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Reaction Transport Systems Mesoscopic Foundations Fronts And Spatial Instabilities Springer Series In Synergetics

Lecture 49 Transport Effects on Reactions Electronic transport in mesoscopic systems: some examples Mesoscopic aspects of classical transport (Lecture 1) by Christian Maes The 4th STATE of LIFE: Bioplasma \u0026 Bioelectricity. (All Parts) - VERSADOCO COMSOL: Mass transfer with Reaction and Catalyst 08 – Reaction Systems - Definitions Unit 8 Reaction-Diffusion lecture 3:3 Contaminant Transport - Evaluating dispersivity - lab, field forced- and natural-gradient Modeling Photo Induced Electron transfer and transport | 2022 EMSL User Meeting Introduction to MCell4: Monte Carlo Simulator of Reaction/Diffusion | Cell Modeling Workshop 2022 Analysis of Transport Phenomena I: Mathematical Methods | MITx on edX Gradients, Poisson's Equation and Light Transport | Two Minute Papers #20 Does LLM Size Matter? How Many Billions of Parameters do you REALLY Need? Modeling Complex Systems of Chemical Reactions Diffusion: Steady State vs Transient {Texas A\u0026M: Intro to Materials (MSEN 201)} Dynamics and transport in integrable and nearly integrable models (Lecture 1) by Joel Moore

Reaction Transport Systems Mesoscopic Foundations Fronts And Spatial Instabilities Springer Series In Synergetics *OMB No. 1795354048961 edited by*

WALLS VAUGHAN

Mesoscopic Theories of Heat Transport in Nanosystems

Springer
This book introduces readers to MesoBioNano (MBN) Explorer – a multi-purpose software package designed to model molecular systems at various levels of size and complexity. In addition, it presents a specially designed multi-task toolkit and interface – the MBN Studio – which enables the set-up of input files, controls the simulations, and supports the subsequent visualization and analysis of the results obtained. The book subsequently provides a systematic description of the capabilities of this universal and powerful software package within the framework of computational molecular science, and guides readers through its applications in numerous areas of research in bio- and chemical physics and material science – ranging from the nano- to the mesoscale. MBN Explorer is particularly suited to computing the system’s energy, to optimizing molecular structure, and to exploring the various facets of molecular and random walk dynamics. The package allows the use of a broad variety of interatomic potentials and can, e.g., be configured to select any subset of a molecular system as rigid fragments, whenever a significant reduction in the number of dynamical degrees of freedom is required for computational practicalities. MBN Studio enables users to easily construct initial geometries for the molecular, liquid, crystalline, gaseous and hybrid systems that serve as input for the subsequent simulations of their physical and chemical properties using MBN Explorer. Despite its universality, the computational efficiency of MBN Explorer is comparable to that of other, more specialized software packages, making it a viable multi-purpose alternative for the computational modeling of complex molecular systems. A number of detailed case studies presented in the second part of this book demonstrate MBN Explorer’s usefulness and efficiency in the fields of atomic clusters and nanoparticles, biomolecular systems, nanostructured materials, composite materials and hybrid systems, crystals, liquids and gases, as well as in providing modeling support for novel and emerging technologies. Last but not least, with the release of the 3rd edition of MBN Explorer in spring 2017, a free trial version will be available from the MBN Research Center website (mbnresearch.com).

Handbook of Applications of Chaos Theory

John Wiley & Sons
"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.
Correlations and Clustering Phenomena in Subatomic Physics World Scientific
This multi-author reference work provides a unique introduction to the currently emerging, highly interdisciplinary field of those transport processes that cannot be described by using standard methods of statistical mechanics. It comprehensively summarizes topics ranging from mathematical foundations of anomalous dynamics to the most recent experiments in this field. In so doing, this monograph extracts and emphasizes common principles and methods from many different disciplines while providing up-to-date coverage of this new field of research, considering such diverse applications as plasma physics, glassy material, cell science, and socio-economic aspects. The book will be of interest to both theorists and experimentalists in nonlinear dynamics, statistical physics and stochastic processes. It also forms an ideal starting point for graduate students moving into this area. 18 chapters written by internationally recognized experts in this field provide in-depth introductions to fundamental aspects of anomalous transport.

