

Nonlinear
Electromechanical
Couplings (Nonlinear
science: theory &
applications)

Mauguin, G. A.

Note: This is not the actual book cover

Nonlinear Electromechanical Couplings

Jiashi Yang



Nonlinear Electromechanical Couplings:

Nonlinear Electromechanical Couplings G. A. Maugin, 1992-10-13 Offers an updated and rigorous treatise on most manifestations of nonlinear electromechanical couplings in dielectric media with applications to piezoelectric and ferroelectric crystals piezoelectric powders and solutions of electrodeformable macromolecules Presents a variety of static and dynamic nonlinear effects which have important engineering applications Contains an insight into the nonlinear behavior of such new substances as ceramics powders and ferroelectrics Rigorous mathematical treatment includes hyperbolic systems asymptotic expansions singular perturbations convexity and soliton theory **Nonlinear Electromechanical**

Couplings Gérard A. Maugin, 1992-01-01 This work is concerned with i the formulation of nonlinear models of electrodeformable continua essentially of the solid type but with some slight incursion in the realm of fluid solutions presenting a deformable solid like microstructure and ii the applied mathematical study of the numerous effects that arise in this framework For the basics it draws heavily on modern continuum mechanics where great care is taken of both geometrical and physical nonlinearities and the electrodynamics of continua cast in this modern framework which allows scientists to deal with electric fields of high intensity *An Introduction to the Theory of Piezoelectricity* Jiashi

Yang, 2006-06-14 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 **American Society of Composites-28th Technical Conference** Charles

Bakis, 2013-11-01 New and unpublished U S and international research on multifunctional active biobased SHM self healing composites from nanolevel to large structures New information on modeling design computational engineering manufacturing testing Applications to aircraft bridges concrete medicine body armor wind energy This fully searchable CD ROM contains 135 original research papers on all phases of composite materials The document provides cutting edge

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Buscarino, Mattia Frasca, Carlo Famoso, 2017-05-19 This book focuses on a class of uncertain systems that are called imperfect and shows how much systems can regularly work if an appropriate control strategy is adopted Along with some practical well studied examples a formalization of the models for imperfect system is considered and a control strategy is proposed Experimental case studies on electromechanical systems are also included New concepts experimental innovative circuits and laboratory details allow the reader to implement at low cost the outlined strategy Emergent topics in nonlinear device realization are emphasized with the aim to allow researchers and students to perform experiments with large scale electromechanical systems Moreover the possibility of using imperfections and noise to generate nonlinear strange behavior is discussed **Nonlinear Theory of Electroelastic and Magnetoelastic Interactions** Luis Dorfmann, Ray W.

Ogden, 2014-02-06 This book provides a unified theory on nonlinear electro magnetomechanical interactions of soft materials capable of large elastic deformations The authors include an overview of the basic principles of the classic theory of electromagnetism from the fundamental notions of point charges and magnetic dipoles through to distributions of charge and current in a non deformable continuum time dependent electromagnetic fields and Maxwell s equations They summarize relevant theories of continuum mechanics required to account for the deformability of material and present a constitutive framework for the nonlinear magneto and electroelastic interactions in a highly deformable material The equations contained in the book formulate and solve a variety of representative boundary value problems for both nonlinear magnetoelasticity and electroelasticity Nonlinear Wave Dynamics J. Engelbrecht, 2013-04-17 At the end of the twentieth century nonlinear dynamics turned out to be one of the most challenging and stimulating ideas Notions like bifurcations attractors chaos fractals etc have proved to be useful in explaining the world around us be it natural or artificial However much of our everyday understanding is still based on linearity i e on the additivity and the proportionality The larger the excitation the larger the response this seems to be carved in a stone tablet The real world is not always reacting this way and the additivity is simply lost The most convenient way to describe such a phenomenon is to use a mathematical term nonlinearity The importance of this notion i e the importance of being nonlinear is nowadays more and more accepted not only by the scientific community but also globally The recent success of nonlinear dynamics is heavily biased towards temporal

characterization widely using nonlinear ordinary differential equations Nonlinear spatio temporal processes i e nonlinear waves are seemingly much more complicated because they are described by nonlinear partial differential equations The richness of the world may lead in this case to coherent structures like solitons kinks breathers etc which have been studied in detail Their chaotic counterparts however are not so explicitly analysed yet The wavebearing physical systems cover a wide range of phenomena involving physics solid mechanics hydrodynamics biological structures chemistry etc

