

Continuum Thermomechanics The Art And Science Of Modelling Material Behavior A Volume Dedicated To P

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Explore the intricate world of Continuum Thermomechanics, a field blending art and science to model material behavior. This volume delves into the theoretical foundations and practical applications of continuum mechanics, providing insights into how materials respond to thermal and mechanical stimuli. From fundamental principles to advanced modeling techniques, this resource offers a comprehensive overview for researchers and engineers seeking to understand and predict the behavior of complex materials under diverse conditions.

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Continuum Thermomechanics

Contributed by world-renowned specialists on the occasion of Paul Germain's 80th birthday, this unique book reflects the foundational works and the intellectual influence of this author. It presents the realm of modern thermomechanics with its extraordinary wealth of applications to the behaviour of materials, whether solid or fluid. The thirty-one contributions follow an easygoing autobiographical sketch by Paul Germain, and highlight the power and richness of a methodological approach to the phenomenology of many materials. This approach combines harmoniously thermodynamics and continuum theory in order to provide exploitable, thermodynamically admissible models of a large variety of behaviours and phenomena, including those of diffusion, thermoelasticity, viscoplasticity, relaxation, hysteresis, wetting, shape-memory effects, growth, phase transitions, stability, fracture, shocks, machining of materials, microstructured solids, complex fluids, etc. Especially aimed at graduate students, researchers, and engineers in mechanical engineering and materials science, this book also presents the state of the art in an active field of research and opens new horizons in other scientific fields, such as applied mathematics and applied physics, because of the intellectual satisfaction and remarkable efficiency provided by the advocated approach.

Advances in Continuum Mechanics and Thermodynamics of Material Behavior

The papers included in this volume were presented at the Symposium on Advances in the Continuum Mechanics and Thermodynamics of Material Behavior, held as part of the 1999 Joint ASME Applied Mechanics and Materials Summer Conference at Virginia Tech on June 27-30, 1999. The Symposium was held in honor of Professor Roger L. Fosdick on his 60th birthday. The papers are written by prominent researchers in the fields of mechanics, thermodynamics, materials modeling, and applied mathematics. They address open questions and present the latest development in these and related areas. This volume is a valuable reference for researchers and graduate students in universities and research laboratories.

IUTAM Symposium on Size Effects on Material and Structural Behavior at Micron- and Nano-Scales

This volume is a collection of twenty five written contributions by distinguished invited speakers from seven countries to the IUTAM Symposium on Size Effects on Material and Structural Behavior at Micron- and Nano-scales. Size effects on material and structural behaviors are of great interest to physicists, material scientists, and engineers who need to understand and model the mechanical behavior of solids especially at micron- and nano-scales.

Non-Linear Mechanics of Materials

In mechanical engineering and structural analysis there is a significant gap between the material models currently used by engineers for industry applications and those already available in research laboratories. This is especially apparent with the huge progress of computational possibilities and the corresponding dissemination of numerical tools in engineering practice, which essentially deliver linear solutions. Future improvements of design and life assessment methods necessarily involve non-linear solutions for inelastic responses, in plasticity or viscoplasticity, as well as damage and fracture analyses. The dissemination of knowledge can be improved by software developments, data base completion and generalization, but also by information and training. With such a perspective Non-Linear Mechanics of Materials proposes a knowledge actualization, in order to better understand and use recent material constitutive and damage modeling methods in the context of structural analysis or multiscale material microstructure computations.

Comprehensive Structural Integrity

The aim of this major reference work is to provide a first point of entry to the literature for the researchers in any field relating to structural integrity in the form of a definitive research/reference tool which links the various sub-disciplines that comprise the whole of structural integrity. Special emphasis will be given to the interaction between mechanics and materials and structural integrity applications. Because of the interdisciplinary and applied nature of the work, it will be of interest to mechanical engineers and materials scientists from both academic and industrial backgrounds including bioengineering, interface engineering and nanotechnology. The scope of this work encompasses, but is not restricted to: fracture mechanics, fatigue, creep, materials, dynamics, environmental degradation, numerical methods, failure mechanisms and damage mechanics, interfacial fracture and nano-technology, structural analysis, surface behaviour and heart valves. The structures under consideration include: pressure vessels and piping, off-shore structures, gas installations and pipelines, chemical plants, aircraft, railways, bridges, plates and shells, electronic circuits, interfaces, nanotechnology, artificial organs, biomaterial prostheses, cast structures, mining... and more. Case studies will form an integral part of the work.

