

Reading free Information and selforganization a macroscopic approach to complex systems Copy

complex systems are ubiquitous and practically all branches of science ranging from physics through chemistry and biology to economics and sociology have to deal with them in this book we wish to present concepts and methods for dealing with complex systems from a unifying point of view therefore it may be of interest to graduate students professors and research workers who are concerned with theoretical work in the above mentioned fields the basic idea for our unified approach stems from that of synergetics in order to find unifying principles we shall focus our attention on those situations where a complex system changes its macroscopic behavior qualitatively or in other words where it changes its macroscopic spatial temporal or functional structure until now the theory of synergetics has usually begun with a microscopic or mesoscopic description of a complex system in this book we present an approach which starts out from macroscopic data in particular we shall treat systems that acquire their new structure without specific interference from the outside i.e. systems which are self organizing the vehicle we shall use is information since this word has several quite different meanings all of which are important for our purpose we shall discuss its various aspects these range from shannon information from which all semantics has been exorcised to the effects of information on receivers and the self creation of meaning the widespread interest this book has found among professors scientists and students working in a variety of fields has made a new edition necessary i have used this opportunity to add three new chapters on recent developments one of the most fascinating fields of modern science is cognitive science which has become a meeting place of many disciplines ranging from mathematics over physics and computer science to psychology here one of the important links between these fields is the concept of information which however appears in various disguises be it as shannon information or as semantic information or as something still different so far meaning seemed to be exorcised from shannon information whereas meaning plays a central role in semantic or as it is sometimes called pragmatic information in the new chapter 13 it will be shown however that there is an important interplay between shannon and semantic information and that in particular the latter plays a decisive role in the fixation of shannon information and in cognitive processes allows a drastic reduction of that information a second equally fascinating and rapidly developing field for mathematicians computer scientists and physicists is quantum information and quantum computation the inclusion of these topics is a must for any modern treatise dealing with information it becomes more and more evident that the abstract concept of information is inseparably tied up with its realizations in the physical world membranes dissipative structures and evolution.

edited by g nicolis r lefever focuses on the problem of the emergence maintenance of biological order at successively higher levels of complexity covers the spatiotemporal organization of simple biochemical networks the formation of pluricellular or macromolecular assemblies the evolution of these structures and the functions of specific biological structures volume 29 in advances in chemical physics series i prigogine stuart a rice editors 1975 theory and applications of molecular paramagnetism edited by e a boudreaux l n mulay comprehensively treats the basic theory of paramagnetic phenomena from both the classical and mechanical vantages it examines the magnetic behavior of lanthanide and actinide elements as well as traditional transition metals for each class of compounds appropriate details of descriptive and mathematical theory are given before their applications 1976 theory and applications of molecular diamagnetism edited by l n mulay e a boudreaux an invaluable reference for solving chemical problems in magnetics magnetochemistry and related areas where magnetic data are important such as solid state physics and optical spectroscopy 1976 self organization of matter is observed in every context and on all scales from the nanoscale of quantum fields and subatomic particles to the macroscale of galaxy superclusters this book analyzes the wide range of patterns of organization present in nature highlighting their similarities rather than their differences this unconventional approach results in an illuminating read which should be part of any physics student s background the contributions to this volume attempt to apply different aspects of ilya prigogine s nobel prize winning work on dissipative structures to nonchemical systems as a way of linking the natural and social sciences they address both the mathematical methods for description of pattern and form as they evolve in biological systems and the mechanisms of the evolution of social systems containing many variables responding to subjective qualitative stimuli the mathematical modeling of human systems especially those far from thermodynamic equilibrium must involve both chance and determinism aspects both quantitative and qualitative such systems and the physical states of matter which they resemble are referred to as self organized or dissipative structures in order to emphasize their dependence on the flows of matter and energy to and from their surroundings some such systems evolve along lines of inevitable change but there occur instances of choice or bifurcation when chance is an important factor in the qualitative modification of structure such systems suggest that evolution is not a system moving toward equilibrium but instead is one which most aptly evokes the patterns of the living world the volume is truly interdisciplinary and should appeal to researchers in both the physical and social sciences based on a workshop on dissipative structures held in 1978 at the university of texas contributors include prigogine a g wilson andre de palma d kahn j l deneubourgh j w stucki richard n adams and erick jantsch the papers presented include allen self organization in the urban system robert herman remarks on traffic flow theories and the characterization of traffic in cities w h zurek and schieve nucleation paradigm survival threshold in population dynamics de palma et al boolean equations with temporal delays nicholas georgescu roegin energy analysis and technology assessment magoroh maruyama four different causal meta types in biological and social sciences and jantsch from self reference to self

