Chemically Driven Nonlinear Waves And Oscillations At An

Proceedings of the NATO Advanced Study Institute, Bad Windsheim, Germany, August 23-September 3, 1982

Winner of 2018 PROSE Award for MULTIVOLUME REFERENCE/SCIENCE This encyclopedia offers a comprehensive and easy reference to physical organic chemistry (POC) methodology and techniques. It puts POC, a classical and fundamental discipline of chemistry, into the context of modern and dynamic fields like biochemical processes, materials science, and molecular electronics. Covers basic terms and theories into organic reactions and mechanisms, molecular designs and syntheses, tools and experimental techniques, and applications and future directions Includes coverage of green chemistry and polymerization reactions Reviews different strategies for molecular design and synthesis of functional molecules Discusses computational methods, software packages, and more than 34 kinds of spectroscopies and techniques for studying structures and mechanisms Explores applications in areas from biology to materials science The Encyclopedia of Physical Organic Chemistry has won the 2018 PROSE Award for MULTIVOLUME REFERENCE/SCIENCE. The PROSE Awards recognize the best books, journals and digital content produced by professional and scholarly publishers. Submissions are reviewed by a panel of 18 judges that includes editors, academics, publishers and research librarians who evaluate each work for its contribution to professional and scholarly publishing. You can find out more at: proseawards.com Also available as an online edition for your library, for more details visit Wiley Online Library

Circumstellar dust, the astronomical dust that forms around a star, provides today's researchers with important clues for understanding how the Universe has evolved. This volume examines the structure, dynamics and observable consequences of the dust clouds surrounding highly evolved stars on the Giant Branch. Early chapters cover the physical and chemical basis of the formation of dust shells, the outflow of matter, and condensation processes, while offering detailed descriptions of techniques for calculating dust formation and growth. Later chapters showcase a wide range of modeling strategies, including chemical and radiative transfer and dust-induced non-linear dynamics, as well as the latest data obtained from AGB stars and other giants. This volume introduces graduate students and researchers to the theoretical description for modeling the dusty outflows from cool stars and provides a full understanding of the processes involved.

Leading scientists discuss the most recent physical and experimental results in the physics of Bose-Einstein condensate theory, the theory of nonlinear lattices (including quantum and nonlinear lattices), and nonlinear optics and photonics. Classical and quantum aspects of the dynamics of nonlinear waves are considered. The contributions focus on the Gross-Pitaevskii equation and on the quantum nonlinear Schrödinger equation. Recent experimental results on atomic condensates and hydrogen bonded systems are reviewed. Particular attention is given to nonlinear matter waves in periodic potential.

In September 2006, research leaders in the field of coastal engineering, fluid mechanics, and wave theory met at Cornell University to celebrate the 60th birthday of Prof. Philip L-F Liu. This volume is a compilation of the research papers presented at the symposium, and includes both review and new research papers. Topics such as nonlinear wave theory, tsunamis, wave-structure interaction, turbulence, and modeling of complex sediment transport are discussed in this volume. All of the contributing authors are research collaborators of Prof. Liu, and include leaders in coastal engineering such as Maarten Dingemans, Hwung-Hweng Hwung, Nobu Kobayashi, Inigo Losada, Hocine Oumeraci, Costas Synolakis, and Harry Yeh.

Interfacial Phenomena and ConvectionCRC Press

The dynamics of physical, chemical, biological, or fluid systems generally must be described by nonlinear models, whose detailed mathematical solutions are not obtainable. To understand some aspects of such dynamics, various complementary methods and viewpoints are of crucial importance. In this book the perspectives generated by analytical, topological and computational methods, and interplays between them, are developed in a variety of contexts. This book is a comprehensive introduction to this field, suited to a broad readership, and reflecting a wide range of applications. Some of the concepts considered are: topological equivalence; embeddings; dimensions and fractals; Poincaré maps and map-dynamics; empirical computational sciences vis-á-vis mathematics; Ulam's synergetics; Turing's instability and dissipative structures; chaos; dynamic entropies; Lorenz and Rossler models; predator-prey and replicator models; FPU and KAM phenomena; solitons and nonsolitons; coupled maps and pattern dynamics; cellular automata.