The Behavior of Structures Composed of Composite Materials

Composite structures and products have developed tremendously since the publication of the first edition of this work in 1986. This new edition of the now classic 1986 text has been written to educate the engineering reader in the various aspects of mechanics for using composite materials in the design and analysis of composite structures and products. Areas dealt with include manufacture, micromechanical properties, structural design, joints and bonding and a much needed introduction to composite design philosophy. Each chapter is concluded by numerous problems suitable for home assignments or examination. A solution guide is available on request from the authors.

Mechanics of Strain Gradient Materials

Over the past 50 years, strain gradient material theories have been developed for the continuum modeling of size effects in materials and structures in terms of their elasticity, plasticity and fracturing. This book puts forward a unifying perspective to combine existing theories involving the higher order gradient of the strain tensor, or of plastic strain. It begins by reviewing experimental findings on the existence (or non-existence) of size effects on the mechanics of materials. In turn, the book devises first, second and higher order strain gradient theories from general principles, and presents constitutive frameworks that satisfy thermodynamic requirements. The special case of strain gradient plasticity is then developed and illustrated via computational analyses of size effects on the plasticity of metals at small scales. In closing, the book explains the origin of gradient effects in the case of lattice structures by drawing on homogenization theory.

IUTAM Symposium on Multiscale Modeling and Characterization of Elastic-Inelastic Behavior of Engineering Materials

The papers in this proceeding are a collection of the works presented at the IUTAM symposium-Marrakech 2002 (October 20-25) which brought together scientists from various countries. These papers cover contemporary topics in multiscale modeling and characterization of materials behavior of engineering materials. They were selected to focus on topics related to deformation and failure in metals, alloys, intermetallics and polymers including: experimental techniques, deformation and failure mechanisms, dislocation-based modelling, microscopic-macroscopic averaging schemes, application to forming processes and to phase transformation, localization and failure phenomena, and computational advances. Key areas that are covered by some of the papers include modeling of material deformation at various scales. At the atomistic scale, results from MD simulations pertaining to deformation mechanisms in nano-crystalline materials as well as dislocation-defect interactions are presented. Advances in modeling of deformation in metals using discrete dislocation analyses are also presented, providing an insight into this emerging scientific technique that can be used to model deformation at the microscale. These papers address current engineering problems, including deformation of thin films, dislocation behavior and strength during nanoindentation, strength in metal matrix composites, dislocation-crack interaction, development of textures in polycrystals, and problems involving twinning and shape memory behavior. On Behalf of the organizing committee, I would like to thank Professor P.

Modeling High Temperature Materials Behavior for Structural Analysis

This monograph presents approaches to characterize inelastic behavior of materials and structures at high temperature. Starting from experimental observations, it discusses basic features of inelastic phenomena including creep, plasticity, relaxation, low cycle and thermal fatigue. The authors formulate constitutive equations to describe the inelastic response for the given states of stress and microstructure. They introduce evolution equations to capture hardening, recovery, softening, ageing and damage processes. Principles of continuum mechanics and thermodynamics are presented to provide a framework for the modeling materials behavior with the aim of structural analysis of high-temperature engineering components.

Multiscale Fatigue Crack Initiation and Propagation of Engineering Materials: Structural Integrity and Microstructural Worthiness

What can be added to the fracture mechanics of metal fatigue that has not already been said since the 1900s? From the view point of the material and structure engineer, there are many aspects of failure by fatigue that are in need of attention, particularly when the size and time of the working components are changed by orders of magnitude from those considered by traditional means. The 21 century marks an era of technology transition where structures are made larger and devices are made smaller, rendering the method of destructive testing impractical. While health monitoring entered the field of science and engineering, the practitioners are discovering that the correlation between the signal and the location of interest depends on a priori knowledge of where failure may initiate. This information is not easy to find because the integrity of the physical system will change with time. Required is software that can self-adjust in time according to the monitored data. In this connection, effective application of health monitoring can use a predictive model of fatigue crack growth. Earlier fatigue crack growth models assumed functional dependence on the maximum stress and the size of the pre-existing crack or defect. Various possibilities were examined in the hope that the data could be grouped such that linear interpolation would apply.

