperature effects are presented. The main design codes and recommendations (including RILEM B3 and B4) are critically compared. Statistical uncertainty of century-long predictions is analyzed and its reduction by extrapolation is discussed, with emphasis on updating based on short-time tests and on long-term measurements on existing structures. Testing methods and the statistics of large randomly collected databases are critically appraised and improvements of predictions of multi-decade relaxation of prestressing steel, cyclic creep in bridges, cracking damage, etc., are demonstrated. Important research directions, such as nanomechanical and probabilistic modeling, are identified, and the need for separating the long-lasting autogenous shrinkage of modern concretes from the creep and drying shrinkage data and introducing it into practical prediction models is emphasized. All the results are derived mathematically and justified as much as possible by extensive test data. The theoretical background in linear viscoelasticity with aging is covered in detail. The didactic style makes the book suitable as a textbook. Everything is properly explained, step by step, with a wealth of application examples as well as simple illustrations of the basic phenomena which could alternate as homeworks or exams. The book is of interest to practicing engineers, researchers, educators and graduate students.

Developments in Corrosion Protection

This book provides a working knowledge of the modeling and engineering applications of shape memory alloys (SMAs), beginning with a rigorous introduction to continuum mechanics and continuum thermodynamics as they relate to the development of SMA modeling.Modern SMAs can recover from large amounts of bending and deformation, and millions of repetitions within recoverable ranges. SMAs are used in the medical industry to create stents, in the dental industry to create dental and orthodontic archwires, and in the aerospace industry to create fluid fittings. The text presents a unified approach to the constitutive modeling of SMAs, including modeling of magnetic and high temperature SMAs.

Shape Memory Alloys

Mechatronics represents a unifying interdisciplinary and intelligent engineering science paradigm that features an interdisciplinary knowledge area and interactions in terms of the ways of work and thinking, practical experiences, and theoretical knowledge. Mechatronics successfully fuses (but is not limited to) mechanics, electrical, electronics, informatics and intelligent systems, intelligent control systems and advanced modeling, intelligent and autonomous robotic

systems, optics, smart materials, actuators and biomedical and biomechanics, energy and sustainable development, systems engineering, artificial intelligence, intelligent computer control, computational intelligence, precision engineering and virtual modeling into a unified framework that enhances the design of products and manufacturing processes. Interdisciplinary Mechatronics concerns mastering a multitude of disciplines, technologies, and their interaction, whereas the science of mechatronics concerns the invention and development of new theories, models, concepts and tools in response to new needs evolving from interacting scientific disciplines. The book includes two sections, the first section includes chapters introducing research advances in mechatronics engineering, and the second section includes chapters that reflects the teaching approaches (theoretical, projects, and laboratories) and curriculum development for under- and postgraduate studies. Mechatronics engineering education focuses on producing engineers who can work in a high-technology environment, emphasize real-world hands-on experience, and engage in challenging problems and complex tasks with initiative, innovation and enthusiasm. Contents: 1. Interdisciplinary Mechatronics Engineering Science and the Evolution of Human Friendly and Adaptive Mechatronics, Maki K. Habib. 2. Micro-Nanomechatronics for Biological Cell Analysis and Assembly, Toshio Fukuda, Masahiro Nakajima, Masaru Takeuchi, Tao Yue and Hirotaka Tajima. 3. Biologically Inspired CPG-Based Locomotion Control System of a Biped Robot Using Nonlinear Oscillators with Phase Resetting, Shinya Aoi. 4. Modeling a Human's Learning Processes toward Continuous Learning Support System, Tomohiro Yamaguchi, Kouki Takemori and Keiki Takadama. 5. PWM Waveform Generation Using Pulse-Type Hardware Neural Networks, Ken Saito, Minami Takato, Yoshifumi Sekine and Fumio Uchikoba. 6. Parallel Wrists: Limb Types, Singularities and New Perspectives, Raffaele Di Gregorio. 7. A Robot-Assisted Rehabilitation System – RehabRoby, Duygun Erol Barkana and Fatih Özkul. 8. MIMO Actuator Force Control of a Parallel Robot for Ankle Rehabilitation, Andrew Mcdaid, Yun Ho Tsoi and Shengquan Xie. 9. Performance Evaluation of a Probe Climber for Maintaining Wire Rope, Akihisa Tabata, Emiko Hara and Yoshio Aoki. 10. Fundamentals on the Use of Shape Memory Alloys in Soft Robotics, Matteo Cianchetti. 11. Tuned Modified Transpose Jacobian Control of Robotic Systems, S. A. A. Moosavian and M. Karimi. 12. Derivative-Free Nonlinear Kalman Filtering for PMSG Sensorless Control, Gerasimos Rigatos, Pierluigi Siano and Nikolaos Zervos. 13. Construction and Control of Parallel Robots, Moharam Habibnejad Korayem, Soleiman Manteghi and Hami Tourajizadeh. 14. A Localization System for Mobile Robot Using Scanning Laser and Ultrasonic Measurement, Kai Liu, Hongbo Li and Zengqi Sun. 15. Building of Open-Structure Wheel-Based Mobile Robotic Platform, Aleksandar Rodic and Ivan Stojkovic. 16. Design and Physical Implementation of Holonomous Mobile Robot–Holbos, Jasmin Velagic, Admir Kaknjo, Faruk Dautovic, Muhidin Hujdur and Nedim Osmic. 17. Advanced Artificial Vision and Mobile Devices for New Applications in Learning, Entertainment and Cultural Heritage Do