In 438 alphabetically-arranged essays, this work provides a useful overview of the core mathematical background for nonlinear science, as well as its applications to key problems in ecology and biological systems, chemical reaction-diffusion problems, geophysics, economics, electrical and mechanical oscillations in engineering systems, lasers and nonlinear optics, fluid mechanics and turbulence, and condensed matter physics, among others.

Interfacial phenomena driven by heat or mass transfer are widespread in science and various branches of engineering. Research in this area has become quite active in recent years, attributable in part, at least, to the entry of physicists and their sophisticated experimental techniques into the field. Until now, however, the field has lacked a readable account of the recent developments. Interfacial Phenomena and Convection remedies this problem by furnishing a self-contained monograph that examines a rich variety of phenomena in which interfaces pay a crucial role. From a unified perspective that embraces physical chemistry, fluid mechanics, and applied mathematics, the authors study recent developments related to the Marangoni effect, including patterned convection and instabilities, oscillatory/wavy phenomena, and turbulent phenomena. They examine Bénard layers subjected to transverse and longitudinal thermal gradients and phenomena involving surface tension gradients as the driving forces, including falling films, drops, and liquid bridges. It is only in the past two or three decades that researchers have performed suitable, clear-cut experiments involving interfacial phenomena, and the stage is now set for a virtual explosion of the field. Interfacial Phenomena and Convection will bring you quickly up to date on the advances realized and prepare you to both use the results and to make further advances.

Issues in Chemical Engineering and other Chemistry Specialties: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Chemical Engineering and other Chemistry Specialties. The editors have built Issues in Chemical Engineering and other Chemistry Specialties: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Chemical Engineering and other Chemistry Specialties in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Chemical Engineering and other Chemistry Specialties: 2011 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

Advances in Quantum Chemistry presents surveys of current developments in this rapidly developing field that falls between the historically established areas of mathematics, physics, chemistry, and biology. With invited reviews written by leading international researchers, each presenting new results, it provides a single vehicle for following progress in this interdisciplinary area.

Since 1972 the Schools on Nonlinear Physics in Gorky have been a meeting place for Soviet Scientists working in this field. Since 1989 the proceedings appear in English. They present a good cross section of nonlinear physics in the USSR. This third volume emerged from material presented at the 1989 School. It contains sections dealing with nonlinear problems in physics and astrophysics, quantum and solid state physics, dynamical chaos and self-organization.

This book collects recent advances in the field of nonlinear dynamics in biological systems. Focusing on medical applications as well as more fundamental questions in biochemistry, it presents recent findings in areas such as control in chemically driven reaction-diffusion systems, electrical wave propagation through heart tissue, neural network growth, chiral symmetry breaking in polymers and mechanochemical pattern formation in the cytoplasm, particularly in the context of cardiac cells. It is a compilation of works, including contributions from international scientists who attended the "2nd BCAM Workshop on Nonlinear Dynamics in Biological Systems," held at the Basque Center for Applied Mathematics, Bilbao in September 2016. Embracing diverse disciplines and using multidisciplinary approaches – including theoretical concepts, simulations and experiments – these contributions highlight the nonlinear nature of biological systems in order to be able to reproduce their complex behavior. Edited by the conference organizers and featuring results that represent recent findings and not necessarily those presented at the conference, the book appeals to applied mathematicians, biophysicists and computational biologists.

This book constitutes the revised selected papers of the 12th Italian Workshop on Advances in Artificial Life, Evolutionary Computation, WIVACE 2017, held in Venice, Italy, in September 2017.The 23 full papers presented were thoroughly reviewed and selected from 33 submissions. They cover the following topics: physical-chemical phenomena; biological systems; economy and society; complexity; optimization.

The physics and mathematics of nonlinear dynamics, chaotic and complex systems constitute some of the most fascinating developments of late twentieth century science.

