

Piezoelectricity Introduction To Theory And Applications Of Electromechanical Phenomena In Crystals 2 Volumes

Control Applications of Smart Materials
 Cement Industry
 Piezoelectric Energy Harvesting
 Advanced Piezoelectric Materials
 Optimization, Characterization and Sustainable Application
 Fundamentals and Applications
 Piezoelectric Nanomaterials for Biomedical Applications
 Sensing, Energy Harvesting, and Distributed Control—Second Edition
 An Introduction to the Theory and Applications of Electromechanical Phenomena in Crystals
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BARRERA SIENA

Control Applications of Smart Materials Springer Science & Business Media

The Beginnings of Piezoelectricity, the first history of the subject, exhaustively examines how diverse influences led to the discovery of the phenomenon in 1880, and how they shaped subsequent research until the consolidation of an empirical and theoretical knowledge of the field circa 1895. Shaul Katzir's historical account shows that this 'mundane' science was an intriguing intellectual and practical enterprise, which involved originality, surprises and controversies.

Springer

Discovered in 1880, piezoelectric materials play a key role in an innovative market of several billions of dollars. Recent advances in applications derive from new materials and their development, as well as to new market requirements. With the exception of quartz, ferroelectric materials are used for they offer both high efficiency and sufficient versatility to meet adequately the multidimensional requirements for application. Consequently, strong emphasis is placed on tailoring materials and technology, whether one deals with single crystals, ceramics or plastic materials. Tailoring requires a basic understanding of both physical principles and technical possibilities and limitations. This report elucidates these developments by a broad spectrum of examples, comprising ultrasound in medicine and defence industry, frequency control, signal processing by SAW-devices, sensors, actuators, including novel valves for modern motor management. It delivers a mutual fertilization of technology push and market pull that should be of interest not only to materials scientists or engineers but also to managers who dedicate themselves to a sound future-oriented R&D policy.

Cement Industry Springer Science & Business Media

This book is based on lecture notes for a graduate course that has been offered at University of Nebraska-Lincoln on and off since 1998. The course is intended to provide graduate students with the basic aspects of the continuum modeling of electroelastic interactions in solids. A concise treatment of linear, nonlinear, static and dynamic theories and problems is presented. The emphasis is on formulation and understanding of problems useful in device applications rather than solution techniques of mathematical problems. The mathematics used in the book is minimal. The book is suitable for a one-semester graduate course on electroelasticity. It can also be used as a reference for researchers. I would like to take this opportunity to thank UNL for a Maude Hammond Fling Faculty Research Fellowship in 2003 for the preparation of the first draft of this book. I also wish to thank Ms. Deborah Derrick of the College of Engineering and Technology at UNL for editing assistance with the book, and Professor David Y. Gao of Virginia Polytechnic Institute and State University for recommending this book to Kluwer for publication in the series of Advances in Mechanics and Mathematics. JSY Lincoln, Nebraska 2004 Preface Electroelastic materials exhibit electromechanical coupling. They experience mechanical deformations when placed in an electric field, and become electrically polarized under mechanical loads. Strictly speaking, piezoelectricity refers to linear electromechanical couplings only.

Piezoelectric Energy Harvesting An Introduction to the Theory of Piezoelectricity

The book discusses the underlying physical principles of piezoelectric materials, important properties of ferroelectric/piezoelectric materials used in today's transducer technology, and the principles used in transducer design. It provides examples of a wide range of applications of such materials along with the appertaining rationales. With contributions from distinguished researchers, this is a comprehensive reference on all the pertinent aspects of piezoelectric materials.

Advanced Piezoelectric Materials Springer

This book describes the application of piezoelectric materials, particularly piezoceramics, in the wide field of actuators and sensors. It gives a step-by-step introduction to the structure and mechanics of piezoelectric beam bending actuators in multilayer technology, which are of increasing importance for industrial applications. The book presents the suitability of the developed theoretical aspects in a memorable way.

Optimization, Characterization and Sustainable Application BoD - Books on Demand

Presents the fundamental physics of piezoelectric sensors. Only book with this scope Targeted to those engineers, physicists and chemists who are involved in materials processing, device design and manufacturing.