Shape Memory Materials

This book is a printed edition of the Special Issue Shape Memory Alloys 2017" that was published in Metals

Smart Structures Theory

Master's Thesis from the year 2013 in the subject Engineering - Mechanical Engineering, grade: 3.6/4, Universiti Putra Malaysia (University Putra Malaysia (UPM)), course: Master of Manufacturing Engineering, language: English, abstract: One of the aims of this study is to optimize machining of nickel based shape memory alloys. Nickel-titanium (Nitinol) is a famous shape memory material which is applied in a wide range of products especially in aerospace, medical, and biomedical. The main issue in this project is related to the materials which cannot be machined easily, high tool wear, high cutting force, huge hardness and surface defects add many problems to their machining. Experimental studies were compared with simulations in this report and the main section of that is the optimum cutting speed of nickel-titanium machining would be obtained. Experimental studies show that the cutting speed of machining of nickel-titanium alloy might be around 100 m/min, because the tool wear and cutting force are in minimum condition. In this study, by applying ANSYS software based on the finite element method, the optimum speed of machining process could be guessed around 100 m/min. Cutting speed-Stress diagram in the modeling results have confirmed the same cutting speed in machining process of NiTi in compare with experimental results.

RoboCup 2010: Robot Soccer World Cup XIV

Superalloy, or high-performance alloy, is an alloy that exhibits several key characteristics: excellent mechanical strength, resistance to thermal creep deformation, good surface stability, and resistance to corrosion or oxidation. The crystal structure is typically face-centered cubic austenitic. Superalloy development has relied heavily on both chemical and process innovations. Superalloys develop high temperature strength through solid solution strengthening. An important strengthening mechanism is precipitation strengthening which forms secondary phase precipitates such as gamma prime and carbides. Oxidation or corrosion resistance is provided by elements such as aluminium and chromium. This book collects new developments about superalloys.