transcendence the evolution of self organization dynamics this book provides an outline of theoretical concepts and their experimental verification in studies of self organization phenomena in chemical systems as they emerged in the mid 20th century and have evolved since presenting essays on selected topics it was prepared by authors who have made profound contributions to the field traditionally physical chemistry has been concerned with interactions between atoms and molecules that produce a variety of equilibrium structures or the dead order in a stationary state but biological cells exhibit a different living kind of order prompting e schrödinger to pose his famous question what is life in 1943 through an unprecedented theoretical and experimental development it was later revealed that biological self organization phenomena are in complete agreement with the laws of physics once they are applied to a special class of thermodynamically open systems and non equilibrium states this knowledge has in turn led to the design and synthesis of simple inorganic systems capable of self organization effects these artificial living organisms are able to operate on macroscopic to microscopic scales even down to single molecule machines in the future such research could provide a basis for a technological breakthrough comparable in its impact with the invention of lasers and semiconductors its results can be used to control natural chemical processes and to design artificial complex chemical processes with various functionalities the book offers an extensive discussion of the history of research on complex chemical systems and its future prospects according to its definition synergetics is concerned with systems that produce macroscopic spatial temporal or functional structures autowaves are a specific yet very important case of spatio temporal structures the term autowave was coined in the soviet union in analogy to the term auto oscillator this is perhaps too literal translation of the russian word avto ostsillyatory self oscillator which in its proper translation means self sustained oscillator these are oscillators e g clocks whose internal energy dissipation is compensated by a more or less continuous power input similarly the term autowaves denotes propagation effects including waves in active media which provide spatially distributed energy sources and thus may compensate dissipation an example which is now famous is represented by spiral or concentric waves in a chemically active medium undergoing the belousov zhabotinsky reaction this book provides the reader with numerous further examples from physics chemistry and biology e g autowaves of the heart while the belousov zhabotinsky reaction is now widely known a number of very important results obtained in the soviet union are perhaps less well known i am particularly glad that this book may help to make readers outside the soviet union acquainted with these important experimental and theoretical findings which are presented in a way which elucidates the common principles underlying this kind of propagation effects professor v this text on the interdisciplinary field of synergetics will be of interest to students and scientists in physics chemistry mathematics biology electrical civil and mechanical engineering and other fields it continues the outline of basic concepts and methods presented in my book synergetics an introduction which has by now appeared in english russian japanese chinese and german i have written the present book in such a way that most of it can be read independently of my previous book

though occasionally some knowledge of that book might be useful but why do these books address such a wide audience why are instabilities such a common feature and what do devices and self organizing systems have in common self organizing systems acquire their structures or functions without specific interference from outside the differentiation of cells in biology and the process of evolution are both examples of self organization devices such as the electronic oscillators used in radio transmitters on the other hand are man made but we often forget that in many cases devices function by means of processes which are also based on self organization in an electronic oscillator the motion of electrons becomes coherent without any coherent driving force from the outside the device is constructed in such a way as to permit specific collective motions of the electrons quite evidently the dividing line between self organizing systems and man made devices is not at all rigid this work is about creating desired artificial self organization in multi agent and multi robotic systems it is demonstrated that emergent phenomena can artificially be designed when to treat collective systems on a new structural level examples of desired self organization implemented in manufacturing environment and in a large scale swarm of micro robots allow deeper understanding of collective artificial intelligence the work wins the infos faculty award as the best dissertation of 2008 this monograph offers an interdisciplinary approach to the analysis of geological systems which become spatially organized through the mediation of chemical processes the treatment is based on a mathematical approach the intended readership includes researchers and advanced undergraduate and graduate students in all branches of geology as well as scientists and mathematicians concerned with nonlinear dynamics numerical analysis self organization nonlinear waves and dynamics and phase transition phenomena the work could also serve as a basis for a special topics course in mathematics chemistry or physics integrating nano and microphysical effects this book s team of expert authors offers new insights into self organized structure formation in nanomaterials a major question addressed in this book is the role of spatial and temporal order in particular you ll discover how to apply concepts developed on macroscopic and microscopic scales to structure formation occurring on nanoscales a key focus of interest at the frontiers of science self organization and clinical psychology signals the advent of a new paradigm in psychology physicists neuroscientists and individual and group therapists have joined forces to elucidate the new and exciting advances that are being achieved by applying the concepts of non linear dynamics and self organization to the human nervous system and the mind

search for equilibrium is replaced by the search for the dynamics of processes 3 the classical system environment model according to which the adaptation of a system to its environment is controlled externally and according to which the adaptation of the system occurs in the course of a learning process is replaced by a model of systemic closure this closure is operational in so far as the effects produced by the system are the causes for the maintenance of systemic organization if there is sufficient complexity the systems perform internal self observation and exert self control cognition as understood by Maturana as self perception and self limitation e.g. that of a cell vis a vis its environment 22 but any information a system provides on its environment is a system internal construct the reference to the other is merely a special case of self reference the social sciences frequently have suffered from the careless way in which scientific ideas and models have been transferred this book tells the story of how inert matter can acquire self organizing and other properties ascribed to life the author's multidisciplinary approach does not require knowledge of chemistry physics or biology on the part of the reader part i covers the properties of matter and evolutionary criteria part ii presents an introduction to the necessary chemical concepts part iii explains the self organization of biosystems and the development of organisms this is the second volume with the title the paradigm of self organization and will serve to complement the previous one by developing and extending the discussion of self organizing systems it contains contributions from three areas general questions questions from physics and chemistry and questions from cognition and biology which provide elucidation to the subject of self organization the diversity of topics in this volume show the pervasiveness of the theme of self organization in science and will thus be of interest to all scientists who are concerned with its development lasers and synergetics written to honour Hermann Haken on his 60th birthday is concerned with the two main areas of research to which Prof. Haken has made fundamental contributions in fact the two areas are interrelated since the development of the interdisciplinary science synergetics has been closely connected with the emergence of laser theory synergetics deals with complex systems that possess the fundamental property of spontaneous selforganization of their macroscopic behaviour the book summarizes basic ideas important concepts and principles used to describe selforganizing systems from a unified viewpoint special attention is paid to lasers nonlinear optics and to coherence phenomena in other physical biological and sociological systems some surveys of historical developments are presented but most space is devoted to the publication of recent results and the description of current research work self organization and adaptation are concepts stemming from the nature and have been adopted in systems theory this book provides in depth thoughts about several methodologies and technologies for the area it represents the future generation of it systems comprised of communication infrastructures and computing applications self organization of matter is observed in every context and on all scales from the nanoscale of quantum fields and subatomic particles to the macroscale of galaxy superclusters this book analyzes the wide range of patterns of organization present in nature highlighting their similarities rather than their differences this unconventional

