The Mathematics Of Diffusion

Surveying a wide variety of mathematical models of diffusion in the ecological context, this book is written with the primary intent of providing scientists, particularly physicists but also biologists, with some background of the mathematics and physics of diffusion and how they can be applied to ecological problems. Equally, this is a specialized text book for graduates interested in mathematical ecology -- assuming no more than a basic knowledge of probability and differential equations. Each chapter in this new edition has been substantially updated by appopriate leading researchers in the field and contains much new material covering recent developments.
Unlike abstract approaches to advanced control theory, this volume presents key concepts through concrete examples. Once the basic fundamentals are established, readers can apply them to solve other control problems of partial differential equations.
Brownian diffusion, the motion of large molecules in a sea of very many much smaller molecules, is topical because it is one of the ways in which biologically important molecules move about inside

living cells. This book presents the mathematical physics that underlies the four simplest models of Brownian diffusion.

Beginning with the concept of random processes and Brownian motion and building on the theory and research directions in a self-contained manner, this book provides an introduction to stochastic analysis for graduate students, researchers and applied scientists interested in stochastic processes and their applications.

Aimed at research students and academics in mathematics and engineering, as well as engineering specialists, this book provides a systematic and comprehensive presentation of the mathematical theory of the nonlinear heat equation usually called the Porous Medium Equation.

This book systematically presents solutions to the linear time-fractional diffusion-wave equation. It introduces the integral transform technique and discusses the properties of the Mittag-Leffler, Wright, and Mainardi functions that appear in the solutions. The time-nonlocal dependence between the flux and the gradient of the transported quantity with the "long-tail" power kernel results in the time-fractional diffusion-wave equation with the Caputo fractional

derivative. Time-nonlocal generalizations of classical Fourier's, Fick's and Darcy's laws are considered and different kinds of boundary conditions for this equation are discussed (Dirichlet, Neumann, Robin, perfect contact). The book provides solutions to the fractional diffusion-wave equation with one, two and three space variables in Cartesian, cylindrical and spherical coordinates. The respective sections of the book can be used for university courses on fractional calculus, heat and mass transfer, transport processes in porous media and fractals for graduate and postgraduate students. The volume will also serve as a valuable reference guide for specialists working in applied mathematics, physics, geophysics and the engineering sciences.
This text is used by for the resolution of partial differential equations, trasnport equations, the Boltzmann equation and the parabolic equations of diffusion.
This book presents various results and techniques from the theory of stochastic processes that are useful in the study of stochastic problems in the natural sciences. The main focus is analytical methods, although numerical methods and statistical inference methodologies for studying diffusion processes are also

presented. The goal is the development of techniques that are applicable to a wide variety of stochastic models that appear in physics, chemistry and other natural sciences. Applications such as stochastic resonance, Brownian motion in periodic potentials and Brownian motors are studied and the connection between diffusion processes and time-dependent statistical mechanics is elucidated. The book contains a large number of illustrations, examples, and exercises. It will be useful for graduate-level courses on stochastic processes for students in applied mathematics, physics and engineering. Many of the topics covered in this book (reversible diffusions, convergence to equilibrium for diffusion processes, inference methods for stochastic differential equations, derivation of the generalized Langevin equation, exit time problems) cannot be easily found in textbook form and will be useful to both researchers and students interested in the applications of stochastic processes.

A Closer Look at the Diffusion Equation
Introduction to Diffusion Tensor Imaging
Linear Fractional Diffusion-Wave Equation for Scientists and Engineers
Degenerate Diffusions
(AMS-208)
Nonlinear Diffusion Equations