Alloys and Intermetallic Compounds

Shape memory polymer chemistry and design for active materials and morphing structuresCovers shape memory in polymers, alloys and composites, including models and testing Essential equations for analysis of the structure, behavior and properties of SMPsMany graphs and figures in full color A technical analysis of shape-memory polymers (SMPs) and their composites, particularly in adaptive materials, this volume introduces designs linking SMPs to metals, elastomers, foams, nanoparticles and other materials, as well as the engineering of SMPs directly into parts and active (morphing) components. Attention is given to controlled structures activated by light, heat, electricity and other energy sources, as well as the connection of SMPs with actuators. Part one discusses the activation and analysis of the shape memory response, including shape recovery. Subsequent chapters offer modeling and other tools for investigating the SMP response, including shape recovery. Part three combines the response with micro- and macro-scale reinforcing phases for producing SMP composites, and the following section discusses synthetic and nanostructured customization of the shape memory polymer response. The final section focuses on specific SMP concepts in aircraft,

including morphing skins, wings, unimorph composite actuators for deployment, and variable stiffness elements.

Analysis of Shells, Plates, and Beams

This book provides a systematic approach to realizing NiTi shape memory alloy actuation, and is aimed at science and engineering students who would like to develop a better understanding of the behaviors of SMAs, and learn to design, simulate, control, and fabricate these actuators in a systematic approach. Several innovative biomedical applications of SMAs are discussed. These include orthopedic, rehabilitation, assistive, cardiovascular, and surgery devices and tools. To this end unique actuation mechanisms are discussed. These include antagonistic bi-stable shape memory-superelastic actuation, shape memory spring actuation, and multi axial tension-torsion actuation. These actuation mechanisms open new possibilities for creating adaptive structures and biomedical devices by using SMAs.

Shape Memory Alloy Actuators

This book showcases different processes of fabrication and processing applied to shape memory alloys. It provides details and collective information on working principles, process mechanisms, salient features, novel aspects, process capabilities, properties of material and unique applications of shape memory alloys. The recent progress on fabrication and processing are specially addressed in this book. It covers major topics of manufacturing such as machining, joining, welding and processing of shape memory alloys.

Critical Stresses for Twinning, Slip and Transformation in Shape Memory Alloys: Modeling and Experiments

This book includes the thoroughly refereed post-conference proceedings of the 14th RoboCup International Symposium, held in Singapore, in June, 2010 - representing the scientific tracks structured in four sessions entitled simulation and rescue robots; robot perception and localization; robot motion and humanoid robots; and human robot interaction and semantic scene analysis. The 20 revised full papers and 16 revised short papers presented were carefully reviewed and selected from 78 submissions. Documenting the research advances of the RoboCup community since the predecessor symposium, this book constitutes a valuable source of reference and inspiration for R&D professionals interested in RoboCup or in robotics and distributed AI more generally.

Shape Memory Effects in Alloys

This book focuses on smart materials and structures, which are also referred to as intelligent, adaptive, active, sensory, and metamorphic. The ultimate goal is to develop biologically inspired multifunctional materials with the capability to adapt their structural characteristics, monitor their health condition, perform self-diagnosis and self-repair, morph their shape, and undergo significant controlled motion.

IUTAM Symposium on Smart Structures and Structronic Systems

This book focuses on the role of modeling in the design of alloys and intermetallic compounds. It includes an introduction to the most important and most used modeling techniques, such as CALPHAD and ab-initio methods, as well as a section devoted to the latest developments in applications of alloys. The book emphasizes the correlation between modeling and technological developments while discussing topics such as wettability of Ultra High Temperature Ceramics by metals, active brazing of diamonds to metals in cutting tools, surface issues in medicine, novel Fe-based superconductors, metallic glasses, high entropy alloys, and thermoelectric materials.

Interdisciplinary Mechatronics

This book is devoted to the development of the shape memory materials and their applications. It covers many aspects of smart materials. It also describes the method on how we can obtain not only large recovery strains but also high recovery stress, energy storage and energy dissipation in applications. This volume treats the mechanical properties of shape memory alloys, shape memory polymers and the constitutive equations of the materials which are necessary to design the shape memory elements in applications. It also deals with the fatigue properties of materials, the method to design the shape memory elements, and the shape memory composites. The authors are international experts on shape memory alloys and shape memory polymers in the metallurgical, chemical, mechanical and engineering fields. The book will be of interest to graduate students, engineers, scientists and designers who are working in the field of electric and mechanical engineering, industries, medical engineering, aerospace engineering, robots, automatic machines, clothes and recycling for research, design and manufacturing.

