ISAAK MAYERGOYZ

MATHEMATICAL MODELS OF HYSTERESIS AND THEIR APPLICATIONS

A Volume in the Elsevier Series in Electromagnetism

Mathematical Models Of Hysteresis And Their Applications

Qingsong Xu,Kok Kiong Tan

Mathematical Models Of Hysteresis And Their Applications:

Mathematical Models of Hysteresis and their Applications Isaak D. Mayergoyz,2003-10-01 This new edition has been significantly revised and updated to reflect advances in the field since the publication of the first edition such as the systematic experimental testing of Preisach models of hysteresis The author has however retained the two most salient features of the original the emphasis on the universal nature of mathematical models of hysteresis and their applicability to the description of hysteresis phenomena in various areas of science technology and economics and its accessibility to a broad audience of researchers engineers and students Provides a unique emphasis on the development of universal mathematical models of hysteresis Accessibility to a broad audience using simple and complex mathematical tools application to various areas of science Presents new theoretical and experimental results   **Mathematical Models of Hysteresis** I.D. Mayergoyz,2012-12-06 The purpose of this book is to describe in sufficient detail the mathematical models of hysteresis nonlinearities with nonlocal memories The distinct feature of these nonlinearities is that their future states depend on past histories of input variations It turns out that memories of hysteresis nonlinearities are quite selective Indeed experiments show that only some past input extrema not the entire input variations leave their marks upon future states of hysteresis nonlinearities Thus special mathematical tools are needed to describe nonlocal selective memories of hysteresis nonlinearities The origin of such tools can be traced back to the landmark paper of Preisach The book is primarily concerned with Preisach type models of hysteresis All these models have a common generic feature they are constructed as superposi tions of simplest hysteresis nonlinearities rectangular loops The discussion is by and large centered around the following topics various generalizations and extensions of the classical Preisach model with special emphasis on vector generalizations finding of necessary and sufficient conditions for the represen tation of actual hysteresis nonlinearities by various Preisach type models solution of identification problems for these models and numerical implementa tion and experimental testing of Preisach type models Although the study of Preisach type models constitutes the main subject of the book some effort is also made to establish some interesting connections between these models and such topics as the critical state model for superconducting hysteresis the classi cal Stoner Wohlfarth model for vector magnetic hysteresis thermal activation type models for viscosity magnetostrictive hysteresis and neural networks   **Ferroelectrics and Their Applications** Husein Irzaman,Renan Prasta Jenie,2018-10-03 Ferroelectricity is a symptom of inevitable electrical polarization changes in materials without external electric field interference Ferroelectricity is a phenomenon exhibited by crystals with a spontaneous polarization and hysteresis effects associated with dielectric changes when an electric field is given Our fascination with ferroelectricity is in recognition of a beautiful article by Itskovsky in which he explains the kinetics of a ferroelectric phase transition in a thin ferroelectric layer film We have been researching ferroelectric materials since 2001 There are several materials known for their ferroelectric properties Barium titanate and barium strontium titanate are the