The concepts behind diffusion tensor imaging (DTI) are commonly difficult to grasp, even for magnetic resonance physicists. To make matters worse, a many more complex higher-order methods have been proposed over the last few years to overcome the now well-known deficiencies of DTI. In Introduction to Diffusion Tensor Imaging: And Higher Order Models, these concepts are explained through extensive use of illustrations rather than equations to help readers gain a more intuitive understanding of the inner workings of these techniques. Emphasis is placed on the interpretation of DTI images and tractography results, the design of experiments, and the types of application studies that can be undertaken. Diffusion MRI is a very active field of research, and theories and techniques are constantly evolving. To make sense of this constantly shifting landscape, there is a need for a textbook that explains the concepts behind how these techniques work in a way that is easy and intuitive to understand—Introduction to Diffusion Tensor Imaging fills this gap. Extensive use of illustrations to explain the concepts of diffusion tensor imaging and related methods Easy to understand, even without a background in physics Includes sections on image interpretation, experimental design, and applications Up-to-date information on more recent higher-order models, which are increasingly being used for clinical applications

Since its first publication in 1965 in the series Grundlehren der mathematischen Wissenschaften this book has had a profound and enduring influence on research into the stochastic processes associated with diffusion phenomena. Generations of mathematicians have appreciated the clarity of the descriptions given of one- or more- dimensional diffusion processes and the mathematical insight provided into Brownian motion. Now, with its republication in the Classics in Mathematics it is hoped that a new generation will be able to enjoy the classic text of Itô and McKean.

Nonlocal diffusion problems arise in a wide variety of applications, including biology, image processing, particle systems, coagulation models, and mathematical finance. These types of problems are also of great interest for their purely mathematical content. This book presents recent results on nonlocal evolution equations with different boundary conditions, starting with the linear theory and moving to nonlinear cases, including two nonlocal models for the evolution of sandpiles. Both existence and uniqueness of solutions are considered, as well as their asymptotic behaviour. Moreover, the authors present results concerning limits of solutions of the nonlocal equations as a rescaling parameter tends to zero. With these limit procedures the most frequently used diffusion models are recovered: the heat equation, the p-Laplacian evolution equation, the porous media equation, the total variation flow, a convection-diffusion equation and the local models for the evolution of sandpiles due to Aronsson-Evans-Wu and Prigozhin. Readers are assumed to be familiar with the basic concepts and techniques of functional analysis and partial differential equations. The text is otherwise self-contained, with the *exposition emphasizing an intuitive understanding and results given with full proofs. It is suitable for graduate students or researchers. The authors cover a subject that has received a great deal of attention in recent years. The book is intended as a reference tool for a general audience in analysis and PDEs, including mathematicians, engineers, physicists, biologists, and others interested in nonlocal diffusion problems.*

The study of electrochemical reactions by relaxation or transient techniques has expanded rapidly over the last two decades. The impetus for the develop ment of these techniques has been the desire to obtain quantitative data on the rates of "fast" electrochemical processes, including those coupled to homogeneous chemical reactions in solution. This has necessarily meant the development of techniques that are capable of delineating the effects of mass transport and charge transfer at very short times. The purpose of this book is to describe how the various transient techniques may be used to obtain the desired information. Emphasis is placed upon the detailed mathematical development of the subject, since this aspect is the most frequently ignored in other texts in this field. In any relaxation or transient technique for the study of rate processes, it is necessary to disturb the reaction from equilibrium or the steady state by applying a perturbing impulse to the system. The system is then allowed to relax to a new equilibrium or steady-state position, and. the transient (i. e. , the response as a function of time) is analyzed to extract the desired kinetic information. In electrochemical studies the heterogeneous rate constants are, in general, dependent upon the potential difference across the interface, so that the perturbing impulse frequently takes the form of a known variation in potential as a function of time.

Since the 'Introduction' to the main text gives an account of the way in which the problems treated in the following pages originated, this 'Preface' may be limited to an acknowledgement of the support the work has received. It started during the pe riod when I was professor of aero- and hydrodynamics at the Technical University in Delft, Netherlands, and many discussions with colleagues ha ve in:fluenced its devel opment. Oftheir names I mention here only that ofH. A. Kramers. Papers No. 1-13 ofthe list given at the end ofthe text were written during that period. Severa! ofthese were attempts to explore ideas which later had to be abandoned, but gradually a line of thought emerged which promised more definite results. This line began to come to the foreground in pa per No. 3 (1939}, while a preliminary formulation ofthe results was given in paper No. 12 (1954}. At that time, however, there still was missing a practica! method for manipulating a certain distribution function of central interest. A six months stay at the Hydrodynamics Laboratories ofthe California Institute of Technology, Pasadena, California (1950-1951}, was supported by a Contract with the Department of the Air F orce, N o. AF 33(038}-17207. A course of lectures was given during this period, which were published in typescript under the title 'On Turbulent Fluid Motion', as Report No. E-34. 1, July 1951, of the Hydrodynamics Laboratory.