Smart Materials

The aim of this book is to understand and describe themartensitic phase transformation and the process of martensiteplatelet reorientation. These two key elements enable the author tointroduce the main features associated with the behavior ofshape-memory alloys (SMAs), i.e. the one-way shape-memory effect,pseudo-elasticity, training and recovery. Attention is paid in particular to the thermodynamical frame forsolid materials modeling at the macroscopic scale and itsapplications, as well as to the particular use of such alloys– the simplified calculations for the bending of bars andtheir torsion. Other chapters are devoted to key topics such as theuse of the “crystallographical theory of martensite”for SMA modeling, phenomenological and statistical investigationsof SMAs, magneto-thermo-mechanical behavior of magnetic SMAs andthe fracture mechanics of SMAs. Case studies are provided on thedimensioning of SMA elements offering the reader an additionaluseful framework on the subject. Contents 1. Some General Points about SMAs. 2. The World of Shape-memory Alloys. 3. Martensitic Transformation. 4. Thermodynamic Framework for the Modeling of SolidMaterials. 5. Use of the “CTM” to Model SMAs. 6. Phenomenological and Statistical Approaches for SMAs. 7. Macroscopic Models with Internal Variables. 8. Design of

SMA Elements: Case Studies. 9. Behavior of Magnetic SMAs. 10. Fracture Mechanics of SMAs. 11. General Conclusion. Appendix 1. Intrinsic Properties of Rotation Matrices. Appendix 2. “Twinning Equation” Demonstration. Appendix 3. Calculation of the Parameters a, n and Q from the“Twinning” Equation. Appendix 4. “Twinned” Austenite/MartensiteEquation. About the Authors Christian Lexcellent is Emeritus Professor at the ÉcoleNational Supérieure de Mécanique et des Microtechniquesde Besançon and a researcher in the Department of AppliedMechanics at FEMTO-ST in France. He is a specialist in themechanics of materials and phase transition and has taught in thesubjects of mechanics of continuum media and shape memory alloys.He is also a member of the International Committee of ESOMAT.

Design of Shape Memory Alloy (SMA) Actuators

Engineering Aspects of Shape Memory Alloys provides an understanding of shape memory by defining terms, properties, and applications. It includes tutorials, overviews, and specific design examples—all written with the intention of minimizing the science and maximizing the engineering aspects. Although the individual chapters have been written by many different authors, each one of the best in their fields, the overall tone and intent of the book is not that of a proceedings, but that of a textbook. The book consists of five parts. Part I deals with the mechanism of shape memory and the alloys that exhibit the effect. It also defines many essential terms that will be used in later parts. Part II deals primarily with constrained recovery, but to some extent with free recovery. There is an introductory paper which defines terms and principles, then several specific examples of products based on constrained recovery. Both Parts III and IV deal with actuators. Part III introduces engineering principles while Part IV presents several of the specific examples. Finally, Part V deals with superelasticity, with an introductory paper and then several specific examples of product engineering.

Shape Memory and Superelastic Alloys

First Principles Modelling of Shape Memory Alloys

Materials sciences relate the macroscopic properties of materials to their microscopic structure and postulate the need for holistic multiscale research. The investigation of shape memory alloys is a prime example in this regard. This particular class of materials exhibits strong coupling of temperature, strain and stress, determined by solid state phase transformations of their metallic lattices. The present book presents a collection of simulation studies of this behaviour. Employing conceptually simple but comprehensive models, the fundamental material properties of shape memory alloys are qualitatively explained from first principles. Using contemporary methods of molecular dynamics simulation experiments, it is shown how microscale dynamics may produce characteristic macroscopic material properties. The work is rooted in the materials sciences of shape memory alloys and covers thermodynamical, micro-mechanical and crystallographical aspects. It addresses scientists in these research fields and their students.