Self-Consistent Methods for Composites

This unique book is dedicated to the application of self-consistent methods to the solution of static and dynamic problems of the mechanics and physics of composite materials. The effective elastic, electric, dielectric, thermo-conductive and other properties of composite materials reinforced by ellipsoidal, spherical multi-layered inclusions, thin hard and soft inclusions, short fibers and unidirectional multi-layered fibers are considered. The book contains many concrete results.

IUTAM Symposium on Field Analyses for Determination of Material Parameters — Experimental and Numerical Aspects

Proceedings of the IUTAM Symposium held in Abisko National Park, Kiruna, Sweden, July 31-August 4, 2000

Models of Mechanics

This textbook on models and modeling in mechanics introduces a new unifying approach to applied mechanics: through the concept of the open scheme, a step-by-step approach to modeling evolves. The unifying approach enables a very large scope on relatively few pages: the book treats theories of mass points and rigid bodies, continuum models of solids and fluids, as well as traditional engineering mechanics of beams, cables, pipe flow and wave propagation.

Thermoelastic Models of Continua

This volume is concerned with the basic problems of the theory of thermoelasticity for three models of continuous bodies: materials with voids, micropolar solids and nonsimple bodies. Beginning with the basic laws of thermodynamics, the theory of thermoelastic materials with voids is treated. Two subsequent chapters cover the analysis of the linear theory of micropolar thermoelastic bodies. The book concludes with a study of nonsimple thermoelastic materials, which are characterised by the inclusion of higher gradients of displacement in the basic postulates. Relevant examples and exercises which illustrate the theory are given throughout the text. The book should be of interest to mathematicians and specialists working in the fields of elasticity, thermoelasticity, civil engineering and geophysics.

IUTAM Symposium on Multiscale Modelling of Damage and Fracture Processes in Composite Materials

Integrating macroscopic properties with observations at lower levels, this book details advances in multiscale modelling and analysis pertaining to classes of composites which either have a wider range of relevant microstructural scales, such as metals, or do not have a very well-defined microstructure, e.g. cementitious or ceramic composites. The IUTAM symposia proceedings provide a platform for extensive further discussion and research.

Functional Analysis

This book started its life as a series of lectures given by the second author from the 1970's onwards to students in their third and fourth years in the Department of Mechanics and Mathematics at Rostov State University. For these lectures there was also an audience of engineers and applied mechanicians who wished to understand the functional analysis used in contemporary research in their fields. These people were not so much interested in functional analysis itself as in its applications; they did not want to be told about functional analysis in its most abstract form, but wanted a guided tour through those parts of the analysis needed for their applications. The lecture notes evolved over the years as the first author started to make more formal typewritten versions incorporating new material. About 1990 the first author prepared an English version and submitted it to Kluwer Academic Publishers for inclusion in the series Solid Mechanics and its Applications. At that state the notes were divided into three long chapters covering linear and nonlinear analysis. As Series Editor, the third author started to edit them. The requirements of lecture notes and books are vastly different. A book has to be complete (in some sense), self contained, and able to be read without the help of an instructor.

IUTAM Symposium on Physicochemical and Electromechanical Interactions in Porous Media

In the last decades, new experimental and numerical techniques have taken many advanced features of porous media mechanics down to practical engineering applications. This happened in areas that sometimes were not even suspected to be open to engineering ideas at all. The challenge that often faces engineers in the field of geomechanics, biomechanics, rheology and materials science is the translation of ideas existing in one field to solutions in the other. The purpose of the IUTAM symposium from which this proceedings volume has been compiled was to dive deep into the mechanics of those porous media that involve mechanics and chemistry, mechanics and electromagnetism, mechanics

and thermal fluctuations of mechanics and biology. The different sections have purposely not been formed according to field interest, but on the basis of the physics involved.