Fundamentals and Applications Courier Dover Publications

This book introduces physical effects and fundamentals of piezoelectric sensors and actuators. It gives a comprehensive overview of piezoelectric materials such as quartz crystals and polycrystalline ceramic materials. Different modeling approaches and methods to precisely predict the behavior of piezoelectric devices are described. Furthermore, a simulation-based approach is detailed which enables the reliable characterization of sensor and actuator materials. One focus of the book lies on piezoelectric ultrasonic transducers. An optical approach is presented that allows the quantitative determination of the resulting sound fields. The book also deals with various applications of piezoelectric sensors and actuators. In particular, the studied application areas are · process measurement technology, · ultrasonic imaging, · piezoelectric positioning systems and · piezoelectric motors. The book addresses students, academic as well as industrial reseachers and development engineers who are concerned with piezoelectric sensors and actuators.

Piezoelectric Nanomaterials for Biomedical Applications Springer Science & Business Media

Piezoelectric Materials and Devices: Applications in Engineering and Medical Sciences provides a complete overview of piezoelectric materials, covering all aspects of the materials starting from fundamental concepts. The treatment includes physics of piezoelectric materials, their characteristics and applications. The author uses simple language to explain the theory of piezoelectricity and introduce readers to the properties and design of different types of piezoelectric materials, such as those used in engineering and medical device applications. This book: Introduces various types of dielectrics and their classification based on their characteristics Addresses the mathematical formulation of piezoelectric effects and the definition of various piezoelectric constants Describes the structure and properties of practical piezoelectric materials such as quartz, lead zirconate titanate, barium titanate, zinc oxide, and polyvinylidene fluoride Covers the entire gamut of piezoelectric devices used in engineering and medical applications Discusses briefly the use of piezoelectric materials for energy harvesting and structural health monitoring Explores new developments in biomedical applications of piezoelectric devices such as drug delivery, blood flow and blood pressure monitoring, robotic operating tools, etc. Elaborates on design and virtual prototyping of piezoelectric devices through the use of FE software tools ANSYS and PAFEC Giving design engineers, scientists, and technologists the information and guidance they will need to adopt piezoelectric materials in the development of smart devices, this book will also motivate engineering and science students to initiate new research for developing innovative devices. Its contents will be invaluable to both students and professionals seeking a greater understanding of fundamentals and applications in the evolving field of piezoelectrics.

Sensing, Energy Harvesting, and Distributed Control—Second Edition Apc International, Limited

As a continuation of the author's previous book An Introduction to the Theory of Piezoelectricity (Springer, New York, 2005) on the three-dimensional theory of piezoelectricity, this book covers one- and two-dimensional theories of piezoelectric structures including rods, beams, plates and shells. In

addition to the so-called low-frequency motions of extension and bending, high-frequency motions of thickness shear and thickness stretch are also considered for certain applications unique in resonant piezoelectric devices. Both single-layer and multi-layer structures are treated. Nonlinear effects due to large deflection or large shear deformation are also discussed. The emphasis is on the development of structural theories with various levels of sophistication for different applications in piezoelectric devices. The book is heavily influenced by R D Mindlin's early contributions to this field. It is destined to be one of the most systematic and comprehensive books on piezoelectric structures. This second edition is a major reorganization of the first edition with multiple additions as well as deletion of chapters and sections.

An Introduction to the Theory and Applications of Electromechanical Phenomena in Crystals Springer Science & Business Media

Structural Health Monitoring with Piezoelectric Wafer Active Sensors, Second Edition provides an authoritative theoretical and experimental guide to this fast-paced, interdisciplinary area with exciting applications across a range of industries. The book begins with a detailed yet digestible consolidation of the fundamental theory relating to structural health monitoring (SHM). Coverage of fracture and failure basics, relevant piezoelectric material properties, vibration modes in different structures, and different wave types provide all the background needed to understand SHM and apply it to real-world structural challenges. Moving from theory to experimental practice, the book then provides the most comprehensive coverage available on using piezoelectric wafer active sensors (PWAS) to detect and quantify damage in structures. Updates to this edition include circular and straight-crested Lamb waves from first principle, and the interaction between PWAS and Lamb waves in 1-D and 2-D geometries. Effective shear stress is described, and tuning expressions between PWAS and Lamb waves has been extended to cover axisymmetric geometries with a complete Hankel-transform-based derivation. New chapters have been added including hands-on SHM case studies of PWAS stress, strain, vibration, and wave sensing applications, along with new sections covering essential aspects of vibration and wave propagation in axisymmetric geometries. Comprehensive coverage of underlying theory such as piezoelectricity, vibration, and wave propagation alongside experimental techniques Includes step-by-step guidance on the use of piezoelectric wafer active sensors (PWAS) to detect and quantify damage in structures, including clear information on how to interpret sensor signal patterns Updates to this edition include a new chapter on composites and new sections on advances in vibration and wave theory, bringing this established reference in line with the cutting edge in this emerging area

