Brownian Agents And Active Particles Collective Dynamics In The Natural And Social Sciences Springer Series In Synergetics

This book develops new mathematical methods and tools to model living systems. The material it presents can be used in such real-world applications as immunology, transportation engineering, and economics. The first part of the book deals with deriving general evolution equations that can be customized to particular systems of interest in the applied sciences. The second part of the book deals with various models and applications. The book will be a valuable resource to all involved in modeling complex social systems and living matter in general.

This book constitutes the refereed proceedings of the Workshops which complemented the 11th International Conference on Practical Applications of Agents and Multi-Agent Systems, PAAMS 2013, held in Salamanca, Spain, in May 2013. This volume presents the papers that have been accepted for the workshops: Workshop on Agent-based Approaches for the Transportation Modeling and Optimization, Workshop on Agent-Based Solutions for Manufacturing and Supply Chain, Workshop on User-Centric Technologies and Applications, Workshop on Conflict Resolution in Decision Making, Workshop on Multi-Agent System Based Learning Environments, Workshop on Multi-agent based Applications for Sustainable Energy Systems, Workshop on Agents and multi-agent Systems for AAL and e-Health

Economics and the social sciences are, in fact, the "hard" sciences, as Herbert Simon argued, because the complexity of the problems dealt with cannot simply be reduced to analytically solvable models or decomposed into separate subprocesses. Nevertheless, in recent years, the emerging interdisciplinary "sciences of complexity" have provided new methods and tools for tackling these problems, ranging from complex data analysis to sophisticated computer simulations. In particular, advanced methods developed in the natural sciences have recently also been applied to social and economic problems. The twenty-one chapters of this book reflect this modern development from various modeling perspectives (such as agent-based models, evolutionary game theory, reinforcement learning and neural network techniques, time series analysis, non-equilibrium macroscopic dynamics) and for a broad range of socio-economic applications (market dynamics, technological evolution, spatial dynamics and economic growth, decision processes, and agent societies). They jointly demonstrate a shift of perspective in economics and the social sciences that is allowing a new outlook in this field to emerge. Contents:Market Dynamics:Trading Behavior and Excess Volatility in Toy Markets (M Marsili & D Challet)Percolation Models of Financial Market Dynamics (D Stauffer)Electrodynamical Model of Quasi-Efficient Financial Markets (K N Ilinski & A S Stepanenko)Multi-Agent Market Modeling of Foreign Exchange Rates (G Zimmermann et al.)Forecasting Price Increments Using an Artificial Neural Network (F Castiglione)Spectral Regularization, Data Complexity and Agent Behavior (A Ilyinsky)Technological Evolution:Dynamics of Economic and Technological Search Processes in Complex Adaptive Landscapes (W Ebeling et al.)New Results in a Self-Organized Model of Technological Evolution (A Arenas et al.)Firms' Decision-Making Process in an Evolutionary Model of Industrial Dynamics (W Kwasnicki)Spatial Dynamics and Economic Growth:Modelling Migration and Economic Agglomeration with Active Brownian Particles (F Schweitzer)The Evolution of Industrial Clusters — Simulating Spatial Dynamics (T Brenner & N Weigelt)The Growth Dynamics of German Business Firms (J Voit)A Dynamic Theory of a Firm: An Application of 'Economic Forces' (M

Estola) Decision Processes: Adaptive Platform Dynamics in Multi-Party Spatial Voting (B M R Stadler) Subtle Nonlinearity in Popular Album Charts (R A Bentley & H D G Maschner) Dynamical Aspects in the Adoption of Agri-Environmental Measures (G Weisbuch & G Boudjema) Collective Choice and Mutual Knowledge Structures (D Richards et al.) Agent Societies: Evolutionary Study of Interethnic Co-Operation (V Kvasnicka & J Pospichal) Coalition Factor in the Evolution of Non-Kin Altruism (J-L Dessalles) Optimal Payoff Functions for Members of Collectives (D H Wolpert & K Tumer) A Day at the Beach: Human Agents Self-Organizing on the Sand Pile (H Ishii et al.) Readership: Researchers in the field of complex system science, economists, sociologists, physicists with an interdisciplinary focus, graduates, and professionals. Keywords:

Understanding Cities with Cellular Automata, Agent-based Models, and Fractals

Proceedings of the 1st International Conference on Bio-Inspired Computational Methods Used for Difficult Problems Solving: Development of Intelligent and Complex Systems

Encyclopedia of Mathematical Physics

Journal of the Physical Society of Japan

Environment & Planning

Solid state phenomena

International Workshops of PAAMS 2013, Salamanca, Spain, May 22-24, 2013. Proceedings

This volume comprises the proceedings of the 6th international conference on Self-Formation Theory and Applications.