You're outnumbered, in fear for your life, surrounded by flesheating zombies. What can save you now? Mathematics, of course. Mathematical Modelling of Zombies engages the imagination to illustrate the power of mathematical modelling. Using zombies as a "hook," you'll learn how mathematics can predict the unpredictable. In order to be prepared for the *apocalypse, you'll need mathematical models, differential equations, statistical estimations, discretetime models, and adaptive strategies for zombie attacks—as well as baseball bats and Dire Straits records (latter two items not included). In Mathematical Modelling of Zombies, Robert Smith? brings together a highly skilled team of contributors to fend off a zombie uprising. You'll also learn how modelling can advise government policy, how theoretical results can be communicated to a nonmathematical audience and how models can be formulated with only limited information. A forward by Andrew Cartmel—former script editor of Doctor Who, author, zombie fan and all-round famous person in science-fiction circles—even provides a genealogy of the undead. By understanding how to combat zombies, readers will be introduced to a wide variety of modelling techniques that are applicable to other real-world issues (biology, epidemiology, medicine, public health, etc.). So if the zombies turn up, reach for this book. The future of the human race may depend on it.*

Polymers are permeable, whilst ceramics, glasses and metals are gener ally impermeable. This may seem a disadvantage in that polymeric containers may allow loss or contamination of their contents and aggressive substances such as water will diffuse into polymeric struc tures such as adhesive joints or fibre-reinforced composites and cause weakening. However, in some cases permeability is an advantage, and one particular area where this is so is in the use of polymers in drug delivery systems. Also, without permeable polymers, we would not enjoy the wide range of dyed fabrics used in clothing and furnishing. The fundamental reason for the permeability of polymers is their relatively high level of molecular motion, a *factor which also leads to their high levels of creep in comparison with ceramics, glasses and metals. The aim of this volume is to examine some timely applied aspects of polymer permeability. In the first chapter basic issues in the mathema tics of diffusion are introduced, and this is followed by two chapters where the fundamental aspects of diffusion in polymers are presented. The following chapters, then, each examine some area of applied science where permeability is a key issue. Each chapter is reasonably self-contained and intended to be informative without frequent outside reference. This inevitably leads to some repetition, but it is hoped that this is not excessive.*

A great deal can be learned through modeling and mathematical analysis about real-life phenomena, even before numerical simulations are used to accurately portray the specific configuration of a situation. Scientific computing also becomes more effective and efficient if it is preceded by some preliminary analysis. These important advantages of mathematical modeling are demonstrated by models of historical importance in an easily understandable way. The organization of Mathematical Models and Their Analysis groups models by the issues that need to be addressed about the phenomena. The new approach shows how mathematics effective for one modeled phenomenon can be used to analyze another unrelated problem. For instance, the mathematics of differential equations useful in understanding the classical physics of planetary models, fluid motion, and heat conduction is also applicable to the seemingly unrelated phenomena of traffic flow and congestion, offshore sovereignty, and regulation of overfishing and deforestation. The formulation and in-depth analysis of these and other models on modern *social issues, such as the management of exhaustible and renewable resources in response to consumption demands and economic growth, are of increasing concern to students and researchers of our time. The modeling of current social issues typically starts with a simple but meaningful model that may not capture all the important elements of the phenomenon. Predictions extracted from such a model may be informative but not compatible with all known observations; so the model may require improvements. The cycle of model formulation, analysis, interpretation, and assessment is made explicit for the modeler to repeat until a model is validated by consistency with all known facts.*