Elasticity of Transversely Isotropic Materials

This book aims to provide a comprehensive introduction to the theory and applications of the mechanics of transversely isotropic elastic materials. There are many reasons why it should be written. First, the theory of transversely isotropic elastic materials is an important branch of applied mathematics and engineering science; but because of the difficulties caused by anisotropy, the mathematical treatments and descriptions of individual problems have been scattered throughout the technical literature. This often hinders further development and applications. Hence, a text that can present the theory and solution methodology uniformly is necessary. Secondly, with the rapid development of modern technologies, the theory of transversely isotropic elasticity has become increasingly important. In addition to the fields with which the theory has traditionally been associated, such as civil engineering and materials engineering, many emerging technologies have demanded the development of transversely isotropic elasticity. Some immediate examples are thin film technology, piezoelectric technology, functionally gradient materials technology and those involving transversely isotropic and layered microstructures, such as multi-layer systems and tribology mechanics of magnetic recording devices. Thus a unified mathematical treatment and presentation of solution methods for a wide range of mechanics models are of primary importance to both technological and economic progress.

Dynamics of Advanced Materials and Smart Structures

Two key words for mechanical engineering in the future are Micro and Intelligence. It is well known that the leadership in the intelligence technology is a matter of vital importance for the future status of industrial society, and thus national research projects for intelligent materials, structures and machines have started not only in advanced countries, but also in developing countries. Materials and structures which have self-sensing, diagnosis and actuating systems, are called intelligent or smart, and are of growing research interest in the world. In this situation, the IUTAM symposium on Dynamics of Advanced Materials and Smart Structures was a timely one. Smart materials and structures are those equipped with sensors and actuators to achieve their designed performance in a changing environment. They have complex structural properties and mechanical responses. Many engineering problems, such as interface and edge phenomena, mechanical and electro-magnetic interaction/coupling and sensing, actuating and control techniques, arise in the development of intelligent structures. Due to the multi-disciplinary nature of these problems, all of the classical sciences and technologies, such as applied mathematics, material science, solid and fluid mechanics, control techniques and others must be assembled and used to solve them. IUTAM well understands the importance of this emerging technology. An IUTAM symposium on Smart Structures and Structronic Systems (Chaired by U.

Plate and Panel Structures of Isotropic, Composite and Piezoelectric Materials, Including Sandwich Construction

Plates and panels are primary components in many structures including space vehicles, aircraft, automobiles, buildings, bridge decks, ships and submarines. The ability to design, analyse, optimise and select the proper materials for these structures is a necessity for structural designers, analysts and researchers. This text consists of four parts. The first deals with plates of isotropic (metallic and polymeric) materials. The second involves composite material plates, including anisotropy and laminate considerations. The third section treats sandwich constructions of various types, and the final section gives an introduction to plates involving piezoelectric materials, in which the "smart" or "intelligent" materials are used as actuators or sensors. In each section, the formulations encompass plate structures subjected to static loads, dynamic loads, buckling, thermal/moisture environments, and minimum weight structural optimisation. This is a textbook for a graduate course, an undergraduate senior course and a reference. Many homework problems are given in various chapters.

IUTAM Symposium on Topological Design Optimization of Structures, Machines and Materials

This volume offers edited papers presented at the IUTAM-Symposium Topological design optimization of structures, machines and materials - status and perspectives, October 2005. The papers cover the application of topological design optimization to fluid-solid interaction problems, acoustics problems, and to problems in biomechanics, as well as to other multiphysics problems. Also in focus are new basic

modelling paradigms, covering new geometry modelling such as level-set methods and topological derivatives.

IUTAM Symposium on Mesoscopic Dynamics of Fracture Process and Materials Strength

This volume contains the papers presented at the IUTAM Symposium of "Mesoscopic Dynamics of Fracture Process and Materials Strength"

IUTAM Symposium on Analytical and Computational Fracture Mechanics of Non-Homogeneous Materials

This volume constitutes the Proceedings of the IUTAM Symposium on "Analytical and Computational Fracture Mechanics of Non-homogeneous Materials"

Embedded Systems -- Modeling, Technology, and Applications

This book synthesizes the results of the seventh in a successful series of workshops that were established by Shanghai Jiao Tong University and Technische Universität Berlin, bringing together researchers from both universities in order to present research results to an international community. Aspects covered here include, among others, Models and specification; Simulation of different properties; Middleware for distributed real-time systems; Signal Analysis; Control methods; Applications in airborne and medical systems.