It turns out that chaotic bahaviour can be understood, and even utilized, to a far greater degree than had been suspected. Surprisingly, universal constants have been discovered. The implications have changed our understanding of important phenomena in physics, biology, chemistry, economics, medicine and numerous other fields of human endeavor. In this book, two dozen scientists and mathematicians who were deeply involved in the "nonlinear revolution" cover most of the basic aspects of the field.
Just a few decades ago, chemical oscillations were thought to be exotic reactions of only theoretical interest. Now known to govern an array of physical and biological processes, including the regulation of the heart, these oscillations are being studied by a diverse group across the sciences. This book is the first introduction to nonlinear chemical dynamics written specifically for chemists. It covers oscillating reactions, chaos, and chemical pattern formation, and includes numerous practical suggestions on reactor design, data analysis, and computer simulations. Assuming only an undergraduate knowledge of chemistry, the book is an ideal starting point for research in the field. The book begins with a brief history of nonlinear chemical dynamics and a review of the basic mathematics and chemistry. The authors then provide an extensive overview of nonlinear dynamics, starting with the flow reactor and moving on to a detailed discussion of chemical oscillators. Throughout the authors emphasize the chemical mechanistic basis for self-organization. The overview is followed by a series of chapters on more advanced topics, including complex oscillations, biological systems, polymers, interactions between fields and waves, and Turing patterns. Underscoring the hands-on nature of the material, the book concludes with a series of classroom-tested demonstrations and experiments appropriate for an undergraduate laboratory.
Patterns and their formations appear throughout nature, and are studied to analyze different problems in science and make predictions across a wide range of disciplines including biology, physics, mathematics, chemistry, material science, and nanoscience. With the emergence of nanoscience and the ability for researchers and scientists to study living systems at the biological level, pattern formation research has become even more essential. This book is an accessible first of its kind guide for scientists, researchers, engineers, and students who require a general introduction to this research area, in order to gain a deeper analytical understanding of the most recent observations and experiments by top researchers in physics. Pattern Formations describes the most up-to-date status of this developing field and analyzes the physical phenomena behind a wide range of interesting topics commonly known in the scientific community. The study of pattern formations as a research field will continue to grow as scientists expand their understanding of naturally occurring patterns and mimic nature to help solve complex problems. This research area is becoming more highly recognized due to its contributions to signal processing, computer analysis, image processing, complex networks development, advancements in optics and photonics, crystallography, metallurgy, drug delivery (chemotherapy) and the further understanding of gene regulation. The only introductory reference book which places special emphasis on the theoretical analyses of experiments in this rapidly growing field of pattern formation A wide range of physical applications make this book highly interdisciplinary Explanations of observations and experiments deepen the readers understanding of this developing research field

Includes abstracts of Kagaku k?gaku, v. 31-

In the decades the of the formation of structures past subject spontaneous in far from has into a branch of - systems equilibrium major physics grown search with ties to It has become evident that strong neighboring disciplines. a diverse of can be understood within a common mat- phenomena range matical framework which has been called nonlinear of continuous dynamics This name the close to the field of nonlinear systems. emphasizes relationship of with few of freedom which has evolved into a dynamics systems degrees mature in the recent features mathematically subject past. Many dynamical of continuous be described reduction few can a to a systems actually through of freedom and of the latter of continue to degrees properties type systems of continuous the inspire study systems. The of this book is to demonstrate the numerous goal through examples that exist for the of nonlinear the opportunities study phenomena through tools of mathematical and use of common analyses dynamical interpretations. Instead of overview of the a providing comprehensive rapidly evolving field, the contributors to this book are to communicate to a wide scientific trying audience the of what have learnt about the formation of essence they spon- neous structures in continuous and about the dissipative systems competition between order and chaos that characterizes these It is that systems. hoped the book will be even to those scientists whose not helpful are disciplines the authors.

Nonlinear dynamics of complex processes is an active research field with large numbers of publications in basic research, and broad applications from diverse fields of science. Nonlinear dynamics as manifested by deterministic and stochastic evolution models of complex behavior has entered statistical physics, physical chemistry, biophysics, geophysics, astrophysics, theoretical ecology, semiconductor physics and -optics, etc. This field of research has induced a new terminology in science connected with new questions, problems, solutions and methods. New scenarios have emerged for spatio-temporal structures in dynamical systems far from equilibrium. Their analysis and possible control are intriguing and challenging aspects of the current research.The duality of fundamental and applied research is a focal point of its main attractivity and fascination. Basic topics and foundations are always linked to concrete and precise examples. Models and measurements of complex nonlinear processes evoke and provoke new fundamental questions that diversify and broaden the mathematical concepts and tools. In return, new mathematical approaches to modeling and analysis enlarge the scope and efficiency of applied research.