Stochastic Modelling of Reaction-Diffusion Processes

Elliptic Partial Differential Equations
Arnold Diffusion for Smooth Systems of Two and a Half Degrees of Freedom
Diffusion, Quantum Theory, and Radically Elementary Mathematics. (MN-47)
Elementary Feedback Stabilization of the Linear Reaction-Convection-Diffusion Equation and the Wave Equation
Mathematical Modelling of Zombies
Polymer Permeability
Diffusion and Ecological Problems: Modern Perspectives
Volume 2: Reaction-Diffusion Equations

Nonlinear diffusion equations, an important class of parabolic equations, come from a variety of diffusion phenomena which appear widely in nature. They are suggested as mathematical models of physical problems in many fields, such as filtration, phase

transition, biochemistry and dynamics of biological groups. In many cases, the equations possess degeneracy or singularity. The appearance of degeneracy or singularity makes the study more involved and challenging. Many new ideas and methods have been developed to overcome the special difficulties caused by the degeneracy and singularity, which enrich the theory of partial differential equations.This book provides a comprehensive presentation of the basic problems, main results and typical methods for nonlinear diffusion equations with degeneracy. Some results for equations with singularity are touched upon.
Practical introduction for advanced undergraduate or beginning graduate students of applied mathematics, developed at the University of Oxford.
The book deals with the existence, uniqueness, regularity, and asymptotic behavior of solutions to the initial value problem (Cauchy problem) and the initial-Dirichlet problem for a class of degenerate diffusions modeled on the porous medium type equation $u_t = \Delta u^m$, $m \geq 0$, $u \geq 0$. Such models arise in plasma physics, diffusion through porous media, thin liquid film dynamics, as well as in geometric flows such as the Ricci flow on surfaces and the Yamabe flow. The approach presented to these problems uses local regularity estimates and Harnack type inequalities, which yield compactness for families of solutions. The

theory is quite complete in the slow diffusion case ($ m>1$) and in the supercritical fast diffusion case ($m_c
This book is the most comprehensive and flexible theory of chloride ingress in concrete to date. Based on test results and field observations, the book demonstrates the easy application of this theory to practice. The information is presented in a clear style with each chapter containing an introduction, technical applications and examples, and a final section covering the mathematics behind the theory, to enable the reader to obtain a deeper insight into the subject. Primarily aimed at practising engineers engaged in analysis and design of concrete structures exposed to a chloride laden environment, this book is also a useful reference for mathematicians and engineering students.
Unique book on Reaction-Advection-Diffusion problems
The Mathematics of DiffusionOxford University Press
For this edition, a number of typographical errors and minor slip-ups have been corrected. In addition, following the persistent encouragement of Olga Oleinik, I have added a new chapter, Chapter 25, which I titled "Recent Results." This chapter is divided into four sections, and in these I have discussed what I consider to be some of the important developments which have come about since the writing of the first edition. Section I deals with reaction-diffusion

equations, and in it are described both the work of C. Jones, on the stability of the travelling wave for the Fitz-Hugh-Nagumo equations, and symmetry-breaking bifurcations. Section II deals with some recent results in shock-wave theory. The main topics considered are L. Tartar's notion of compensated compactness, together with its application to pairs of conservation laws, and T.-P. Liu's work on the stability of viscous profiles for shock waves. In the next section, Conley's connection index and connection matrix are described; these general notions are useful in con structing travelling waves for systems of nonlinear equations. The final sec tion, Section IV, is devoted to the very recent results of C. Jones and R. Gardner, whereby they construct a general theory enabling them to locate the point spectrum of a wide class of linear operators which arise in stability problems for travelling waves. Their theory is general enough to be applica ble to many interesting reaction-diffusion systems.

If we had to formulate in one sentence what this book is about, it might be "How partial differential equations can help to understand heat explosion, tumor growth or evolution of biological species". These and many other applications are described by reaction-diffusion equations. The theory of reaction-diffusion equations appeared in the first half of the last century. In the present time, it is widely used in population

dynamics, chemical physics, biomedical modelling. The purpose of this book is to present the mathematical theory of reaction-diffusion equations in the context of their numerous applications. We will go from the general mathematical theory to specific equations and then to their applications. Existence, stability and bifurcations of solutions will be studied for bounded domains and in the case of travelling waves. The classical theory of reaction-diffusion equations and new topics such as nonlocal equations and multi-scale models in biology will be considered.