approach results in an illuminating read which should be part of any physics student's background the book with its emphasis on the interaction of microstructures with the entire biosphere ecosystems etc and on how micro and macrocosmos mutually create the conditions for their further evolution provides a comprehensive framework for a deeper understanding of human creativity in a time of transition for centuries humankind has believed that the world with all its form and structure was created by supernatural forces in recent decades science has shaken these beliefs with the discovery of the exciting possibility of a self created and self creating world of self organization synergetics endeavours to reveal the intimate mechanisms of self organization the transitions from chaos to order the nature of self organization the various approaches to it and certain philosophical inferences are outlined synergetics thus represents a remarkable confluence of many strands of thought and has become a paradigm in modern culture this book exposes the reader to striking new vistas in physics and mathematics chemistry and biology social sciences and philosophy all interlocked around the concept of self organization in the last years adaptive networks have been discovered simultaneously in different fields as a universal framework for the study of self organization phenomena understanding the mechanisms behind these phenomena is hoped to bring forward not only empirical disciplines such as biology sociology ecology and economy but also engineering disciplines seeking to employ controlled emergence in future technologies this volume presents new analytical approaches which combine tools from dynamical systems theory and statistical physics with tools from graph theory to address the principles behind adaptive self organization it is the first class of approaches that is applicable to continuous networks the volume discusses the mechanisms behind three emergent phenomena that are prominently discussed in the context of biological and social sciences synchronization spontaneous diversification and self organized criticality self organization in continuous adaptive networks contains extended research papers it can serve as both a review of recent results on adaptive self organization as well as a tutorial of new analytical methods self organization in continuous adaptive networks is ideal for academic staff and master research students in complexity and network sciences in engineering physics and maths first to review nanoscale self assembly employing such a wide variety of methods covers a wide variety physical chemical and biological systems phenomena and applications first overviews of nanotube biotechnology and bimetallic nanoparticles this invaluable book is the first of its kind on selforganizology the science of self organization it covers a wide range of topics such as the theory principle and methodology of selforganizology agent based modelling intelligence basis ant colony optimization fish particle swarm optimization cellular automata spatial diffusion models evolutionary algorithms self adaptation and control systems self organizing neural networks catastrophe theory and methods and self organization of biological communities etc readers will have an in depth and comprehensive understanding of selforganizology with detailed background information provided for those who wish to delve deeper into the subject and explore research literature this book is a valuable reference for research scientists university teachers graduate students and high level

undergraduates in the areas of computational science artificial intelligence applied mathematics engineering science social science and life sciences contents organization and organizational theoryselforganizology the science of self organizationagent based modelingintelligence principlescatastrophe theory and methodsself adaptation and control systemscellular automata and spatial diffusion modelsartificial neural networksant colony optimizationfish and particle swarm optimizationsynergy coevolution and evolutionary algorithmssynergy correlation analysiscommunity succession and assemblymathematical foundations readership research scientists university teachers graduate students and high level undergraduates in the areas of computational science artificial intelligence applied mathematics engineering science social science and life sciences key features this book is the first monograph on selforganizology in the world with no competing titles the author is a prominent scientist who is the editor in chief of six international journals including selforganizologykeywords selforganizology self organization agent based modeling algorithms computational intelligence ant colony optimization evolutionary algorithms cellular automata particle swarm optimization catastrophe theory these proceedings contain invited lectures presented at the third international conference on irreversible processes and dissipative structures in kiihlungsborn german democratic republic in march 1985 these conferences the first of which was held in rostock in 1977 and the second in berlin in 1982 are devoted to the study of irreversible processes far from thermal equilibrium and to the phenomena of selforganization the meeting in kiihlungsborn brought together some 160 mathematicians physicists chemists and biologists from 10 countries who are all interested in the inter disciplinary field of synergetics the main topics of the conference were basic concepts of selforganization and evolution such as entropy instabilities nucleation dissipative structures chaos and turbulence the contributions cover methods from thermodynamics the theory of dynamic systems stochastic and statistic theory the method of green s functions the fluctuation dissipation theorem etc several problems are studied in more detail e g the kinetics of nucleation especially in finite systems the dynamics of interfaces reaction diffusion systems chemical and biochemical pattern formation and information processing further several contributions are devoted to the development of the concepts of chaos and turbulence the editors hope that the contributions collected in this volume will provide some new information about the field of selforganization which is in full development now this thoroughly updated version of the german authoritative work on self organization has been completely rewritten by internationally renowned experts and experienced book authors to also include a review of more recent literature it retains the original enthusiasm and fascination surrounding thermodynamic systems far from equilibrium synergetics and the origin of life representing an easily readable book and tutorial on this exciting field the book is unique in covering in detail the experimental and theoretical fundamentals of self organizing systems as well as such selected features as random processes structural networks and multistable systems while focusing on the physical and theoretical modeling of natural selection and evolution processes the authors take examples from