Advances in Shape Memory Materials

This second edition of the textbook presents a systematic introduction to the structural mechanics of composite components. The book focusses on modeling and calculation of sandwiches and laminated composites i.e. anisotropic material. The new edition includes an additional chapter covering the latest advances in both research and applications, which are highly relevant for readers. The textbook is written for use not only in engineering curricula of aerospace, civil and mechanical engineering, but also for materials science and applied mechanics. Furthermore, it addresses practicing engineers and researchers. No prior knowledge of composite materials and structures is required for the understanding of its content. The book is close to classical courses of "Strength of Materials" and "Theory of Beams, Plates and Shells" but it extends the classic content on two topics: the linear elastic material behavior of isotropic and non-isotropic structural elements, and inhomogeneous material properties in the thickness direction. The Finite Element Analysis of laminate and sandwich structures is briefly presented. Many solved examples illustrate the application of the techniques learned.

Shape Memory Alloys

One of the first thing that comes to your mind after hearing the term “corrosion” is corrosion of a metal. Corrosion is a basically harmful phenomenon, but it can be useful in some cases. For instance, environment’s pollution with corrosion products and damage to the performance of a system are among its harmful effects, whereas electric energy generation in a battery and cathodic protection of many structures are among its advantages. However, these advantages are almost nothing as compared to the costs and effects imposed by its detrimental influences. The enormous costs of this phenomenon can be better understand through studying the published statistics on direct and indirect corrosion damages on economy of governments. The direct cost of corrosion is near 3 % of the gross domestic product (GDP) of USA. Considering this huge cost, it is necessary to develop and expand the corrosion science and its protection technologies.

Engineering Aspects of Shape Memory Alloys

This book introduces shape memory alloy technology with a specific focus on valve applications. The authors describe application characteristics as well the current and potential uses of this technology. They include an overview of thermal and electrical valves as well as detailed valve design strategies.

Mechanics of Composite Structural Elements

This short monograph presents an analysis and design methodology for shape memory alloy (SMA) components such as wires, beams, and springs for different applications. The solid-solid, diffusionless phase transformations in thermally responsive SMA allows them to demonstrate unique characteristics like superelasticity and shape memory effects. The combined sensing and actuating capabilities of such materials allows them to provide a system level response by combining multiple functions in a single material system. In SMA, the combined

mechanical and thermal loading effects influence the functionality of such materials. The aim of this book is to make the analysis of these materials accessible to designers by developing a "strength of materials" approach to the analysis and design of such SMA components inspired from their various applications with a review of various factors influencing the design process for such materials.

Shape Memory Alloys

Numerical Modeling of Shape Memory Alloy Plates Considering Tension/compression Asymmetry and Its Verification Under Pure Bending

Shape Memory Alloys

Superalloys

This book provides a systematic approach to realizing NiTi shape memory alloy actuation, and is aimed at science and engineering students who would like to develop a better understanding of the behaviors of SMAs, and learn to design, simulate, control, and fabricate these actuators in a systematic approach. Several innovative biomedical applications of SMAs are discussed. These include orthopedic, rehabilitation, assistive, cardiovascular, and surgery devices and tools. To this end unique actuation mechanisms are discussed. These include antagonistic bi-stable shape memory-superelastic actuation, shape memory spring actuation, and multi axial tension-torsion actuation. These actuation mechanisms open new possibilities for creating adaptive structures and biomedical devices by using SMAs.