This book constitutes the revised selected papers of the 10th Italian Workshop on Advances in Artificial Life, Evolutionary Computation and Systems Chemistry, WIVACE 2015, held at Bari, Italy, in September 2015. The 18 papers presented have been thoroughly reviewed and selected from 45 submissions. They cover the following topics: evolutionary computation, bioinspired algorithms, genetic algorithms, bioinformatics and computational biology, modeling and simulation of artificial and biological systems, complex systems, synthetic and systems biology, systems chemistry.

The present book introduces and develops mathematical techniques for the treatment of nonlinear waves and singular perturbation methods at a level that is suitable for graduate students, researchers and faculty throughout the natural sciences and engineering. The practice of implementing these techniques and their value are largely realized by showing their

application to problems of nonlinear wave phenomena in electronic transport in solid state materials, especially bulk semiconductors and semiconductor superlattices. The authors are recognized leaders in this field, with more than 30 combined years of contributions.
Nonlinear dynamics of complex processes is an active research field with large numbers of publications in basic research, and broad applications from diverse fields of science. Nonlinear dynamics as manifested by deterministic and stochastic evolution models of complex behavior has entered statistical physics, physical chemistry, biophysics, geophysics, astrophysics, theoretical ecology, semiconductor physics and -optics, etc. This field of research has induced a new terminology in science connected with new questions, problems, solutions and methods. New scenarios have emerged for spatio-temporal structures in dynamical systems far from equilibrium. Their analysis and possible control are intriguing and challenging aspects of the current research. The duality of fundamental and applied research is a focal point of its main attractivity and fascination. Basic topics and foundations are always linked to concrete and precise examples. Models and measurements of complex nonlinear processes evoke and provoke new fundamental questions that diversify and broaden the mathematical concepts and tools. In return, new mathematical approaches to modeling and analysis enlarge the scope and efficiency of applied research.
The renewed interest in safety issues for large scale industrial devices and in high speed combustion has driven recent intense efforts to gain a deeper theoretical understanding of detonation wave dynamics. Linear stability analyses, weakly nonlinear bifurcation calculations as well as full scale multi-dimensional direct numerical simulations have been pursued for a standard model problem based on the reactive Euler equations for an ideal gas with constant specific heat capacities and simplified chemical reaction models. Most of these studies are concerned with overdriven detonations. This is true despite the fact that the majority of all detonations observed in nature are running at speeds close to the Chapman-Jouguet (CJ) limit value. By focusing on overdriven waves one removes an array of difficulties from the analysis that is associated with the sonic flow conditions in the wake of a CJ-detonation. In particular, the proper formulation of downstream boundary conditions in the CJ-case is a yet unsolved analytical problem. A proper treatment of perturbations in the back of a Chapman-Jouguet detonation has to account for two distinct weakly nonlinear effects in the forward acoustic wave component. The first is a nonlinear interactionof highly temperature sensitive chemistry with the forward acoustic wave component in a transonic boundary layer near the end of the reaction zone. The second is a cumulative three-wave-resonance in the sense of Majda et al. which is active in the near-sonic burnt gas flow and which is essentially independent of the details of the chemical model. In this work, we consider detonations in mixtures with moderate state sensitivity of the chemical reactions. Then, the acoustic perturbations do not influence the chemistry at the order considered and we may concentrate on the second effect; the three-wave resonance.
Proceedings of a NATO ARW held in Leeds, UK, September 11-15, 1989
Although the mathematical theory of nonlinear waves and solitons has made great progress, its applications to concrete physical problems are rather poor, especially when compared with the classical theory of linear dispersive waves and nonlinear fluid motion. The Whitham method, which describes the combining action of the dispersive and nonlinear effects as modulations of periodic waves, is not widely used by applied mathematicians and physicists, though it provides a direct and natural way to treat various problems in nonlinear wave theory. Therefore it is topical to describe recent developments of the Whitham theory in a clear and simple form suitable for applications in various branches of physics.This book develops the techniques of the theory of nonlinear periodic waves at elementary level and in great pedagogical detail. It provides an introduction to a Whitham's theory of modulation in a form suitable for applications. The exposition is based on a thorough analysis of representative

examples taken from fluid mechanics, nonlinear optics and plasma physics rather than on the formulation and study of a mathematical theory. Much attention is paid to physical motivations of the mathematical methods developed in the book. The main applications considered include the theory of collisionless shock waves in dispersive systems and the nonlinear theory of soliton formation in modulationally unstable systems. Exercises are provided to amplify the discussion of important topics such as singular perturbation theory, Riemann invariants, the finite gap integration method, and Whitham equations and their solutions.