physics chemistry biology and social systems and include results hitherto unpublished in english the result is a one stop resource relevant for students and scientists in physics or related interdisciplinary fields including mathematical physics biophysics information science and nanotechnology during the past twenty years a broad spectrum of theories and methods have been developed in physics chemistry and molecular biology to explain structure formation in complex systems these methods have been applied to many different fields such as economics sociology and town planning and this book reflects the interdisciplinary nature of complexity and self organisation the main focus is on the emergence of collective phenomena from individual or microscopic interactions presents a wide ranging overview from fundamental aspects of the evolution of complexity to applications in biology ecology sociology economics and urban structure formation self organization is a generic term describing the capacity of a system to change its own structure by itself while interacting with the environment in this sense self organization is not environment determined or environment adaptive but is self determined and self adaptive the concept of self organization was born in the 1960s and attempts were made to establish a theory based on the logic of a system and its control in contrast the 1980s introduced a view based on the logic of creative individuals and on fluctuations antithetical differences exist between the two the former regards the system of aggregated individuals as the object of consideration where self organization is the sum of the practices of a system led by control or self control in particular the latter focuses on the practices of individuals deviating from the logic of a system making the existing system fluctuate and transforming its structure this volume attempts to integrate these viewpoints through inquiry into the structure of the self and through self reflexion a new horizon thus opens for the synthesis of planning control action theory and spontaneous performative action theory applied natural science environmental issues and global perspectives provides the reader with a complete insight into the natural scientific pattern of the world covering the most important historical stages of the development of various areas of science methods of natural scientific research general scientific and philosophical concepts and the fundamental laws of nature the book analyzes the main scientific trends and developments of modern natural science and also discusses important aspects of environmental protection topics include the problem of the two cultures the mathematization of natural sciences and the informatization of society the non linear nature of the processes occurring in nature and society application of the second law of thermodynamics to describe the development of biological systems global problems of the biosphere theory and practice of stable organic paramagnetic materials polymers and the natural environment key features include an interdisciplinary approach in considering scientific and technical problems a discussion of general scientific trends in modern natural science including globalization challenges in nature and society the organic chemistry of stable paramagnetic materials the fundamentals of the environmental chemistry of polymeric materials etc a justification of applying classical non equilibrium thermodynamics to studying the behavior of open including biological systems of particular importance in the book is the discussion of some

problems associated with the place of man in the biosphere issues of the globalization of science and technology new ideas about the universe and the concept of universal evolutionism at the same time the book discusses more specific issues related to solving major global and regional environmental problems particularities of organic paramagnetic materials the influence of polymers on the man and environment etc all this leads to the fundamental conclusion of the unity of animate and inanimate nature as well as improvement of the process of cognition of the real world which consists in objective and natural changing of world views the book is intended for professors teachers and students of classical and technological universities who are interested in the development of the foundations of modern natural sciences as well as for professionals working in the field of chemical physics and applied ecology is it possible to guide the process of self organisation towards specific patterns and outcomes wouldn't this be self contradictory after all a self organising process assumes a transition into a more organised form or towards a more structured functionality in the absence of centralised control then how can we place the guiding elements so that they do not override rich choices potentially discoverable by an uncontrolled process this book presents different approaches to resolving this paradox in doing so the presented studies address a broad range of phenomena ranging from autopoietic systems to morphological computation and from small world networks to information cascades in swarms a large variety of methods is employed from spontaneous symmetry breaking to information dynamics to evolutionary algorithms creating a rich spectrum reflecting this emerging field demonstrating several foundational theories and frameworks as well as innovative practical implementations guided self organisation inception will be an invaluable tool for advanced students and researchers in a multiplicity of fields across computer science physics and biology including information theory robotics dynamical systems graph theory artificial life multi agent systems theory of computation and machine learning reality is not as is but as interpreted humans are caged not freed by the logic of own thought that conceals everyone behind own egocentric self emotions and intuition are created by magic golden irrational that is ratio and balance the irrational separates number from magnitude while this magnitude cannot be found the logical rational thought as the sole expression of our civilization starts from somewhere follows a logical path and ends with a conclusion because all ideas have an end in themselves how close to this conclusion or end are we is the rational world only a distorted projection of the irrational world does civilization make sense only for a linear mind what are the principles that keep our society together this question is even more difficult to answer than the long standing question what are the forces that keep our world together however the social challenges of humanity in the 21st century ranging from the financial crises to the impacts of globalization require us to make fast progress in our understanding of how society works and how our future can be managed in a resilient and sustainable way this book can present only a few very first steps towards this ambitious goal however based on simple models of social interactions one can already gain some surprising insights into the social macro level outcomes and dynamics that is implied by individual micro level interactions

depending on the nature of these interactions they may imply the spontaneous formation of social conventions or the birth of social cooperation but also their sudden breakdown this can end in deadly crowd disasters or tragedies of the commons such as financial crises or environmental destruction furthermore we demonstrate that classical modeling approaches such as representative agent models do not provide a sufficient understanding of the self organization in social systems resulting from individual interactions the consideration of randomness spatial or network interdependencies and nonlinear feedback effects turns out to be crucial to get fundamental insights into how social patterns and dynamics emerge given the explanation of sometimes counter intuitive phenomena resulting from these features and their combination our evolutionary modeling approach appears to be powerful and insightful the chapters of this book range from a discussion of the modeling strategy for socio economic systems over experimental issues up the right way of doing agent based modeling we furthermore discuss applications ranging from pedestrian and crowd dynamics over opinion formation coordination and cooperation up to conflict and also address the response to information issues of systemic risks in society and economics and new approaches to manage complexity in socio economic systems selected parts of this book had been previously published in peer reviewed journals intriguing phenomena of the appearance of order from chaos under light pumping are investigated in the monograph this light driven self organisation takes place due to the fact that each new excitation is generated recombines in the field produced by already existing excitations therefore probability of the generation recombination at some point and state depends on the spatial distribution and states of the available excitations as the result spatial and orientational ordering of the excitations raise in random media electrons and holes in amorphous semiconductors are separated in space and despite the coulomb repulsion form electron and hole domains due to particle segregation the ordered state is long lived up to astronomical long time orientational ordering breaks the initial inversional symmetry of a material and may be tested by the appearance of second harmonic signal as it is observed in ge doped silica fibres self organised system reveals positive feedback in response to static electric field oriented excitations amplifies initial field and result in strong phase matched electric field provided effective second harmonic generation light acts like optical piston it fulfils sesyphian labour pushing electrons in opposite to electric force direction current against voltage this allows to perform all optical poling of glasses as a signature of self organised system flicker noise of optical parameters with universal spectrum $1/f$ is observed this volume presents the new objectives of physics on self organizing systems composed of multi components in order to create a new field and establish universal comprehension in physics the book covers broad topics such as the thermodynamic time asymmetry in both transient and stationary nonequilibrium states the seriousness of auxiliary conditions in physicochemical processes and biological systems the quantum classical and micro macro interfaces which are familiar in mesoscopic physics the purification scheme of quantum entanglement topics on gamma ray bursts and the walking mechanism of single