Shape Memory Polymers for Aerospace Applications

Shape Memory Alloy Engineering introduces materials, mechanical, and aerospace engineers to shape memory alloys (SMAs), providing a unique perspective that combines fundamental theory with new approaches to design and modeling of actual SMAs as compact and inexpensive actuators for use in aerospace and other applications. With this book readers will gain an understanding of the intrinsic properties of SMAs and their characteristic state diagrams, allowing them to design innovative compact actuation systems for applications from aerospace and aeronautics to ships, cars, and trucks. The book realistically discusses both the potential of these fascinating materials as well as their limitations in everyday life, and how to overcome some of those limitations in order to achieve proper design of useful SMA mechanisms. Discusses material characterization processes and results for a number of newer SMAs Incorporates numerical (FE) simulation and integration procedures into commercial codes (Msc/Nastran, Abaqus, and others) Provides detailed examples on design procedures and optimization of SMA-based actuation systems for real cases, from specs to verification lab tests on physical

demonstrators One of the few SMA books to include design and set-up of demonstrator characterization tests and correlation with numerical models

Shape Memory Alloy Actuators

This book commemorates the 75th birthday of Prof. George Jaiani – Georgia's leading expert on shell theory. He is also well known outside Georgia for his individual approach to shell theory research and as an organizer of meetings, conferences and schools in the field. The collection of papers presented includes articles by scientists from various countries discussing the state of the art and new trends in the theory of shells, plates, and beams. Chapter 20 is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

Shape Memory Alloy Engineering

The book on Sustainable Automotive Technologies aims to draw special attention to the research and practice focused on new technologies and approaches capable of meeting the challenges to sustainable mobility. In particular, the book features incremental and radical technical advancements that are able to meet social, economic and environmental targets in both local and global contexts. These include original solutions to the problems of pollution and congestion, vehicle and public safety, sustainable vehicle design and manufacture, new structures and materials, new power-train technologies and vehicle concepts. In addition to vehicle technologies, the book is also concerned with the broader systemic issues such as sustainable supply chain systems, integrated logistics and telematics, and end-of-life vehicle management. It captures selected peer reviewed papers accepted for presentation at the 4th International Conference on Sustainable Automotive Technologies, ICSAT2012, held at the RMIT, Melbourne, Australia.

Shape Memory Alloy Valves

Pseudoelasticity of Shape Memory Alloys: Theory and Experimental Studies is devoted to the phenomenon of pseudoelasticity (superelasticity) exhibited by shape memory alloy materials. It provides extensive introductory content on the state-of-the-art in the field, including SMA materials development, definition of shape memory effects, and discussions on where shape memory behavior is found in various engineering application areas. The book features a survey of modeling approaches targeted at reliable prediction of SMA materials' behavior on different scales of observation, including atomistic, microscopic, mezoscopic, and macroscopic. Researchers and graduate students will find detailed information on the modern methodologies used in the process of building constitutive models of advanced materials exhibiting complex behavior. Introduces the phenomenon of pseudoelasticity exhibited by shape memory alloy materials Features a survey of modeling approaches targeted at reliable prediction of SMN materials' behavior on different scales of observation Provides extensive coverage of the state-of-the-art in the field Ideal reference for researchers and graduate students interested in the modern methodologies used in the process of building constitutive models of advanced materials

Shape-Memory Alloys Handbook

The International Symposium on Shape Memory Effects and Appli cations was held at the University of Toronto on May 19-20, 1975, in four sessions over two days, as part of the regular 1975 Spring Meeting of The Metallurgical Society of AlME, sponsored by the Physical Metallurgy Committee of The Metallurgical Society. This was the first symposium on the subject, the only previous meeting at all related being the 1968 NOL Symposium on TiNi and Associated Compounds. One of the major intentions of this Symposium was to provide a forum for cross-communication between workers in the diverse metallurgical areas pertinent to shape memory effects, areas such as martensitic transformation, crystallography and thermodynamics, mechanical behavior, stress-induced transformation, lattice sta bility, and alloy development. Authors were encouraged to place an emphasis on delineation of general controlling factors and mech anisms, and on comparison of shape memory effect alloy systems with systems not exhibiting SME.

Shape Memory Alloys

Explores State-of-the-Art Work from the World's Foremost Scientists, Engineers, Educators, and Practitioners in the FieldWhy use smart materials?Since most smart materials do not add mass, engineers can endow structures with built-in responses to a myriad of contingencies. In their various forms, these materials can adapt to their environments by c