most well known Several others include tantalum oxide lead zirconium titanate gallium nitride lithium tantalate aluminium copper oxide and lithium niobate There is still a blue ocean of ferroelectric applications yet to be expounded It is and hopefully always will be a bright future   Mathematical Models and Numerical Simulation in Electromagnetism Alfredo Bermúdez de Castro,Dolores Gomez,Pilar Salgado,2014-07-22 The book represents a basic support for a master course in electromagnetism oriented to numerical simulation The main goal of the book is that the reader knows the boundary value problems of partial differential equations that should be solved in order to perform computer simulation of electromagnetic processes Moreover it includes a part devoted to electric circuit theory based on ordinary differential equations The book is mainly oriented to electric engineering applications going from the general to the specific namely from the full Maxwell s equations to the particular cases of electrostatics direct current magnetostatics and eddy currents models Apart from standard exercises related to analytical calculus the book includes some others oriented to real life applications solved with MaxFEM free simulation software   Modeling and Precision Control of Systems with Hysteresis Lei Liu,Yi Yang,2015-11-20 Modelling and Precision Control of Systems with Hysteresis covers the piezoelectric and other smart materials that are increasingly employed as actuators in precision engineering from scanning probe microscopes SPMs in life science and nano manufacturing to precision active optics in astronomy including space laser communication space imaging cameras and the micro electro mechanical systems MEMS As smart materials are known for having hysteretic dynamics it is necessary to overcome issues with a broadband range of frequencies This book offers both the mathematical tools for modeling the systems and applications including complete case studies and source code for the experiments to help both academics and researchers in the industry to achieve precision in the control of Smart Actuator systems Provides a comprehensive identification of typical complex hysteresis Presents control algorithm design for systems with hysteresis Contain numerous real life examples and two complete case studies Source code to examples are provided   Nonlinear Partial Differential Equations and Their Applications Doina Cioranescu,Jacques-Louis Lions,1998-08-15 This book presents the texts of selected lectures on recent work in the field of nonlinear partial differential equations delivered by leading international experts at the well established weekly seminar held at the Coll ge de France Emphasis is on applications to numerous areas including control theory theoretical physics fluid and continuum mechanics free boundary problems dynamical systems scientific computing numerical analysis and engineering Proceedings of this seminar will be of particular interest to postgraduate students and specialists in the area of nonlinear partial differential equations   **The Science of Hysteresis** Giorgio Bertotti,Isaak D. Mayergoyz,2005-12-20 Volume 1 covers Mathematical models Differential equations Stochastic aspects of hysteresis Binary detection using hysteresis Models of unemployment in economics Volume 2 covers Physical models of magnetic hysteresis All aspects of magnetisation dynamics Volume 3 covers Hysteresis phenomena in materials Over 2100 pages rich with supporting illustrations figures and equations Contains contributions from an international list of authors

from a wide range of disciplines Covers all aspects of hysteresis from differential equations and binary detection to models of unemployment and magnetisation dynamics *Functional Approach to Nonlinear Models of Water Flow in Soils* G. Marinoschi,2006-09-05 a pure mathematician does what he can do as well as he should whilst an applied mathematician does what he should do as well as he can Gr C Moisil Romanian mathematician 1906 1973 Flows in porous media were initially the starting point for the study which has evolved into this book because the acquirement and improving of kn ledge about the analysis and control of water in ltration and solute spreading arechallenginganddemandingpresentissuesinmanydomains likesoilsci ces hydrology water management water quality management ecology The mathematical modelling required by these processes revealed from the beg ning interesting and di cult mathematical problems so that the attention was redirected to the theoretical mathematical aspects involved Then the qualitative results found were used for the explanation of certain behaviours of the physical processes which had made the object of the initial study and for giving answers to the real problems that arise in the soil science practice In this way the work evidences a perfect topic for an applied mathematical research This book was written in the framework of my research activity within the Institute of Mathematical Statistics and Applied Mathematics of the Ro nianAcademy SomeresultswereobtainedwithintheprojectCNCSIS33045 2004 2006 nanced by the Romanian Ministry of Research and Education In a preliminary form part of the results included here were lecture notes for master and Ph D students during the scienti c stages November December 2003 and May June 2004 of the author at the Center for Optimal Control and Discrete Mathematics belonging to the Central China Normal University in Wuhan   **Intelligent Robotics and Applications** Chun-Yi Su,Subhash Rakheja,Liu Honghai,2012-09-28 The three volume set LNAI 7506 LNAI 7507 and LNAI 7508 constitutes the refereed proceedings of the 5th International Conference on Intelligent Robotics and Applications ICIRA 2012 held in Montreal Canada in October 2012 The 197 revised full papers presented were thoroughly reviewed and selected from 271 submissions They present the state of the art developments in robotics automation and mechatronics This volume covers the topics of adaptive control systems automotive systems estimation and identification intelligent visual systems application of differential geometry in robotic mechanisms unmanned systems technologies and applications new development on health management fault diagnosis and fault tolerant control biomechatronics intelligent control of mechanical and mechatronic systems   Advances In Dynamics, Instrumentation And Control, Volume Ii - Proceedings Of The 2006 International Conference (Cdic '06) Chun-yi Su,Subhash Rakheja,Alejandro G Lozano,2007-07-05 This second volume is a compilation of 43 articles representing the scientific and technical advances in various aspects of system dynamics instrumentation measurement techniques simulation and controls which would serve as an important resource in the field The articles represent state of the art contributions in the fields of dynamics and control of nonlinear hybrid and stochastic systems nonlinear control theory and adaptive model predictive and real time controls with applications involving fault diagnostics manufacturing systems vehicular dynamics simulator designs smart actuators etc