Information and Self-Organization

2013-11-11

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Information and Self-Organization

2006-06-26

the widespread interest this book has found among professors scientists and students working in a variety of fields has made a new edition necessary i have used this opportunity to add three new chapters on recent developments one of the most fascinating fields of modern science is cognitive science which has become a meeting place of many disciplines ranging from mathematics over physics and computer science to psychology here one of the important links between these fields is the concept of information which however appears in various disguises be it as shannon information or as semantic information or as something still different so far meaning seemed to be exorcised from shannon information whereas meaning plays a central role in semantic or as it is sometimes called pragmatic information in the new chapter 13 it will be shown however that there is an important interplay between shannon and semantic information and that in particular the latter plays a decisive role in the fixation of shannon information and in cognitive processes allows a drastic reduction of that information a second equally fascinating and rapidly developing field for mathematicians computer scientists and physicists is quantum information and quantum computation the inclusion of these topics is a must for any modern treatise

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Self-Organization in Nonequilibrium Systems

1977-05-13

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Information and Self-organization

1988

self organization of matter is observed in every context and on all scales from the nanoscale of quantum fields and subatomic particles to the macroscale of galaxy superclusters this book analyzes the wide range of patterns of organization present in nature highlighting their similarities rather than their differences this unconventional approach results in an illuminating read which should be part of any physics student s background

Self-organization of Matter

2020-07-06

the contributions to this volume attempt to apply different aspects of ilya prigogine s nobel prize winning work on dissipative structures to nonchemical systems as a way of linking the natural and social sciences they address both the mathematical methods for description of pattern and form as they evolve in biological systems and

the mechanisms of the evolution of social systems containing many variables responding to subjective qualitative stimuli the mathematical modeling of human systems especially those far from thermodynamic equilibrium must involve both chance and determinism aspects both quantitative and qualitative such systems and the physical states of matter which they resemble are referred to as self organized or dissipative structures in order to emphasize their dependence on the flows of matter and energy to and from their surroundings some such systems evolve along lines of inevitable change but there occur instances of choice or bifurcation when chance is an important factor in the qualitative modification of structure such systems suggest that evolution is not a system moving toward equilibrium but instead is one which most aptly evokes the patterns of the living world the volume is truly interdisciplinary and should appeal to researchers in both the physical and social sciences based on a workshop on dissipative structures held in 1978 at the university of texas contributors include prigogine a g wilson andre de palma d kahn j l deneubourgh j w stucki richard n adams and erick jantsch the papers presented include allen self organization in the urban system robert herman remarks on traffic flow theories and the characterization of traffic in cities w h zurek and schieve nucleation paradigm survival threshold in population dynamics de palma et al boolean equations with temporal delays nicholas georgescu roegin energy analysis and technology assessment magoroh maruyama four different causal meta types in biological and social sciences and jantsch from self reference to self transcendence the evolution of self organization dynamics

Self-Organization and Dissipative Structures

1982-04-01

this book provides an outline of theoretical concepts and their experimental verification in studies of self organization phenomena in chemical systems as they emerged in the mid 20th century and have evolved since presenting essays on selected topics it was prepared by authors who have made profound contributions to the field traditionally physical chemistry has been concerned with interactions between atoms and molecules that produce a variety of equilibrium structures or the dead order in a stationary state but biological cells exhibit a different living kind of order prompting e schrödinger to pose his famous question what is life in 1943 through an unprecedented theoretical and experimental development it was later revealed that biological self organization phenomena are in complete agreement with the laws of physics once they are applied to a special class of thermodynamically open systems and non equilibrium states this knowledge has in turn led to the design and synthesis of simple inorganic systems capable of self organization effects these artificial living organisms are able to operate on macroscopic to microscopic scales even down to single molecule machines in the future such research could provide a basis for a technological breakthrough comparable in its impact with the invention of

lasers and semiconductors its results can be used to control natural chemical processes and to design artificial complex chemical processes with various functionalities the book offers an extensive discussion of the history of research on complex chemical systems and its future prospects

Chemical Complexity

2017-08-10

according to its definition synergetics is concerned with systems that produce macroscopic spatial temporal or functional structures autowaves are a specific yet very important case of spatio temporal structures the term autowave was coined in the soviet union in analogy to the term auto oscillator this is perhaps too literal translation of the russian word avto ostsillyatory self oscillator which in its proper translation means self sustained oscillator these are oscillators e g clocks whose internal energy dissipation is compensated by a more or less continuous power input similarly the term autowaves denotes propagation effects including waves in active media which provide spatially distributed energy sources and thus may compensate dissipation an example which is now famous is represented by spiral or concentric waves in a chemically active medium undergoing the belousov zhabotinsky reaction this book provides the reader with numerous further examples from physics chemistry and biology e g autowaves of the heart while the belousov zhabotinsky reaction is now widely known a number of very important results obtained in the soviet union are perhaps less well known i am particularly glad that this book may help to make readers outside the soviet union acquainted with these important experimental and theoretical findings which are presented in a way which elucidates the common principles underlying this kind of propagation effects professor v