IUTAM Symposium on Advances in Mathematical Modelling of Atmosphere and Ocean Dynamics

The goals of the Symposium were to highlight advances in modelling of atmosphere and ocean dynamics, to provide a forum where atmosphere and ocean scientists could present their latest research results and learn of progress and promising ideas in these allied disciplines; to facilitate interaction between theory and applications in atmosphere/ocean dynamics. These goals were seen to be especially important in view of current efforts to model climate requiring models which include interaction between atmosphere, ocean and land influences. Participants were delighted with the diversity of the scientific programme; the opportunity to meet fellow scientists from the other discipline (either atmosphere or ocean) with whom they do not normally interact through their own discipline; the opportunity to meet scientists from many countries other than their own; the opportunity to hear significant presentations (50 minutes) from the keynote speakers on a range of relevant topics. Certainly the goal of creating a forum for exchange between atmosphere and ocean scientists who need to input to create realistic models for climate prediction was achieved by the Symposium and this goal will hopefully be further advanced by the publication of these Proceedings.

Structural Synthesis of Parallel Robots

This is the first book of robotics presenting solutions of uncoupled and fully-isotropic parallel robotic manipulators and a method for their structural synthesis. Part 1 presents the methodology proposed for structural synthesis. Part 2 presents the various topologies of parallel robots generated by this systematic approach. Many solutions are presented here for the first time. The book will contribute to a widespread implementation of these solutions in industrial products.

Boundary Integral Equations in Elasticity Theory

by the author to the English edition The book aims to present a powerful new tool of computational mechanics, complex variable boundary integral equations (CV-BIE). The book is conceived as a continuation of the classical monograph by N. I. Muskhelishvili into the computer era. Two years have passed since the Russian edition of the present book. We have seen growing interest in numerical simulation of media with internal structure, and have evidence of the potential of the new methods. The evidence was especially clear in problems relating to multiple grains, blocks, cracks, inclusions and voids. This prompted me, when preparing the English edition, to place more emphasis on such topics. The other change was inspired by Professor Graham Gladwell. It was he who urged me to abridge the chain of formulae and to increase the number of examples. Now the reader will find more examples showing the potential and advantages of the analysis. The first chapter of the book contains a simple exposition of the theory of real variable potentials, including the hypersingular potential and the hypersingular equations. This makes up for the absence of such exposition in current textbooks,

and reveals important links between the real variable BIE and the complex variable counterparts. The chapter may also help readers who are learning or lecturing on the boundary element method.

Variational and Quasi-Variational Inequalities in Mechanics

The essential aim of this book is to consider a wide set of problems arising in the mathematical modeling of mechanical systems under unilateral constraints. In these investigations elastic and non-elastic deformations, friction and adhesion phenomena are taken into account. All the necessary mathematical tools are given: local boundary value problem formulations, construction of variational equations and inequalities and their transition to minimization problems, existence and uniqueness theorems, and variational transformations (Friedrichs and Young-Fenchel-Moreau) to dual and saddle-point search problems.

IUTAM Symposium on Evolutionary Methods in Mechanics

Proceedings of the IUTAM Symposium held in Cracow, Poland, 24-27 September 2002

Optimal Control from Theory to Computer Programs

The aim of this book is to present the mathematical theory and the know-how to make computer programs for the numerical approximation of Optimal Control of PDE's. The computer programs are presented in a straightforward generic language. As a consequence they are well structured, clearly explained and can be translated easily into any high level programming language. Applications and corresponding numerical tests are also given and discussed. To our knowledge, this is the first book to put together mathematics and computer programs for Optimal Control in order to bridge the gap between mathematical abstract algorithms and concrete numerical ones. The text is addressed to students and graduates in Mathematics, Mechanics, Applied Mathematics, Numerical Software, Information Technology and Engineering. It can also be used for Master and Ph.D. programs.

Design-Oriented Analysis of Structures

This book was developed while I was teaching graduate courses on analysis, design and optimization of structures, in the United States, Europe and Israel. Structural analysis is a main part of any design problem, and the analysis often must be repeated many times during the design process. Much work has been done on design-oriented analysis of structures recently and many studies have been published. The purpose of the book is to collect together selected topics of this literature and to present them in a unified approach. It meets the need for a general text covering the basic concepts and methods as well as recent developments in this area. This should prove useful to students, researchers, consultants and practicing engineers involved in analysis and design of structures. Previous books on structural analysis do not cover most of the material presented in the book. The book deals with the problem of multiple repeated analyses (reanalysis) of structures that is common to numerous analysis and design tasks. Reanalysis is needed in many areas such as structural optimization, analysis of damaged structures, nonlinear analysis, probabilistic analysis, controlled structures, smart structures and adaptive structures. It is related to a wide range of applications in such fields as Aerospace Engineering, Civil Engineering, Mechanical Engineering and Naval Architecture.