Mechanical, Dielectric, and Thermodynamical Properties of Piezoelectric Materials Springer Science & Business Media

Cement is the basis of the building and construction industry and of fundamental importance for many civil engineering applications. As such, the cement industry is one of the key industries worldwide necessary for the current and future sustainable development of society. Despite its undisputed importance, the cement industry is one of those industrial branches predominately responsible for high energy consumption and excessive generation of large amounts of carbon dioxide and other contaminants that significantly endanger human health and the environment and contributes to global warming. In this context, nanomaterials, polymeric materials, and natural additives are being used for cement enhancement in various applications. This book examines these novel materials and their optimization, characterization, and sustainable application in the building industry and for stabilizing hazardous waste.

Structural Health Monitoring with Piezoelectric Wafer Active Sensors Peninsula Pub

The fundamental principle of piezotronics and piezo-phototronics were introduced by Wang in 2007 and 2010, respectively. Due to the polarization of ions in a crystal that has non-central symmetry in materials, such as the wurtzite structured ZnO, GaN and InN, a piezoelectric potential (piezopotential) is created in the crystal by applying a stress. Owing to the simultaneous possession of piezoelectricity and semiconductor properties, the piezopotential created in the crystal has a strong effect on the carrier transport at the interface/junction. Piezotronics is for devices fabricated using the piezopotential as a "gate" voltage to control charge carrier transport at a contact or junction. The piezo-phototronic effect uses the piezopotential to control the carrier generation, transport, separation and/or recombination for improving the performance of optoelectronic devices, such as photon detector, solar cell and LED. The functionality offered by piezotronics and piezo-phototronics are complementary to CMOS technology. There is an effective integration of piezotronic and piezo-phototronic devices with silicon based CMOS technology. Unique applications can be found in areas such as human-computer interfacing, sensing and actuating in nanorobotics, smart and personalized electronic signatures, smart MEMS/NEMS, nanorobotics and energy sciences. This book introduces the fundamentals of piezotronics and piezo-phototronics and advanced applications. It gives guidance to researchers, engineers and graduate students.

An Introduction to the Theory and Applications of Electromechanical Phenomena in Crystals Courier Dover Publications

The need for new types of sensors is more critical than ever. This is due to the emergence of increasingly complex technologies, health and security concerns of a burgeoning world population, and the emergence of terrorist activities, among other factors. Depending on their application, the design, fabrication, testing, and use of sensors, all require various kinds of both technical and nontechnical expertise. With this in mind, Introduction to Sensors examines the theoretical foundations and practical applications of electrochemical, piezoelectric, fiber optic, thermal, and magnetic sensors and their use in the modern era. Incorporating information from sensor-based industries to review current developments in the field, this book: Presents a complete sensor system that includes the preparation phase, the sensing element and platform, and appropriate electronics resulting in a digital readout Discusses solid-state electronic sensors, such as the metal oxide semiconductor (MOS) capacitor, the micromachined capacitive polymer, and the Schottky diode sensors Uses the two-dimensional hexagonal lattice as an example to detail the basic theory associated with piezoelectricity Explores the fundamental relationship between stress, strain, electric field, and electric displacement The magnetic sensors presented are used to determine

measurands such as the magnetic field and semiconductor properties, including carrier concentration and mobility. Offering the human body and the automobile as examples of entities that rely on a multiplicity of sensors, the authors address the application of various types of sensors, as well as the theory and background information associated with their development and the materials used in their design. The coverage in this book reveals the underlying rationale for the application of different sensors while also defining the properties and characteristics of each.

Elements of the Linear Theory of Piezoelectricity and the Vibrations Piezoelectric Plates Springer Science & Business Media

For the first time, this book covers the entire field of piezoelectric sensors for mechanical measurands. It gives extensive practical advice along with an overview of the most important piezoelectric materials and their properties, plus consistent terminology for describing sensors.