Self-Organization

2012-12-06

this text on the interdisciplinary field of synergetics will be of interest to students and scientists in physics chemistry mathematics biology electrical civil and mechanical engineering and other fields it continues the outline of basic concepts and methods presented in my book synergetics an introduction which has by now appeared in english russian j apanese chinese and german i have written the present book in such a way that most of it can be read independently of my previous book though occasionally some knowledge of that book might be useful but why do these books address such a wide audience why are instabilities such a common feature and what do devices and self organizing systems have in common self organizing systems acquire their structures or functions without specific interference from outside the differentiation of cells in biology and the process of evolution are both examples of

self organization devices such as the electronic oscillators used in radio transmitters on the other hand are man made but we often forget that in many cases devices function by means of processes which are also based on self organization in an electronic oscillator the motion of electrons becomes coherent without any coherent driving force from the outside the device is constructed in such a way as to permit specific collective motions of the electrons quite evidently the dividing line between self organizing systems and man made devices is not at all rigid

Advanced Synergetics

2012-12-06

this work is about creating desired artificial self organization in multi agent and multi robotic systems it is demonstrated that emergent phenomena can artificially be designed when to treat collective systems on a new structural level examples of desired self organization implemented in manufacturing environment and in a large scale swarm of micro robots allow deeper understanding of collective artificial intelligence the work wins the infos faculty award as the best dissertation of 2008

Synergetics

1978

this monograph offers an interdisciplinary approach to the analysis of geological systems which become spatially organized through the mediation of chemical processes the treatment is based on a mathematical approach the intended readership includes researchers and advanced undergraduate and graduate students in all branches of geology as well as scientists and mathematicians concerned with nonlinear dynamics numerical analysis self organization nonlinear waves and dynamics and phase transition phenomena the work could also serve as a basis for a special topics course in mathematics chemistry or physics

Structural Self-Organization in Multi-Agents and Multi-Robotic Systems

2008

integrating nano and microphysical effects this book's team of expert authors offers new insights into self organized structure formation in nanomaterials a major question addressed in this book is the role of spatial and temporal order in particular you'll discover how to apply concepts developed on macroscopic and microscopic scales to structure formation occurring on nanoscales a key focus of interest at the frontiers of science

Synergetics

1977

this book tells the story of how inert matter can acquire self organizing and other properties ascribed to life the author s multidisciplinary approach does not require knowledge of chemistry physics or biology on the part of the reader part i covers the properties of matter and evolutionary criteria part ii presents an introduction to the necessary chemical concepts part iii explains the self organization of biosystems and the development of organisms



2002-12-10

this is the second volume with the title the paradigm of self organization and will serve to complement the previous one by developing and extending the discussion of self organizing systems it contains contributions from three areas general questions questions from physics and chemistry and questions from cognition and biology which provide elucidation to the subject of self organization the diversity of topics in this volume show the pervasiveness of the theme of self organization in science and will thus be of interest to all scientists who are concerned with its development

Self-organization in Biological Work Spaces

1989

lasers and synergetics written to honour hermann haken on his 60th birthday is concerned with the two main areas of research to which prof haken has made fundamental contributions in fact the two areas are interrelated since the development of the interdisciplinary science synergetics has been closely connected with the emergence of laser theory synergetics deals with complex systems that possess the fundamental property of spontaneous selforganization of their macroscopic behaviour the book summarizes basic ideas important concepts and principles used to describe selforganizing systems from a unified viewpoint special attention is paid to lasers nonlinear optics and to coherence phenomena in other physical biological and sociological systems some surveys of historical developments are presented but most space is devoted to the publication of recent results and the description of current research work

Selforganization

2013-03-09

self organization and adaptation are concepts stemming from the nature and have been adopted in systems theory this book provides in depth thoughts about several methodologies and technologies for the area it represents the future generation of it systems comprised of communication infrastructures and computing applications

Molecules, Dynamics, and Life

1986-10-14

self organization of matter is observed in every context and on all scales from the nanoscale of quantum fields and subatomic particles to the macroscale of galaxy superclusters this book analyzes the wide range of patterns of organization present in nature highlighting their similarities rather than their differences this unconventional approach results in an illuminating read which should be part of any physics student s background

The Paradigm of Self-organization II

1994

the book with its emphasis on the interaction of microstructures with the entire biosphere ecosystems etc and on how micro and macrocosmos mutually create the conditions for their further evolution provides a comprehensive framework for a deeper understanding of human creativity in a time of transition

Lasers and Synergetics

2012-12-06

for centuries humankind has believed that the world with all its form and structure was created by supernatural forces in recent decades science has shaken these beliefs with the discovery of the exciting possibility of a self created and self creating world of self organization synergetics endeavours to reveal the intimate mechanisms of self organization the transitions from chaos to order the nature of self organization the various approaches to it and certain philosophical inferences are outlined synergetics thus represents a remarkable confluence of many strands of thought and has become a paradigm in modern culture this book exposes the reader to striking new vistas in physics and mathematics chemistry and biology social sciences and philosophy all interlocked around the concept of self organization

Self-organization and Autonomic Informatics (I)

2005

in the last years adaptive networks have been discovered simultaneously in different fields as a universal framework for the study of self organization phenomena understanding the mechanisms behind these phenomena is hoped to bring forward not only empirical disciplines such as biology sociology ecology and economy but also engineering disciplines seeking to employ controlled emergence in future technologies this volume presents new analytical approaches which combine tools from dynamical systems theory and statistical physics with tools from graph theory to address the principles behind adaptive self organization it is the first class of approaches that is applicable to continuous networks the volume discusses the mechanisms behind three emergent phenomena that are prominently discussed in the context of biological and social sciences synchronization spontaneous diversification and self organized criticality self organization in continuous adaptive networks contains extended research papers it can serve as both a review of recent results on adaptive self organization as well as a tutorial of new analytical methods self organization in continuous adaptive networks is ideal for academic staff and master research students in complexity and network sciences in engineering physics and maths