In this book, a generic model in as far as possible mathematical closed-formis developed that predicts the behavior of large self-organizing robot groups (robot swarms) based on their control algorithm. In addition, an extensive subsumption of the relatively young and distinctive interdisciplinary research field of swarm robotics is emphasized. The connection to many related fields is highlighted and the concepts and methods borrowed from these fields are described shortly.

Since the start of modern computing, the studies of living organisms have inspired the progress in developing computers and intelligent machines. In particular, the methods of search and foraging are the benchmark problems for robotics and multi-agent systems. The highly developed theory of search and screening involves optimal search plans that are obtained by standard optimization techniques while the foraging theory addresses search plans that mimic the behavior of living foragers. Search and Foraging: Individual Motion and Swarm Dynamics examines how to program artificial search agents so that they demonstrate the same behavior as predicted by the foraging theory for living organisms. For cybernetics, this approach yields techniques that enable the best online search planning in varying environments. For biology, it allows reasonable insights regarding the internal activity of living organisms performing foraging tasks. The book discusses foraging theory as well as search and screening theory in the same mathematical and algorithmic framework. It presents an overview of the main ideas and methods of foraging and search

theories, making the concepts of one theory accessible to specialists of the other. The book covers Brownian walks and Lévy flight models of individual foraging and corresponding diffusion models and algorithms of search and foraging in random environments both by single and multiple agents. It also describes the active Brownian motion models for swarm dynamics with corresponding Fokker–Planck equations. Numerical examples and laboratory verifications illustrate the application of both theories.

The Mathematical Scientist

Handbook of Research on Design, Control, and Modeling of Swarm Robotics

Flowing Matter

Experimental Chaos

The Cell in Development and Heredity

Simulation of Complex Systems

Information—Consciousness—Reality

This open access book, published in the Soft and Biological Matter series, presents an introduction to selected research topics in the broad field of flowing matter, including the dynamics of fluids with a complex internal structure –from nematic fluids to soft glasses– as well as active matter and turbulent phenomena. Flowing matter is a subject at the crossroads between physics, mathematics, chemistry, engineering, biology and earth sciences, and relies on a multidisciplinary approach to describe the emergence of the macroscopic behaviours in a system from the coordinated dynamics of its microscopic constituents. Depending on the microscopic interactions, an assembly of molecules or of mesoscopic particles can flow like a simple Newtonian fluid, deform elastically like a solid or behave in a complex manner. When the internal constituents are active, as for biological entities, one generally observes complex large-scale collective motions. Phenomenology is further complicated by the invariable tendency of fluids to display chaos at the large scales or when stirred strongly enough. This volume presents several research topics that address these phenomena encompassing the traditional micro-, meso-, and macro-scales descriptions, and contributes to our understanding of the fundamentals of flowing matter. This book is the legacy of the COST Action MP1305 "Flowing Matter".

This open access book chronicles the rise of a new scientific paradigm offering novel insights into the age-old enigmas of existence. Over 300 years ago, the human mind discovered the machine code of reality: mathematics. By utilizing abstract thought systems, humans began to decode the workings of the cosmos. From this understanding, the current scientific paradigm emerged, ultimately discovering the gift of technology. Today, however, our island of knowledge is surrounded by ever longer shores of ignorance. Science appears to have hit a dead end when confronted with the nature of reality and consciousness. In this fascinating and accessible volume, James Glattfelder explores a

radical paradigm shift uncovering the ontology of reality. It is found to be information-theoretic and participatory, yielding a computational and programmable universe.