Nonlinear Vibrations Excited by Limited Power Sources Jose Manoel Balthazar, 2022-04-18 The book covers a wide range of applied engineering research compactly presented in one volume and shows innovative practical engineering solutions for automotive marine and aviation industries as well as power generation related to nonlinear vibrations excited by limited power sources While targeting primarily the audience of professional scientists and engineers the book can also be useful for graduate students and for all of those who are relatively new to the area and are looking for a single source with a good overview of the state of the art as well as up to date information on theories analytical numerical methods and their applications in design simulations testing and manufacturing The readers will find here a rich mixture of approaches software tools and case studies used to investigate and optimize diverse powertrains their functional units and separate machine parts based on different physical phenomena their mathematical model representations solution algorithms and experimental validation

Nonlinearity in Energy Harvesting Systems Elena Blokhina, Abdelali El Aroudi, Eduard Alarcon, Dimitri Galayko, 2016-11-10 This book is a single source guide to nonlinearity and nonlinear techniques in energy harvesting with a focus on vibration energy harvesters for micro and nanoscale applications The authors demonstrate that whereas nonlinearity was avoided as an undesirable phenomenon in early energy harvesters now it can be used as an essential part of these systems Readers will benefit from an overview of nonlinear techniques and applications as well as deeper insight into methods of analysis and modeling of energy harvesters employing different nonlinearities The role of nonlinearity due to different aspects of an energy harvester is discussed including nonlinearity due to mechanical to electrical conversion nonlinearity due to conditioning electronic circuits nonlinearity due to novel materials e g graphene etc Coverage includes tutorial introductions to MEMS and NEMS technology as well as a wide range of applications such as nonlinear oscillators and transducers for energy harvesters and electronic conditioning circuits for effective energy processing

IUTAM Symposium on Mechanics of Martensitic Phase Transformation in Solids Qing-Ping Sun, 2013-03-14 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

Transducers and Arrays for Underwater Sound

Charles Sherman, John Butler, 2007-01-05 The efficacy of sound to penetrate the seas made acoustic systems in the past century the leading tools for sensing objects in and measuring properties of the seas For over sixty years The United States Office of Naval Research ONR has been a major sponsor of undersea research and development at universities national laboratories and industrial organizations Appropriately ONR is the sponsor of this monograph series The intent of the series is to summarize recent accomplishments in and to outline perspectives for underwater acoustics in specific fields of research The general field has escalated in importance and spread broadly with richness and depth of understanding It has also quite naturally become more specialized The goal of this series is to present monographs that critically review both past and recent accomplishments in order to address the shortcomings in present understanding In this way these works will bridge the gaps in understanding among the specialists and favorably color the direction of new research and development Each monograph is intended to be a stand alone advanced contribution to the field We trust that the reader will also find that each is a critical introduction to related specialized topics of interest as well

Surface Waves in Geomechanics: Direct and Inverse Modelling for Soils and Rocks

Carlo G. Lai, Krzysztof Wilmanski, 2007-03-23 Theories of surface waves developed since the end of XIX century and many fundamental problems like existence phase and group velocities attenuation quality factor mode conversion etc have been in part successfully solved within the framework of such simple models as ideal fluids or linear elasticity However a sufficiently complete presentation of this subject particularly for solids is still missing in the literature The sole exception is the book of I A Viktorov which contains an extensive discussion of fundamental properties of surface waves in homogeneous and stratified linear elastic solids with particular emphasis on contributions of Russian scientists Unfortunately the book has never been translated to English and its Russian version is also hardly available Practical applications of surface waves developed intensively since a much shorter period of time than theories even though the motivation of discoverers of surface waves such as Lord Rayleigh stems from their appearance in geophysics and seismology Nowadays the growing interest in practical applications of surface waves stem from the following two main factors surface waves are ideal for developing relatively cheap and convenient methods of nondestructive testing of various systems

spanning from nanomaterials e.g. Handbook of Optoelectronic Device Modeling and Simulation Joachim

Piprek, 2017-10-10 Optoelectronic devices are now ubiquitous in our daily lives from light emitting diodes LEDs in many household appliances to solar cells for energy This handbook shows how we can probe the underlying and highly complex

physical processes using modern mathematical models and numerical simulation for optoelectronic device design analysis and performance optimization It reflects the wide availability of powerful computers and advanced commercial software which have opened the door for non specialists to perform sophisticated modeling and simulation tasks The chapters comprise the know how of more than a hundred experts from all over the world The handbook is an ideal starting point for beginners but also gives experienced researchers the opportunity to renew and broaden their knowledge in this expanding field