On Self-Organization

2014-09-01

first to review nanoscale self assembly employing such a wide variety of methods covers a wide variety physical chemical and biological systems phenomena and applications first overviews of nanotube biotechnology and bimetallic nanoparticles

Introduction to the Physics of Complex Systems

1986

this invaluable book is the first of its kind on selforganizology the science of self organization it covers a wide range of topics such as the theory principle and methodology of selforganizology agent based modelling intelligence basis ant colony optimization fish particle swarm optimization cellular automata spatial diffusion models evolutionary algorithms self adaptation and control systems self organizing neural networks catastrophe theory and methods and self organization of biological communities etc readers will have an in depth and comprehensive understanding of selforganizology with detailed background information provided for those who wish to delve deeper into the subject and explore research literature this book is a valuable reference for research scientists university teachers graduate students and high level undergraduates in the areas of computational science artificial intelligence applied mathematics engineering science social science and life sciences contents organization and organizational theoryselforganizology the science of self

organization agent based modeling intelligence principles catastrophe theory and methods self adaptation and control systems cellular automata and spatial diffusion models artificial neural networks ant colony optimization fish and particle swarm optimizations synergy coevolution and evolutionary algorithms synergy correlation analysis community succession and assembly mathematical foundations readership research scientists university teachers graduate students and high level undergraduates in the areas of computational science artificial intelligence applied mathematics engineering science social science and life sciences key features this book is the first monograph on self organization in the world with no competing titles the author is a prominent scientist who is the editor in chief of six international journals including self organization keywords self organization self organization agent based modeling algorithms computational intelligence ant colony optimization evolutionary algorithms cellular automata particle swarm optimization catastrophe theory

Self-organization of Matter

2020-07-06

these proceedings contain invited lectures presented at the third international conference on irreversible processes and dissipative structures in kiihlungsborn german democratic republic in march 1985 these conferences the first of which was held in rostock in 1977 and the second in berlin in 1982 are devoted to the study of irreversible processes far from thermal equilibrium and to the phenomena of self organization the meeting in kiihlungsborn brought together some 160 mathematicians physicists chemists and biologists from 10 countries who are all interested in the interdisciplinary field of synergetics the main topics of the conference were basic concepts of self organization and evolution such as entropy instabilities nucleation dissipative structures chaos and turbulence the contributions cover methods from thermodynamics the theory of dynamic systems stochastic and statistic theory the method of green's functions the fluctuation dissipation theorem etc several problems are studied in more detail e.g. the kinetics of nucleation especially in finite systems the dynamics of interfaces reaction diffusion systems chemical and biochemical pattern formation and information processing further several contributions are devoted to the development of the concepts of chaos and turbulence the editors hope that the contributions collected in this volume will provide some new information about the field of self organization which is in full development now

The Self-organizing Universe

1980

this thoroughly updated version of the german authoritative work on self organization has been completely rewritten by internationally renowned experts and experienced book authors to also include a review of more recent literature it retains the original enthusiasm and fascination surrounding thermodynamic systems far from equilibrium synergetics and the origin of life representing an easily readable book and tutorial on this exciting field the book is unique in covering in detail the experimental and theoretical fundamentals of self organizing systems as well as such selected features as random processes structural networks and multistable systems while focusing on the physical and theoretical modeling of natural selection and evolution processes the authors take examples from physics chemistry biology and social systems and include results hitherto unpublished in english the result is a one stop resource relevant for students and scientists in physics or related interdisciplinary fields including mathematical physics biophysics information science and nanotechnology

Synergetics: Chaos, Order, Self-organization

1994-04-22

during the past twenty years a broad spectrum of theories and methods have been developed in physics chemistry and molecular biology to explain structure formation in complex systems these methods have been applied to many different fields such as economics sociology and town planning and this book reflects the interdisciplinary nature of complexity and self organisation the main focus is on the emergence of collective phenomena from individual or microscopic interactions presents a wide ranging overview from fundamental aspects of the evolution of complexity to applications in biology ecology sociology economics and urban structure formation

Self-Organization in Continuous Adaptive Networks

2022-09-01

self organization is a generic term describing the capacity of a system to change its own structure by itself while interacting with the environment in this sense self organization is not environment determined or environment adaptive but is self determined and self adaptive the concept of self organization was born in the 1960s and attempts were made to establish a theory based on the logic of a system and its control in contrast the 1980s introduced a view based on the logic of creative individuals and on fluctuations antithetical differences exist between the two the former regards the system of aggregated individuals as the object of consideration where self organization is the sum of the practices of a system led by control or self control in particular the latter focuses on the practices of individuals deviating from the logic of a system making the existing system fluctuate and transforming its structure this volume attempts to integrate these viewpoints through inquiry into the

structure of the self and through self reflexion a new horizon thus opens for the synthesis of planning control action theory and spontaneous performative action theory