Program

Springer
The book contains review articles on recent advances in first-passage phenomena and applications contributed by leading international experts. It is intended for graduate students and researchers who are interested in learning about this intriguing and important topic. Contents:Arrival Statistics and Exploration Properties of Mortal Walkers (S B Yuste, E Abad and K Lindenberg)First Passage of a Randomly Accelerated Particle (T W Burkhardt)First Passage Problems in Anomalous Diffusion (A Rosso and A Zoia)First-Passage Times of Intermittent Random Walks (O Bénichou and R

Voituriez)First-Passage Phenomena on Finite Inhomogeneous Networks (E Agliari and D Cassi)Effective Spectral Dimension in Scale-Free Networks (S Hwang, D-S Lee and B Kahng)First-Passage Statistics for Random Walks in Bounded Domains (R Voituriez and O Bénichou)First Passage Behavior of Multi-Dimensional Fractional Brownian Motion and Application to Reaction Phenomena (J-H Jeon, A V Chechkin and R Metzler)Trajectory-to-Trajectory Fluctuations in First-Passage Phenomena in Bounded Domains (T G Mattos, C Mejía-Monasterio, R Metzler, G Oshanin and G Schehr)Exact Record and Order Statists of Random Walk via First-Passage Ideas (G Schehr and S N Majumdar)First Passage in a Conical Geometry and Ordering of Brownian Particles (E Ben-Naim and P L Krapivsky)First Passage Time Problems in Biophysical Jump Processes with Fast Kinetics (P C Bressloff and J M Newby)First Passage Problems in Biology (T Chou and M R D'Orsogna)The Effect of Detection Mechanisms on Spatial Search and Foraging (D Campos and V Méndez)Search in Random Media with Lévy Flights (E Gelenbe and O H Abdelrahman)Exit Strategies: Visual Search and the Quitting Time Problem (T S Horowitz)Statistical Physics of Evolutionary Trajectories on Fitness Landscapes (M Manhart and A V Morozov)Some Applications of First-Passage Ideas to Finance (R Chicheportiche and J-P Bouchaud)First-Passage and Extremes in Socio-Economic Systems (J Masoliver and J Perelló)Transport and the First-Passage Time Problem with Application to Cold Atoms in Optical Traps (E Barkai and D A Kessler)The Excursion Set Theory in Cosmology (M Maggiore and A Riottoo)Self-Organized Escape Processes of Linear Chains in Nonlinear Potentials (T Gross, D Hennig and L Schimansky-Geier)Efficient Monte Carlo Methods for Simulating Diffusion-Reaction Processes in Complex Systems (D S Grebenkov) Readership: Researchers in stochastic processes, statistical physics, and mathematical physics. Key Features:Comprehensive update of the classical book by Sidney RednerApplications to wide-ranging and active fields of researchWell-known authors in the fieldKeywords:First Passage;Stochastic Processes;Diffusion;Biophysics;Non-Equilibrium Statistical Mechanics;Complex Systems;Econophysics

Multiscale Modeling of Complex Molecular Structure and Dynamics with MBN Explorer World Scientific