Smart Systems Integration and Simulation Nicola Bombieri, Massimo Poncino, Graziano Pravadelli, 2016-02-17 This book presents new methods and tools for the integration and simulation of smart devices The design approach described in this book explicitly accounts for integration of Smart Systems components and subsystems as a specific constraint It includes methodologies and EDA tools to enable multi disciplinary and multi scale modeling and design simulation of multi domain systems subsystems and components at all levels of abstraction system integration and exploration for optimization of functional and non functional metrics By covering theoretical and practical aspects of smart device design this book targets people who are working and studying on hardware software modelling component integration and simulation under different positions system integrators designers developers researchers teachers students etc In particular it is a good introduction to people who have interest in managing heterogeneous components in an efficient and effective way on different domains and different abstraction levels People active in smart device development can understand both the current status of practice and future research directions Provides a comprehensive overview of smart systems design focusing on design challenges and cutting edge solutions Enables development of a co simulation and co design environment that accounts for the peculiarities of the basic subsystems and components to be integrated Describes development of modeling and design techniques methods and tools that enable multi domain simulation and optimization at various levels of abstraction and across different technological domains

Applied Mechanics Reviews, 1986

Mechanics and Electrodynamics of Magneto- and Electro-elastic Materials Raymond Ogden, David Steigmann, 2011-05-25 This volume presents a state of the art overview of the continuum theory of both electro and magneto sensitive elastomers and polymers which includes mathematical and computational aspects of the modelling of these materials from the point of view of material properties and in particular the smart material control of their mechanical properties

[Fracture Mechanics of Piezoelectric and Ferroelectric Solids](#)

Daining Fang, Jinxi Liu, 2014-12-12 *Fracture Mechanics of Piezoelectric and Ferroelectric Solids* presents a systematic and comprehensive coverage of the fracture mechanics of piezoelectric ferroelectric materials which includes the theoretical analysis numerical computations and experimental observations The main emphasis is placed on the mechanics description of various crack problems such static dynamic and interface fractures as well as the physical explanations for the mechanism of electrically induced fracture The book is intended for postgraduate students researchers and engineers in the fields of solid mechanics applied physics material science and mechanical engineering Dr Daining Fang is a professor at the School of

Aerospace Tsinghua University China Dr Jinxi Liu is a professor at the Department of Engineering Mechanics Shijiazhuang Railway Institute China

Continuum Mechanics Through the Eighteenth and Nineteenth Centuries Gérard A.

Maugin, 2014-04-04 Conceived as a series of more or less autonomous essays the present book critically exposes the initial developments of continuum thermo mechanics in a post Newtonian period extending from the creative works of the Bernoullis to the First World war i e roughly during first the Age of reason and next the Birth of the modern world The emphasis is rightly placed on the original contributions from the Continental scientists the Bernoulli family Euler d Alembert Lagrange Cauchy Piola Duhamel Neumann Clebsch Kirchhoff Helmholtz Saint Venant Boussinesq the Cosserat brothers Caratheodory in competition with their British peers Green Kelvin Stokes Maxwell Rayleigh Love It underlines the main breakthroughs as well as the secondary ones It highlights the role of scientists who left essential prints in this history of scientific ideas The book shows how the formidable developments that blossomed in the twentieth century and perused in a previous book of the author in the same Springer Series Continuum Mechanics through the Twentieth Century Springer 2013 found rich compost in the constructive foundational achievements of the eighteenth and nineteenth centuries The pre WWI situation is well summarized by a thorough analysis of treatises Appell Hellinger published at that time English translations by the author of most critical texts in French or German are given to the benefit of the readers

Stability Analysis and Control of Powertrain for New Energy Vehicles Donghai Hu, Bifeng Yin, 2021-09-13 This book introduces the application of nonlinear dynamics theory for driving system of electric vehicle and hybrid electric vehicle respectively It establishes the dynamic models for driving system of electric vehicle and hybrid electric vehicle under various working conditions And the nonlinear dynamics theory is applied to the qualitative analysis and quantitative calculation for the models The theoretical analysis results are applied to guide the optimization of control strategies In the end of each chapter corresponding simulations or experiments are provided to verify the corresponding instances which are carefully selected This book will give some guidance to readers when they deal with nonlinear dynamics problems of vehicles in the future and provide theoretical bases for the further study of the nonlinear dynamics for driving system of electric vehicle and hybrid electric vehicle The book is written for engineer of electric vehicle and hybrid vehicle teachers and students majoring in automobile and automation

Continuum Mechanics Through the Twentieth Century Gerard A Maugin, 2013-04-08 This overview of the development of continuum mechanics throughout the twentieth century is unique and ambitious Utilizing a historical perspective it combines an exposition on the technical progress made in the field and a marked interest in the role played by remarkable individuals and scientific schools and institutions on a rapidly evolving social background It underlines the newly raised technical questions and their answers and the ongoing reflections on the bases of continuum mechanics associated or in competition with other branches of the physical sciences including thermodynamics The emphasis is placed on the development of a more realistic modeling of deformable solids and the exploitation of new mathematical tools The book

presents a balanced appraisal of advances made in various parts of the world The author contributes his technical expertise personal recollections and international experience to this general overview which is very informative albeit concise

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