PIEZOELECTRICITY; AN INTRODUCTION TO THE THEORY AND APPLICATIONS OF ELECTROMECHANICAL PHENOMENA IN CRYSTALS (Volume 1) World Scientific

Piezoelectricity has been a steadily growing field, with recent advances made by researchers from applied physics, acoustics, materials science, and engineering. This collective work presents a comprehensive treatment of selected advanced topics in the subject. The book is written for an intermediate graduate level and is intended for researchers, mechanical engineers, and applied mathematicians interested in the advances and new applications in piezoelectricity.

Piezoelectric Materials and Devices John Wiley & Sons

Piezoelectric materials produce electric charges on their surfaces as a consequence of applying mechanical stress. They are used in the fabrication of a growing range of devices such as transducers (used, for example, in ultrasound scanning), actuators (deployed in such areas as vibration suppression in optical and microelectronic engineering), pressure sensor devices (such as gyroscopes) and increasingly as a way of producing energy. Their versatility has led to a wealth of research to broaden the range of piezoelectric materials and their potential uses. Advanced piezoelectric materials: science and technology provides a comprehensive review of these new materials, their properties, methods of manufacture and applications. After an introductory overview of the development of piezoelectric materials, Part one reviews the various types of piezoelectric material, ranging from lead zirconate titanate (PZT) piezo-ceramics, relaxor ferroelectric ceramics, lead-free piezo-ceramics, quartz-based piezoelectric materials, the use of lithium niobate and lithium in piezoelectrics, single crystal piezoelectric materials, electroactive polymers (EAP) and piezoelectric composite materials. Part two discusses how to design and fabricate piezo-materials with chapters on piezo-ceramics, single crystal preparation techniques, thin film technologies, aerosol techniques and manufacturing technologies for piezoelectric transducers. The final part of the book looks at applications such as high-power piezoelectric materials and actuators as well as the performance of piezoelectric materials under stress. With its distinguished editor and international team of expert contributors Advanced piezoelectric materials: science and technology is a standard reference for all those researching piezoelectric materials and using them to develop new devices in such areas as microelectronics, optical, sound, structural and biomedical engineering. Provides a comprehensive review of the new materials, their properties and methods of manufacture and application Explores the development of piezoelectric materials from the historical background to the present status Features an overview of manufacturing methods for piezoelectric ceramic materials including design considerations

Vibration of Piezoelectric Crystal Plates Springer Science & Business Media

Second in two-volume series covers properties and techniques of quartz, Rochelle salt, ferroelectric crystals, various applications of piezoelectricity, pyroelectricity, optical properties of crystals, and atomic theory of piezoelectricity. 1946 edition.

An Introduction to the Theory and Applications of Electromechanical Phenomena in Crystals Courier Dover Publications

Second in two-volume series covers properties and techniques of quartz, Rochelle salt, ferroelectric crystals, various applications of piezoelectricity, pyroelectricity, optical properties of crystals, and atomic theory of piezoelectricity. 1946 edition.

Plate and Panel Structures of Isotropic, Composite and Piezoelectric Materials, Including Sandwich Construction Springer Science & Business Media

This book helps the reader to understand the specific properties of piezoelectric ceramic resonators. It provides their theoretical description by imittance and equivalent circuit method. The numerical modelling described is accompanied by examples of properties measured experimentally. Piezoelectric ceramic transformers are also covered, followed by a series of solved and unsolved problems prepared specially for students.

Piezoelectric Multilayer Beam Bending Actuators CRC Press

This book offers an introduction to piezoelectric shells and distributed sensing, energy harvesting and control applications. It familiarizes readers with a generic approach of piezoelectric shells and fundamental electromechanics of distributed piezoelectric sensors, energy harvesters and actuators applied to shell structures. The book is divided into two major parts, the first of which focuses on piezoelectric shell continua, while the second examines distributed sensing, energy harvesting and control of elastic continua, e.g., shells and plates. The exploitation of new, advanced multifunctional smart structures and structronic systems has been one of the mainstream research and development activities over the years. In the search for innovative structronics technologies, piezoelectric materials have proved to be very versatile in both sensor and actuator applications. Consequently, the piezoelectric technology has been applied to a broad range of practical applications, from small-scale nano- and micro-sensors/actuators to large-scale airplane and space structures and systems. The book provides practicing engineers and researchers with an introduction to advanced piezoelectric shell theories and distributed sensor/energy harvester/actuator technologies in the context of structural identification, energy harvesting and precision control. The book can also be used as a textbook for graduate students. This second edition contains substantial new materials, especially energy harvesting and experimental components, and has been updated and corrected for a new generation of readers.

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