The dynamics of physical, chemical, biological or fluid systems generally must be described by nonlinear models, whose detailed mathematical solutions are not obtainable. To understand some aspects of such dynamics, various complementary methods and viewpoints are of crucial importance. The presentation and style is intended to stimulate the reader's imagination to apply these methods to a host of problems and situations.

The active field of multi-phase flow has undergone fundamental changes in the last decade. Many salient complex interfacial dynamics of such flows are now understood at a basic level with precise mathematical and quantitative characterization. This is quite a departure from the traditional empirical approach. At an IUTAM Symposium at Notre Dame, in 1999, some of the leading researchers in the field gathered to review the progress thus far and to contemplate future directions. Their reports are summarized in this Proceedings. Topics covered include solitary wave dynamics on viscous film flows, sheet formation and drop entrainment in stratified flow, wetting and dewetting dynamics, self-similar drop formation dynamics, waves in bubbly and suspension flow, and bubble dynamics. It is a unique and essential reference for applied mathematicians, physicists, research engineers, and graduate students to keep abreast of the latest theoretical and numerical developments that promise to transform multi-phase flow research.

This volume of Advances in Chemical Physics is dedicated, by the contributors, to Moshe Shapiro, formerly Canada Research Chair in Quantum Control in the Department of Chemistry at the University of British Columbia and Jacques Mimran Professor of Chemical Physics at the Weizmann Institute, who passed away on December 3, 2013. It focuses primarily on the interaction of light with molecules, one of Moshe’s longstanding scientific loves. However, the wide range of topics covered in this volume constitutes but a small part of Moshe’s vast range of scientific interests, which are well documented in over 300 research publications and two books.

This book addresses the peculiarities of nonlinear wave propagation in waveguides and explains how the stratification depends on the waveguide and confinement. An example of this is an optical fibre that does not allow light to pass through a density jump. The book also discusses propagation in the nonlinear regime, which is characterized by a specific waveform and amplitude, to demonstrate so-called solitonic behaviour. In this case, a wave may be strongly localized, and propagates with a weak change in shape. In the waveguide case there are additional contributions of dispersion originating from boundary or asymptotic conditions. Offering concrete guidance on solving application problems, this essentially (more than twice) expanded second edition includes various aspects of guided propagation of nonlinear waves as well as new topics like solitonic behaviour of one-mode and multi-mode excitation and propagation and plasma waveguides, propagation peculiarities of electromagnetic waves in metamaterials, new types of dispersion, dissipation, electromagnetic waveguides, planetary waves and plasma waves interaction.The key feature of the solitonic behaviour is based on Coupled KdV and Coupled NS systems. The systems are derived in this book and solved numerically with the proof of stability and convergence. The domain wall dynamics of ferromagnetic microwaveguides and Bloch waves in nano-waveguides are also included with some problems of magnetic momentum and charge transport.

This volume is concerned with the theoretical description of patterns and instabilities and their relevance to physics, chemistry, and biology. More specifically, the theme of the work is the theory of nonlinear physical systems with emphasis on the mechanisms leading to the appearance of regular patterns of ordered behavior and chaotic patterns of stochastic behavior. The aim is to present basic concepts and current problems from a variety of points of view. In spite of the emphasis on concepts, some effort has been made to bring together experimental observations and theoretical mechanisms to provide a basic understanding of the aspects of the behavior of nonlinear systems which have a measure of generality. Chaos theory has become a real challenge to physicists with very different interests and also in many other disciplines, of which astronomy, chemistry, medicine, meteorology, economics, and social theory are already embraced at the time of writing. The study of chaos-related phenomena has a truly interdisciplinary charac ter and makes use of important concepts and methods from other disciplines. As one important example, for the description of chaotic structures the branch of mathematics called fractal geometry (associated particularly with the name of Mandelbrot) has proved invaluable. For the discussion of the richness of ordered structures which appear, one relies on the theory of pattern recognition. It is relevant to mention that, to date, computer studies have greatly aided the analysis of theoretical models describing chaos.