This book contains selected papers presented at the International Conference "Bio-Inspired Computational Methods Used for Difficult Problems Solving. Development of Intelligent and Complex Systems" - BICS 2008, organized by the Romanian Academy, Bucharest and Petru Major University of Tg. Mures, held on 5-7 November 2008 at Petry Major University of Tg. Mures, Romania. The aim of this conference was to bring together researchers working in the main areas of Complex Systems, Artificial Intelligence, Intelligent Systems and Natural Computing for presenting their recent results and exchanging ideas. The papers included in the book provide an introduction and also a state of the art to the bio-inspired computer science. The areas covered were those of natural computing, such as evolutionary and neural computing, as well as younger research directions, such as DNA computing, ant colony optimization, with connections and applications to intelligent complex systems and to medical informatics. Thus, both directions of research, from biology to informatics and from informatics to biology are illustrated.

With Applications to Stochastic Problems in Physics, Chemistry and Electrical Engineering

Proceedings of the 6th International Conference on Self-Formation Theory and Applications, Held in Vilnius, Lithuania, November 26-28, 2003

From Statistical Physics to Bio and Nano-motors

Agent-Based Approaches in Economic and Social Complex Systems VII

Supporting Global-to-Local Programming

Brownian Agents and Active Particles

Modeling Complex Living Systems

Most genetics textbooks deal adequately with plant and animal genetics, but tend to neglect fungi except for two areas. Firstly, the ascus segregations which, in the 1960s, contributed so much to developing an understanding of the mechanism of recombination and secondly, the contribution that work on yeast (as a model eukaryote) is currently making to understanding cell cycle control and its genetic regulation. Consequently, most introductory genetics texts will leave the reader/student with the impression that fungi are of use when peculiarities of their structure or life style suit them to particular experimental approaches, but are not worth mentioning otherwise. The authors have produced a book that will compensate for this imbalance. This book discusses the genetics of fungi, or mycology, in a way that is attractive and challenging, succinct yet comprehensive, sensitive to commercial and applied aspects, yet also theoretical, dealing with their genetics from molecules to individuals to population. This short text will be an ideal supplement to the established basic textbooks in genetics or can be used as the sole text for an advanced course devoted to fungal genetics.

Studies on robotics applications have grown substantially in recent years, with swarm robotics being a relatively new area of research. Inspired by studies in swarm intelligence and robotics, swarm robotics facilitates interactions between robots as well as their interactions with the environment. The Handbook of Research on Design, Control, and Modeling of Swarm Robotics is a collection of the most important research achievements in swarm robotics thus far, covering the growing areas of design, control, and modeling of swarm robotics. This handbook serves as an essential resource for researchers, engineers, graduates, and senior

undergraduates with interests in swarm robotics and its applications.
Through expanded intelligence, the use of robotics has fundamentally transformed a variety of fields, including manufacturing, aerospace, medicine, social services, and agriculture. Continued research on robotic design is critical to solving various dynamic obstacles individuals, enterprises, and humanity at large face on a daily basis. Robotic Systems: Concepts, Methodologies, Tools, and Applications is a vital reference source that delves into the current issues, methodologies, and trends relating to advanced robotic technology in the modern world. Highlighting a range of topics such as mechatronics, cybernetics, and human-computer interaction, this multi-volume book is ideally designed for robotics engineers, mechanical engineers, robotics technicians, operators, software engineers, designers, programmers, industry professionals, researchers, students, academicians, and computer practitioners seeking current research on developing innovative ideas for intelligent and autonomous robotics systems.
BICS 2008
From Individual to Collective Dynamics
Acta Physica Polonica
Advances in Artificial Life
Science
Nature
Space-Time Continuous Models of Swarm Robotic Systems