Self-Organized Nanoscale Materials

2010-11-10

applied natural science environmental issues and global perspectives provides the reader with a complete insight into the natural scientific pattern of the world covering the most important historical stages of the development of various areas of science methods of natural scientific research general scientific and philosophical concepts and the fundamental laws of nature the book analyzes the main scientific trends and developments of modern natural science and also discusses important aspects of environmental protection topics include the problem of the two cultures the mathematization of natural sciences and the informatization of society the non linear nature of the processes occurring in nature and society application of the second law of thermodynamics to describe the development of biological systems global problems of the biosphere theory and practice of stable organic paramagnetic materials polymers and the natural environment key features include an interdisciplinary approach in considering scientific and technical problems a discussion of general scientific trends in modern natural science including globalization challenges in nature and society the organic chemistry of stable paramagnetic materials the fundamentals of the environmental chemistry of polymeric materials etc a justification of applying classical non equilibrium thermodynamics to studying the behavior of open including biological systems of particular importance in the book is the discussion of some problems associated with the place of man in the biosphere issues of the globalization of science and technology new ideas about the universe and the concept of universal evolutionism at the same time the book discusses more specific issues related to solving major global and regional environmental problems particularities of organic paramagnetic materials the influence of polymers on the man and environment etc all this leads to the fundamental conclusion of the unity of animate and inanimate nature as well as improvement of the process of cognition of the real world which consists in objective and natural changing of world views the book is intended for professors teachers and students of classical and technological universities who are interested in the development of the foundations of modern natural sciences as well as for professionals working in the field of chemical physics and applied ecology

Selforganizology

2015-11-27

is it possible to guide the process of self organisation towards specific patterns and outcomes wouldn't this be self contradictory after all a self organising process assumes a transition into a more organised form or towards a more structured functionality in the absence of centralised control then how can we place the guiding elements so that they do not override rich choices potentially discoverable by an uncontrolled process this book presents different approaches to resolving this paradox in doing so the presented studies address a broad range of phenomena ranging from autopoietic systems to morphological computation and from small world networks to information cascades in swarms a large variety of methods is employed from spontaneous symmetry breaking to information dynamics to evolutionary algorithms creating a rich spectrum reflecting this emerging field demonstrating several foundational theories and frameworks as well as innovative practical implementations guided self organisation inception will be an invaluable tool for advanced students and researchers in a multiplicity of fields across computer science physics and biology including information theory robotics dynamical systems graph theory artificial life multi agent systems theory of computation and machine learning

Selforganization by Nonlinear Irreversible Processes

2012-12-06

reality is not as is but as interpreted humans are caged not freed by the logic of own thought that conceals everyone behind own egocentric self emotions and intuition are created by magic golden irrational that is ratio and balance the irrational separates number from magnitude while this magnitude cannot be found the logical rational thought as the sole expression of our civilization starts from somewhere follows a logical path and ends with a conclusion because all ideas have an end in themselves how close to this conclusion or end are we is the rational world only a distorted projection of the irrational world does civilization make sense only for a linear mind

Physics of Self-Organization and Evolution

2011-10-17

what are the principles that keep our society together this question is even more difficult to answer than the long standing question what are the forces that keep our world together however the social challenges of humanity in the 21st century ranging from the financial crises to the impacts of globalization require us to make fast progress in our understanding of how society works and how our future can be managed in a resilient and sustainable way this book can present only a few very first steps towards this ambitious goal however based on simple models of social interactions one can already gain some surprising insights into the social macro level

outcomes and dynamics that is implied by individual micro level interactions depending on the nature of these interactions they may imply the spontaneous formation of social conventions or the birth of social cooperation but also their sudden breakdown this can end in deadly crowd disasters or tragedies of the commons such as financial crises or environmental destruction furthermore we demonstrate that classical modeling approaches such as representative agent models do not provide a sufficient understanding of the self organization in social systems resulting from individual interactions the consideration of randomness spatial or network interdependencies and nonlinear feedback effects turns out to be crucial to get fundamental insights into how social patterns and dynamics emerge given the explanation of sometimes counter intuitive phenomena resulting from these features and their combination our evolutionary modeling approach appears to be powerful and insightful the chapters of this book range from a discussion of the modeling strategy for socio economic systems over experimental issues up the right way of doing agent based modeling we furthermore discuss applications ranging from pedestrian and crowd dynamics over opinion formation coordination and cooperation up to conflict and also address the response to information issues of systemic risks in society and economics and new approaches to manage complexity in socio economic systems selected parts of this book had been previously published in peer reviewed journals

Self-Organization of Complex Structures

1997-07-16

intriguing phenomena of the appearance of order from chaos under light pumping are investigated in the monograph this light driven self organisation takes place due to the fact that each new excitation is generated recombines in the field produced by already existing excitations therefore probability of the generation recombination at some point and state depends on the spatial distribution and states of the available excitations as the result spatial and orientational ordering of the excitations raise in random media electrons and holes in amorphous semiconductors are separated in space and despite the coulomb repulsion form electron and hole domains due to particle segregation the ordered state is long lived up to astronomical long time orientational ordering breaks the initial inversional symmetry of a material and may be tested by the appearance of second harmonic signal as it is observed in ge doped silica fibres self organised system reveals positive feedback in response to static electric field oriented excitations amplifies initial field and result in strong phase matched electric field provided effective second harmonic generation light acts like optical piston it fulfils sesyphean labour pushing electrons in opposite to electric force direction current against voltage this allows to perform all optical poling of glasses as a signature of self organised system flicker noise of optical parameters with universal spectrum $1/f$ is observed

Self-Organization and Society

2008-04-15

this volume presents the new objectives of physics on self organizing systems composed of multi components in order to create a new field and establish universal comprehension in physics the book covers broad topics such as the thermodynamic time asymmetry in both transient and stationary nonequilibrium states the seriousness of auxiliary conditions in physicochemical processes and biological systems the quantum classical and micro macro interfaces which are familiar in mesoscopic physics the purification scheme of quantum entanglement topics on gamma ray bursts and the walking mechanism of single molecular motors book jacket

Applied Natural Science

2017-03-03

Guided Self-Organization: Inception

2013-12-19

Solovki's Ersatz

2015-08-30

Social Self-Organization

2012-05-05

Light Driven Self-organization

2003

Physics of Self-organization Systems

2008

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