The book provides an introduction to deterministic (and some stochastic) modeling of spatiotemporal phenomena in ecology, epidemiology, and neural systems. A survey of the classical models in the fields with up to date applications is given. The book begins with detailed description of how spatial dynamics/diffusive processes influence the dynamics of biological populations. These processes play a key role in understanding the outbreak and spread of pandemics which help us in designing the control strategies from the public health perspective. A brief discussion on the functional mechanism of the brain (single neuron models and network level) with classical models of neuronal dynamics in space and time is given. Relevant phenomena and existing modeling approaches in ecology, epidemiology and neuroscience are introduced, which provide examples of pattern formation in these models. The analysis of patterns enables us to study the dynamics of macroscopic and microscopic behaviour of underlying systems and travelling wave type patterns observed in dispersive systems. Moving on to virus dynamics, authors present a detailed analysis of different types models of infectious diseases including two models for influenza, five models for Ebola virus and seven models for Zika virus with diffusion and time delay. A Chapter is devoted for the study of Brain Dynamics (Neural systems in space and time). Significant advances made in modeling the reaction-diffusion systems are presented and spatiotemporal patterning in the systems is reviewed. Development of appropriate mathematical models and detailed analysis (such as linear stability, weakly nonlinear analysis, bifurcation analysis, control theory, numerical simulation) are presented. Key Features Covers the fundamental concepts and mathematical skills required to analyse reaction-diffusion models for biological populations. Concepts are introduced in such a way that readers with a basic knowledge of differential equations and numerical methods can understand the analysis. The results are also illustrated with figures. Focuses on mathematical modeling and numerical simulations using basic conceptual and classic models of population dynamics, Virus and Brain dynamics. Covers wide range of models using spatial and non-spatial approaches. Covers single, two and multispecies reaction-diffusion models from ecology and models from bio-chemistry. Models are analysed for stability of equilibrium points, Turing instability, Hopf bifurcation and pattern formations. Uses Mathematica for problem solving and MATLAB for pattern formations. Contains solved Examples and Problems in Exercises. The Book is suitable for advanced undergraduate, graduate and research students. For those who are working in the above areas, it provides information from most of the recent works. The text presents all the fundamental concepts and mathematical skills needed to build models and perform analyses.

Introduction to GENERIC Springer

This book presents the fundamental theory for non-standard diffusion problems in movement ecology. Lévy processes and anomalous diffusion have shown to be both powerful and useful tools for qualitatively and quantitatively describing a wide variety of spatial population ecological phenomena and dynamics, such as invasion fronts and search strategies. Adopting a self-contained, textbook-style approach, the authors provide the elements of statistical physics and stochastic processes on which the modeling of movement ecology is based and systematically introduce the physical characterization of ecological processes at the microscopic, mesoscopic and macroscopic levels. The explicit definition of these levels and their interrelations is particularly suitable to coping with the broad spectrum of space and time scales involved in bio-ecological problems. Including numerous exercises (with solutions), this text is aimed at graduate students and newcomers in this field at the interface of theoretical ecology, mathematical biology and physics.

The Fiscal Year ... Program World Scientific

This book presents generalized heat-conduction laws which, from a mesoscopic perspective, are relevant to new applications (especially in nanoscale heat transfer, nanoscale thermoelectric phenomena, and in diffusive-to-ballistic regime) and at the same time keep up with the pace of current microscopic research. The equations presented in the book are compatible with generalized formulations of nonequilibrium thermodynamics, going beyond the local-equilibrium. The book includes six main chapters, together with a preface and a final section devoted to the future perspectives, as well as an extensive bibliography.

Partial Differential Equations in Ecology MDPI

This book is an introduction to the dynamics of reaction-diffusion systems, with a focus on fronts and stationary spatial patterns. Emphasis is on systems that are non-standard in the sense that either the transport is not simply classical diffusion (Brownian motion) or the system is not homogeneous. A important feature is the derivation of the basic phenomenological equations from the mesoscopic system properties. Topics addressed include transport with inertia, described by persistent random walks and hyperbolic reaction-transport equations and transport by anomalous diffusion, in particular subdiffusion, where the mean square displacement grows sublinearly with time. In particular reaction-diffusion systems are studied where the medium is in turn either spatially inhomogeneous, compositionally heterogeneous or spatially discrete. Applications span a vast range of interdisciplinary fields and the systems considered can be as different as human or animal groups migrating under external influences, population ecology and evolution, complex chemical reactions, or networks of biological cells. Several chapters treat these applications in detail.