Brownian Agents and Active ParticlesCollective Dynamics in the Natural and Social SciencesSpringer Science & Business Media
Stochastic Dynamics, born almost 100 years ago with the early explanations of Brownian motion by physicists, is nowadays a quickly expanding field of research within nonequilibrium statistical physics. The present volume provides a survey on the influence of fluctuations in nonlinear dynamics. It addresses specialists, although the intention of this book is to provide teachers and students with a reliable resource for seminar work. In particular, the reader will find many examples illustrating the theory as well as a host of recent findings.
Recently, there has been an increasing focus on various biological and physical systems known as "active matter". Examples of such systems range from individual units, such as motile cells or artificial self-propelled particles, to large systems of interacting active particles or individuals. The emergence of large-scale collective motion, as exhibited by flocks of birds or bacterial colonies, is just one prominent and fascinating example of self-organization in active matter systems. In this work, we discuss different individual-based models of active matter using the concept of active Brownian motion. The first part of this work explores the dynamical behavior of single active particles with a particular emphasis on the impact of so-called active fluctuations. The second part extends the scope of this study to interacting active Brownian particles and their collective behavior. First, a systematic derivation of kinetic equations for active Brownian particles with velocity alignment is presented. Further on, motivated by recent biological observations, a new type of "escape-pursuit" model of

collective motion is introduced and successfully employed in modeling collective locust behavior.

Self-formation Theory and Aplications [sic]

Robotic Systems: Concepts, Methodologies, Tools, and Applications B.

6th Experimental Chaos Conference, Potsdam, Germany, 22-26 July 2001

Novel Technological and Methodological Tools for the Understanding of Collective Behaviors

Noise in Complex Systems and Stochastic Dynamics

Environment and Planning

Illustrating the development of Brownian ratchets, from their foundations, to their role in the description of life at the molecular scale and in the design of artificial nano-machinery, this text will appeal to both advanced graduates and researchers entering the field. Providing a self-contained introduction to Brownian ratchets, devices which rectify microscopic fluctuations, Part I avoids technicalities and sets out the broad range of physical systems where the concept of ratchets is relevant. Part II supplies a single source for a complete and modern theoretical analysis of ratchets in regimes such as classical vs quantum and stochastic vs deterministic, and in Part III readers are guided through experimental developments in different physical systems, each highlighting a specific unique feature of ratchets. The thorough and systematic approach to the topic ensures that this book provides a complete guide to Brownian ratchets for newcomers and established researchers in physics, biology and biochemistry.

In recent years many countries have experienced an increase in spatial problems that has led to planning crises. The use of modern planning technologies, such as geographical information systems and remote sensing, gives us new potential to monitor and prevent environmental degradation. Effective strategies for management should consider sustainable development and planning and emphasise the need to handle these matters in an integrated way. These volumes contain the contributions presented at the Second International Conference on Sustainable Development and Planning which deal with the following topics: City planning; Environmental impact assessment; Environmental legislation and policy; Environmental management; Waste management; Resources management; Geo-informatics; Transportation; Ecosystems

analysis, protection and remediation; Regional planning; Rural development; A Multidisciplinary approach to territorial
This book lays out a vision for a coherent framework for understanding complex systems. By developing the genuine idea of Brownian agents, the author combines concepts from informatics, such as multiagent systems, with approaches of statistical many-particle physics. It demonstrates that Brownian agent models can be successfully applied in many different contexts, ranging from physicochemical pattern formation to swarming in biological systems.
Microhydrodynamics, Brownian Motion, and Complex Fluids
A.
How a New Understanding of the Universe Can Help Answer Age-Old Questions of Existence
Modeling Complexity in Economic and Social Systems
Search and Foraging
7th European Conference, ECAL 2003, Dortmund, Germany, September 14-17, 2003, Proceedings
Nonlinear Dynamics and the Spatiotemporal Principles of Biology
This book presents both the fundamentals and the major research topics in statistical physics of systems out of equilibrium. It summarizes different approaches to describe such systems on the thermodynamic and stochastic levels, and discusses a variety of areas including reactions, anomalous kinetics, and the behavior of self-propelling particles.
Michael Batty offers a comprehensive view of urban dynamics in the context of complexity theory, presenting models that demonstrate how complexity theory can embrace a myriad of processes and elements that combine into organic wholes.
This book constitutes the refereed proceedings of the 7th European Conference on Artificial Life, ECAL 2003, held in Dortmund, Germany in September 2003. The 96 revised full papers presented were carefully reviewed and selected from more than 140 submissions. The papers are organized in topical sections on artificial chemistries, self-organization, and self-replication; artificial societies; cellular and neural systems; evolution and development; evolutionary and adaptive dynamics; languages and communication; methodologies and applications; and robotics and autonomous agents.
Active Motion and Swarming