Electrodeposited Nanowires and their Applications Nicoleta Lupu,2010-02-01 The book offers a new and complex perspective on the fabrication and use of electrodeposited nanowires for the design of efficient and competitive applications While not pretending to be comprehensive the book is addressing not only to researchers specialized in this field but also to Ph D students postdocs and experienced technical professionals *Noise-Driven Phenomena in Hysteretic Systems* Mihai Dimian,Petru Andrei,2013-11-04 Noise Driven Phenomena in Hysteretic Systems provides a general approach to nonlinear systems with hysteresis driven by noisy inputs which leads to a unitary framework for the analysis of various stochastic aspects of hysteresis This book includes integral differential and algebraic models that are used to describe scalar and vector hysteretic nonlinearities originating from various areas of science and engineering The universality of the authors approach is also reflected by the diversity of the models used to portray the input noise from the classical Gaussian white noise to its impulsive forms often encountered in economics and biological systems and pink noise ubiquitous in multi stable electronic systems The book is accompanied by HysterSoft a robust simulation environment designed to perform complex hysteresis modeling that can be used by the reader to reproduce many of the results presented in the book as well as to research both disruptive and constructive effects of noise in hysteretic systems **Scientific and Technical Aerospace Reports** ,1994

Spin-stand Microscopy of Hard Disk Data Isaak D. Mayergoyz,Chun Tse,2010-07-07 This book provides an in depth exposition of spin stand microscopy of hard disk data which is a new technique recently developed and extensively tested by the authors of the book Spin stand microscopy is the first magnetic imaging technique where imaging is performed ex situ on a rotating disk mounted on a spin stand This technique is one of the fastest scanning based microscopy techniques It is non invasive and has nano scale resolution For these reasons it provides unique capabilities for the visualization of magnetization patterns recorded on hard disks This book is self contained and it covers in sufficient details the basic facts of magnetic data storage technology the principles and theory of spin stand microscopy its experimental implementations as well as its applications in hard disk diagnostics imaging of overwritten patterns computer forensics of hard disk files and data dependent magnetic thermal relaxations of recorded magnetization patterns This book will be a valuable reference for the magnetic data storage community magnetic microscopy professionals as well as engineers and scientists involved in computer data forensics commercial data recovery and the design of archival data storage systems Conceptual novelty of the technique and the demonstration of its wide scope of applications Detailed exposition of the principles of spin stand magnetic microscopy Comprehensive discussions of novel image reconstruction techniques Demonstration of high resolution spin stand images of hard disk data Presentation of sector by sector ex situ forensics of hard disk files Extensive studies of data dependent thermal relaxations of magnetization patterns recorded on hard disks Variational Problems in Materials Science Gianni Dal Maso,Antonio de Simone,Franco Tomarelli,2006-06-23 This volume contains the proceedings of the international workshop Variational Problems in Materials Science Coverage includes the study of BV vector fields path