Foundations and Applications CRC Press

The Phase Field Crystal (PFC) model incorporates microscopic structural details into a mesoscopic continuum theory. Methods for fast propagation of PFC interfaces are discussed in this book. They can handle a wide range of thermal gradients, supersaturations and supercoolings, including applications such as selective laser melting. The reader will find theoretical treatment in the first half, while the latter half discusses numerical models.

Fractional Dynamics

CRC Press

The articles in this volume summarize the research results obtained in the former SFB 359 "Reactive Flow, Diffusion and Transport" which has been supported by the DFG over the period 1993-2004. The main subjects are physical-chemical processes sharing the difficulty of interacting diffusion, transport and reaction which cannot be considered separately. The modeling and simulation within this book is accompanied by experiments.

Understanding Non-equilibrium Thermodynamics CRC Press

This book focuses on modeling the anomalous diffusion phenomena, being ubiquitous in the natural world. Both the microscopic models (stochastic processes) and macroscopic models (partial differential equations) have been built up. The relationships between the two kinds of models are clarified, and based on these models, some statistical observables are analyzed. From statistics to mathematics, the built models show their power with their associated applications.This book is important for students to develop basic skills to be able to succeed in their future research. In addition to introducing the related models or methods, it also provides the corresponding applications and simulation results, which will attract more readers ranging from mathematicians to physicists or chemists, to name a few.

Simulation Algorithms for Computational Systems Biology Reaction-Transport SystemsMesoscopic Foundations, Fronts, and Spatial Instabilities

The theme of the present volume "Multiscale Analysis" has been introduced about a decade ago and is now reaching a stage where a first balance can be made and further research directions should be decided. Contributions have been carefully selected to ensure the reader will not be confronted with quantum mechanics at one side of the spectrum nor with chemical plants or even the environment on the other side. Maintaining a strong connection with reality i.e. experimental data was another selection criterion. Experimental validation remains the corner stone of any theoretical development and very powerful experimentel techniques are emerging. Areas covered include discussing in depth an important example of experimental techniques. Coming from the medical world, Magnetic Resonance techniques can now provide even quantitative answers to problems our community is faced with. The modeling issue is discussed further. Finally, the limitations of the classic reactor engineering models are outlined. * Original reviews * Leading chemical engineers as authors * Update on biomaterials use * Novel subject on use of biomaterials in drug delivery and gene therapy * Mathematical modeling

Complexity and Statistical Fluctuations. A Maximum Entropy Viewpoint

Elsevier

This book reviews advanced nanotechnology in food, health, water and agriculture. In food, nanobiosensors display an unprecedented efficiency for the detection of allergens, genetically modified organisms and pathogens. In agriculture, nanofertilisers improve plant nutrition by releasing nutrients slowly and steadily. Nanomaterials synthesised using biomass such as fungi are further found remarkable to clean waters polluted by heavy metals. However, as newly introduced materials in the environment, nanoparticles may exhibit toxic effects, which are reviewed in this book. In the context of climate change, methods for water desalinisation are also presented.

Stochastic Foundations in Movement Ecology

Elsevier

A geometric process is a simple monotone process that was first introduced by the author in 1988. It is a generalization of renewal process. This book captures the extensive research work on geometric processes that has been done since then in both probability and statistics theory and various applications. Some results are published for the first time. A reference book for researchers and a handbook for practioners, it is also a useful textbook for postgraduate or senior undergraduate students.

Reactive Flows, Diffusion and Transport Cambridge University Press

The fast progress in many areas of research related to non-equilibrium ther- dynamics has prompted us to write a fourth edition of this book. Like in the previous editions, our main concern is to open the subject to the widest au- ence, including students, teachers, and researchers in physics, chemistry, engine- ing, biology, and materials sciences. Our objective is to present a general view on several open problems arising in non-equilibrium situations, and to afford a wide perspective of applications illustrating their practical outcomes and con- quences. A better comprehension of the foundations is generally correlated to an increase of the range of applications, implying mutual feedback and cross fert- ization. Truly, thermodynamic methods are widely used in many areas of science but, surprisingly, the active dynamism of thermodynamics as a ?eld on its own is not suf?ciently perceived outside a relatively reduced number of specialized researchers. Extended irreversible thermodynamics (EIT) goes beyond the classical f- malisms based on the local equilibrium hypothesis; it was also referred to in an earlier publication by the authors (Lebon et al. 1992) as a thermodynamics of the third type, as it provides a bridge between classical irreversible thermodynamics and rational thermodynamics, enlarging at

the same time their respective range of application. The salient feature of the theory is that the ?uxes are incorporated into the set of basic variables.