Collective Dynamics in the Natural and Social Sciences
The Langevin Equation
Leopoldina-Symposium, Darmstadt, May 13 to 15, 2002 ; with 5 Tables
Post-Proceedings of The AESCS International Workshop 2012
Highlights on Practical Applications of Agents and Multi-Agent Systems
This book deals with the most fundamental and essential

techniques to simulate complex systems, from the dynamics of molecules to the spreading of diseases, from optimization using ant colonies to the simulation of the Game of Life. Several natural systems found in physics, biology and engineering can be considered complex systems, because their behaviour is not easily predictable and is the result of complex interactions among their constituents. Examples of complex systems are a cell with its organelles, an organ, the human brain, social networks, transportation and communication systems, the stock market, ecosystems, systems with prey and predators, a swarm of bees. There are several specialized books focusing on different simulation methods, but there is not one fully devoted to complex systems. The "bottom-up" approach is innovative and allows the reader to conduct numerical experiments to explore the system's behaviour. Key Features: Composed of self-contained, independent chapters Illustrates simulation techniques in a broad range of fields from physics and biology to engineering, social science and economics Provides a hands-on approach with guided exercises Covers the fundamental numerical techniques in complex systems Ideal for self-study Contains supplementary example codes and video tutorials
The Encyclopedia of Mathematical Physics provides a complete resource for researchers, students and lecturers with an interest in mathematical physics. It enables readers to access basic information on topics peripheral to their own areas, to provide a repository of the core information in the area that can be used to refresh the researcher's own memory banks, and aid teachers in directing students to entries relevant to their course-work. The Encyclopedia does contain information that has been distilled, organised and presented as a complete reference tool to the user and a landmark to the body of knowledge that has accumulated in this domain. It also is a stimulus for new researchers working in mathematical physics or in areas using the methods originating from work in mathematical physics by providing them with focused high quality background information. Editorial Board: Jean-Pierre Fran?oise, Universit? Pierre et Marie Curie, Paris, France Gregory L. Naber, Drexel University, Philadelphia, PA, USA Tsou Sheung Tsun, University of Oxford, UK Also available online via ScienceDirect (2006) – featuring extensive browsing, searching, and internal cross-referencing between articles in the work, plus dynamic linking to journal articles and abstract databases, making navigation flexible and easy.
This is an introduction to the dynamics of fluids at small scales, the physical and mathematical underpinnings of Brownian motion, and the application of these subjects to the dynamics

and flow of complex fluids such as colloidal suspensions and polymer solutions. It brings together continuum mechanics, statistical mechanics, polymer and colloid science, and various branches of applied mathematics, in a self-contained and integrated treatment that provides a foundation for understanding complex fluids, with a strong emphasis on fluid dynamics. Students and researchers will find that this book is extensively cross-referenced to illustrate connections between different aspects of the field. Its focus on fundamental principles and theoretical approaches provides the necessary groundwork for research in the dynamics of flowing complex fluids.

Sustainable Development and Planning II

Diffusion and Defect Data

Stochastic Dynamics

Planning & design. B

Cities and Complexity

Brownian Movement and Molecular Reality

Brownian Ratchets

Agent-based modeling/simulation is an emergent approach to the analysis of social and economic systems. It provides a bottom-up experimental method to be applied to social sciences such as economics, management, sociology, and politics as well as some engineering fields dealing with social activities. This book includes selected papers presented at the Seventh International Workshop on Agent-Based Approaches in Economic and Social Complex Systems held in Osaka, Japan, in 2012. At the workshop, 24 reviewed full papers were presented, and of those, 17 were selected to be included in this volume. The papers are divided into two groups as "Fundamentals of Agent-Based Modeling" and "Applications of Agent-Based Modeling".

Statistical Thermodynamics And Stochastic Theory Of Nonequilibrium Systems

A Kinetic Theory and Stochastic Game Approach

Individual Motion and Swarm Dynamics

Concepts, Methodologies, Tools, and Applications

Mathematical Reviews