functionals over Wasserstein spaces variational approaches to quasi static evolution free discontinuity problems with applications to fracture and plasticity systems with hysteresis or with interfacial energies evolution of interfaces multi scale analysis in ferromagnetism and ferroelectricity and much more   Hysteresis Phenomena in Biology Hamid Reza Noori,2013-11-27 The occurrence of hysteresis phenomena has been traditionally associated with mechanical and magnetic properties of materials However recent studies on the dynamics of biological processes suggest switch like behavior that could be described by mathematical models of hysteresis This book presents the milestones and perspectives of biological hysteresis and provides a comprehensive and application oriented introduction to this subject The target audience primarily comprises researchers but the book may also be beneficial for graduate students   **Biomechanical Principles on Force Generation and Control of Skeletal Muscle and their Applications in Robotic Exoskeleton** Yuehong Yin,2019-09-05 This book systematically introduces the bionic nature of force sensing and control the biomechanical principle on mechanism of force generation and control of skeletal muscle and related applications in robotic exoskeleton The book focuses on three main aspects muscle force generation principle and biomechanical model exoskeleton robot technology based on skeletal muscle biomechanical model and SMA based bionic skeletal muscle technology This comprehensive and in depth book presents the author s research experience and achievements of many years to readers in an effort to promote academic exchanges in this field About the Author Yuehong Yin received his B E M S and Ph D degrees from Nanjing University of Aeronautics and Astronautics Nanjing in 1990 1995 and 1997 respectively all in mechanical engineering From December 1997 to December 1999 he was a Postdoctoral Fellow with Zhejiang University Hangzhou China where he became an Associate Professor in July 1999 Since December 1999 he has been with the Robotics Institute Shanghai Jiao Tong University Shanghai China where he became a Professor and a Tenure Professor in December 2005 and January 2016 respectively His research interests include robotics force control exoskeleton robot molecular motor artificial limb robotic assembly reconfigurable assembly system and augmented reality Dr Yin is a fellow of the International Academy of Production Engineering CIRP   *Advanced Control of Piezoelectric Micro-/Nano-Positioning Systems* Qingsong Xu,Kok Kiong Tan,2015-08-28 This book explores emerging methods and algorithms that enable precise control of micro nano positioning systems The text describes three control strategies hysteresis model based feedforward control and hysteresis model free feedback control based on and free from state observation Each paradigm receives dedicated attention within a particular part of the text Readers are shown how to design validate and apply a variety of new control approaches in micromanipulation hysteresis modelling discrete time sliding mode control and model reference adaptive control Experimental results are provided throughout and build up to a detailed treatment of practical applications in the fourth part of the book The applications focus on control of piezoelectric grippers Advanced Control of Piezoelectric Micro Nano Positioning Systems will assist academic researchers and practising control and mechatronics engineers interested in

suppressing sources of nonlinearity such as hysteresis and drift when combining position and force control of precision systems with piezoelectric actuation **Magnetic Material for Motor Drive Systems** Keisuke Fujisaki,2019-11-29 This book focuses on how to use magnetic material usefully for electrical motor drive system especially electrical vehicles and power electronics The contents have been selected in such a way that engineers in other fields might find some of the ideas difficult to grasp but they can easily acquire a general or basic understanding of related concepts if they acquire even a rudimentary understanding of the selected contents The cutting edge technologies of magnetism are also explained From the fundamental theory of magnetism to material equipment and applications readers can understand the underlying concepts Therefore a new electric vehicle from the point of view of magnetic materials or a new magnetic material from the point of a view of electric vehicles can be envisioned that is magnetic material for motor drive systems based on fusion technology of an electromagnetic field Magnetic material alone does not make up an electric vehicle of course Other components such as mechanical structure material semiconductors fuel cells and electrically conductive material are important and they are difficult to achieve However magnetic material involves one of the most important key technologies and there are high expectations for its use in the future It will be the future standard for motor drive system researchers and of magneticmaterial researchers as well This book is a first step in that direction Nonlinear Dynamics, Chaos, Control, Energy Transfer and Their Applications in Engineering Sciences Jose Manoel Balthazar,Paulo Batista Gonçalves,Angelo Marcelo Tusset,Grzegorz Litak,Julijana Simonovic,2025-08-23 The book gathers review papers in emergent engineering applications and new horizons in nonlinear dynamics and originates from DYCAELS 2023 the IV Conference on Dynamics Control and Applications to Applied Engineering and Life Science which was held in Ponta Grossa Brazil on November 6 11 2023 The contributions cover diverse topics such as linear and nonlinear control vibro impact systems energy harvesting robotics bioengineering flexible structures non ideal excitation aeroelastic instabilities new materials synchronization stochastic dynamics multistable systems nonstationary dynamics and different time scales wave propagation chaotic dynamics and mechanisms and machine science

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