Emergence, Information and Prediction

World Scientific
One common feature of new emerging technologies is the fusion of the very small (nano) scale and the large scale engineering. The classical environment provided by single scale theories, as for instance by the classical hydrodynamics, is not anymore satisfactory. The main challenge is to keep the important details while still be able to keep the overall picture and simplicity. It is the thermodynamics that addresses this challenge. Our main reason for writing this book is to explain such general viewpoint of thermodynamics and to illustrate it on a very wide range of examples. Contents Levels of description Hamiltonian mechanics Irreversible evolution Reversible and irreversible evolution Multicomponent systems Contact geometry Appendix: Mathematical aspects
First-Passage Phenomena and Their Applications Springer Science & Business Media
Partial differential equations (PDEs) have been used in theoretical ecology research for more than eighty years. Nowadays, along with a variety of different mathematical techniques, they remain as an efficient, widely used modelling framework; as a matter of fact, the range of PDE applications has even become broader. This volume presents a collection of case studies where applications range from bacterial systems to population dynamics of human riots.
Foundations of Complex Systems World Scientific
This book explains the state-of-the-art algorithms used to simulate biological dynamics. Each technique is theoretically introduced and applied to a set of modeling cases. Starting from basic simulation algorithms, the book also introduces more advanced techniques that support delays, diffusion in space, or that are based on hybrid simulation strategies. This is a valuable self-contained resource for graduate students and practitioners in computer science, biology and bioinformatics. An appendix covers the mathematical background, and the authors include further reading sections in each chapter.

Progress in Mathematical Ecology Springer
This book presents cutting-edge research on the use of physical and mathematical formalisms to model and quantitatively analyze biological phenomena ranging from microscopic to macroscopic systems. The systems discussed in this compilation cover protein folding pathways, gene regulation in prostate cancer, quorum sensing in bacteria to mathematical and physical descriptions to analyze anomalous diffusion in patchy environments and the physical mechanisms that drive active motion in large sets of particles, both fundamental descriptions that can be applied to different phenomena in biology. All chapters are written by well-known experts on their respective research fields with a vast amount of scientific discussion and references in order the interested reader can pursue a further reading. Given these features, we consider Quantitative Models for Microscopic to Macroscopic Biological Macromolecules and Tissues as an excellent and up-to-date resource and reference for advanced undergraduate students, graduate students and junior researchers interested in the latest developments at the intersection of physics, mathematics, molecular biology, and computational sciences. Such research field, without hesitation, is one of the most interesting, challenging and active of this century and the next.
Nanotechnology, Food Security and Water Treatment Walter de Gruyter GmbH & Co KG
Random walks often provide the underlying mesoscopic mechanism for transport phenomena in physics, chemistry and biology. In particular, anomalous transport in branched structures has attracted considerable attention. Combs are simple caricatures of various types of natural branched structures that belong to the category of loopless graphs. The comb model was introduced to understand anomalous transport in percolation clusters. Comb-like models have been widely adopted to describe kinetic processes in various experimental applications in medical physics and biophysics, chemistry of polymers, semiconductors, and many other interdisciplinary applications. The authors present a random walk description of the transport in specific comb geometries, ranging from simple random walks on comb structures, which provide a geometrical explanation of anomalous diffusion, to more complex types of random walks, such as non-Markovian continuous-time random walks. The simplicity of comb models allows to perform a rigorous analysis and to obtain exact analytical results for various types of random walks and reaction-transport processes.