Thin-Walled Composite Beams

Annotation This is the first monograph devoted to the foundation of the theory of composite anisotropic thin-walled beams and to its applications in various problems involving the aeronautical/aerospace, helicopter, naval and mechanical structures. Throughout the theoretical part, an effort was made to provide the treatment of the subject by using the equations of the 3-D elasticity theory. Non-classical effects such as transverse shear, warping constraint, anisotropy of constituent materials yielding the coupling of twist-bending (lateral), bending (transversal)-extension have been included and their implications have been thoroughly analyzed. Thermal effects have been included and in order to be able to circumvent their deleterious effects, functionally graded materials have been considered in their construction. Implications of the application of the tailoring technique and of the active feedback control on free vibration, dynamic response, instability and aeroelasticity of such structures have been amply investigated. Special care was exercised throughout this work to address and validate the adopted solution methodologies and the obtained results against those available in the literature and obtained via numerical or experimental means.

Vibration Control of Active Structures

My objective in writing this book was to cross the bridge between the structural dynamics and control communities, while providing an overview of the potential of SMART materials for sensing and actuating purposes in active vibration control. I wanted to keep it relatively simple and focused on systems which worked. This resulted in the following: (i) I restricted the text to fundamental concepts and left aside most advanced ones (i.e. robust control) whose usefulness had not yet clearly been established for the application at hand. (ii) I promoted the use of collocated actuator/sensor pairs whose potential, I thought, was strongly underestimated by the control community. (iii) I emphasized control laws with guaranteed stability for active damping (the wide-ranging applications of the IFF are particularly impressive). (iv) I tried to explain why an accurate prediction of the transmission zeros (usually called anti-resonances by the structural dynamicists) is so important in evaluating the performance of a control system. (v) I emphasized the fact that the open-loop zeros are more difficult to predict than the poles, and that they could be strongly influenced by the model truncation (high frequency dynamics) or by local effects (such as membrane strains in piezoelectric shells), especially for nearly collocated distributed actuator/sensor pairs; this effect alone explains many disappointments in active control systems.

Nonlinear and Stochastic Dynamics of Compliant Offshore Structures

The purpose of this monograph is to show how a compliant offshore structure in an ocean environment can be modeled in two and three dimensions. The monograph is divided into five parts. Chapter 1 provides the engineering motivation for this work, that is, offshore structures. These are very complex structures used for a variety of applications. It is possible to use beam models to initially study their dynamics. Chapter 2 is a review of variational methods, and thus includes the topics: principle of virtual work, D'Alembert's principle, Lagrange's equation, Hamilton's principle, and the extended Hamilton's principle. These methods are used to derive the equations of motion throughout this monograph. Chapter 3 is a review of existing transverse beam models. They are the Euler-Bernoulli, Rayleigh, shear and Timoshenko models. The equations of motion are derived and solved analytically using the extended Hamilton's principle, as outlined in Chapter 2. For engineering purposes, the natural frequencies of the beam models are presented graphically as functions of normalized wave number and geometrical and physical parameters. Beam models are useful as representations of complex structures. In Chapter 4, a fluid force that is representative of those that act on offshore structures is formulated. The environmental load due to ocean current and random waves is obtained using Morison's equation. The random waves are formulated using the Pierson-Moskowitz spectrum with the Airy linear wave theory.

Parallel Robots

Parallel robots are closed-loop mechanisms presenting very good performances in terms of accuracy, velocity, rigidity and ability to manipulate large loads. They have been used in a large number of applications ranging from astronomy to flight simulators and are becoming increasingly popular in the field of machine-tool industry. This book presents a complete synthesis of the latest results on the possible mechanical architectures, analysis and synthesis of this type of mechanism. It is intended to be used by students (with over 150 exercises and numerous internet addresses), researchers (with over 650 references and anonymous ftp access to the code of some algorithms presented in this book) and engineers (for which practical results, mistakes to avoid, and applications are presented). Since the publication of the first edition (2000) there has been an impressive increase in terms of study and use of this kind of structure that are reported in this book. This second edition has been completely overhauled. The initial chapter on kinematics has been split into Inverse Kinematics and Direct Kinematics. A new chapter on calibration was added. The other chapters have also been rewritten to a large extent. The reference section has been updated to include around 45% new works that appeared after the first edition.

Elasticity

Since the first edition of this book was published, there have been major improvements in symbolic mathematical languages such as Maple and Mathematica and this has opened up the possibility of solving considerably more complex and hence interesting and realistic elasticity problems as classroom examples. It also enables the student to focus on the formulation of the problem (e.g. the appropriate governing equations and boundary conditions) rather than on the algebraic manipulations, with a consequent improvement in insight into the subject and in motivation. During the past 10 years I have developed files in Maple and Mathematica to facilitate this process, notably electronic versions of

the Tables in the present Chapters 19 and 20 and of the recurrence relations for generating spherical harmonics. One purpose of this new edition is to make this electronic material available to the reader through the Kluwer website www.elasticity.org. I hope that readers will make use of this resource and report back to me any aspects of the electronic material that could benefit from improvement or extension. Some hints about the use of this material are contained in Appendix A. Those who have never used Maple or Mathematica will find that it takes only a few hours of trial and error to learn how to write programs to solve boundary value problems in elasticity.

IUTAM Symposium on Mechanics of Martensitic Phase Transformation in Solids

Phase transition phenomena in solids are of vital interest to physicists, materials scientists, and engineers who need to understand and model the mechanical behavior of solids during various kinds of phase transformations. This volume is a collection of 29 written contributions by distinguished invited speakers from 14 countries to the IUTAM Symposium on Mechanics of Martensitic Phase Transformation in Solids, the first IUTAM Symposium focusing on this topic. It contains basic theoretical and experimental aspects of the recent advances in the mechanics research of martensitic phase transformations. The main topics include microstructure and interfaces, material instability and its propagation, micromechanics approaches, interaction between plasticity and phase transformation, phase transformation in thin films, single and polycrystalline shape memory alloys, shape memory polymers, TRIP steels, etc. Due to the multidisciplinary nature of the research covered, this volume will be of interest to researchers, graduate students and engineers in the field of theoretical and applied mechanics as well as materials science and technology.

Fracture Mechanics

New developments in the applications of fracture mechanics to engineering problems have taken place in the last years. Composite materials have extensively been used in engineering problems. Quasi-brittle materials including concrete, cement pastes, rock, soil, etc. all benefit from these developments. Layered materials and especially thin film/substrate systems are becoming important in small volume systems used in micro and nanoelectromechanical systems (MEMS and NEMS). Nanostructured materials are being introduced in our every day life. In all these problems fracture mechanics plays a major role for the prediction of failure and safe design of materials and structures. These new challenges motivated the author to proceed with the second edition of the book. The second edition of the book contains four new chapters in addition to the ten chapters of the first edition. The fourteen chapters of the book cover the basic principles and traditional applications, as well as the latest developments of fracture mechanics as applied to problems of composite materials, thin films, nanoindentation and cementitious materials. Thus the book provides an introductory coverage of the traditional and contemporary applications of fracture mechanics in problems of utmost technological importance. With the addition of the four new chapters the book presents a comprehensive treatment of fracture mechanics. It includes the basic principles and traditional applications as well as the new frontiers of research of fracture mechanics during the last three decades in topics of contemporary importance, like composites, thin films, nanoindentation and cementitious materials. The book contains fifty example problems and more than two hundred unsolved problems. A "Solutions Manual" is available upon request for course instructors from the author.

IUTAM Symposium on Asymptotics, Singularities and Homogenisation in Problems of Mechanics

Proceedings of the IUTAM Symposium held in Liverpool, UK, 8-11 July 2002

Mechanics of Microelectronics

This book is written by leading experts with both profound knowledge and rich practical experience in advanced mechanics and the microelectronics industry essential for current and future development. It aims to provide the cutting edge knowledge and solutions for various mechanical related problems, in a systematic way. It contains important and detailed information about the state-of-the-art theories, methodologies, the way of working and real case studies.