An Introduction to Their Analysis and Numerical Solution
Simple Brownian Diffusion
Nonlocal Diffusion Problems
Multidimensional Diffusion Processes
Shock Waves and Reaction—Diffusion Equations
Asymptotic Solutions and Statistical Problems
Mathematical Theory
The Nonlinear Diffusion Equation
Diffusion Processes and their Sample Paths
Mathematical Models and Their Analysis

Presents a unified treatment of anomalous diffusion problems using fractional calculus in a wide range of applications across scientific and technological disciplines. Diffusion is a principle transport mechanism emerging widely at different scale, from nano to micro and macro levels. This is a contributed book of seventh chapters encompassing local and no-local diffusion *phenomena modelled with integer-order (local) and non-local operators. This book collates research results developed by scientists from different countries but with common research interest in modelling of diffusion problems. The results reported encompass diffusion problems related to efficient numerical modelling, hypersonic flows, approximate analytical solutions of solvent diffusion in polymers and wetting of soils. Some chapters are devoted to fractional diffusion problem with operators with singular and non-singular memory kernels. The book content cannot present the entire rich area of problems related to modelling of diffusion phenomena but allow seeing some new trends and approaches in the modelling technologies. In this context, the fractional models with singular and non-singular kernels the numerical methods and the development of the integration techniques related to the integral-balance approach form fresh fluxes of ideas to this classical engineering area of research.The book is oriented to researchers; master and PhD students involved in diffusion problems with a variety of application and could serves as a rich reference source and a collection of texts provoking new ideas.*

Diffusion has been used extensively in many scientific disciplines to model a wide variety of phenomena. The Mathematics of Diffusion focuses on the qualitative properties of solutions to nonlinear elliptic *and parabolic equations and systems in connection with domain geometry, various boundary conditions, the mechanism of different diffusion rates, and the interaction between diffusion and spatial heterogeneity. The book systematically explores the interplay between different diffusion rates from the viewpoint of pattern formation, particularly Turing's diffusion-driven instability in both homogeneous and heterogeneous environments, and the roles of random diffusion, directed movements, and spatial heterogeneity in the classical Lotka-Volterra competition systems. Interspersed throughout the book are many simple, fundamental, and important open problems for readers to investigate.*

Diffusive motion--displacement due to the cumulative effect of irregular fluctuations--has been a fundamental concept in mathematics and physics since Einstein's work on Brownian motion. It is also relevant to understanding various aspects of quantum theory. This book explains diffusive motion and its relation to both nonrelativistic quantum theory and quantum field theory. It shows how diffusive motion concepts lead to a radical reexamination of the structure of mathematical analysis. The book's inspiration is Princeton University mathematics professor Edward Nelson's influential work in probability, functional analysis, nonstandard analysis, stochastic mechanics, and logic. The book can be used as a tutorial or *reference, or read for pleasure by anyone interested in the role of mathematics in science. Because of the application of diffusive motion to quantum theory, it will interest physicists as well as mathematicians. The introductory chapter describes the interrelationships between the various themes, many of which were first brought to light by Edward Nelson. In his writing and conversation, Nelson has always emphasized and relished the human aspect of mathematical endeavor. In his intellectual world, there is no sharp boundary between the mathematical, the cultural, and the spiritual. It is fitting that the final chapter provides a mathematical perspective on musical theory, one that reveals an unexpected connection with some of the book's main themes.*

The first complete proof of Arnold diffusion—one of the most important problems in dynamical systems and mathematical physics Arnold diffusion, which concerns the appearance of chaos in classical mechanics, is one of the most important problems in the fields of dynamical systems and mathematical physics. Since it was discovered by Vladimir Arnold in 1963, it has attracted the efforts of some of the most prominent researchers in mathematics. The question is whether a typical perturbation of a particular system will result in chaotic or unstable dynamical phenomena. In this groundbreaking book, Vadim Kaloshin and Ke Zhang provide the first *complete proof of Arnold diffusion, demonstrating that that there is topological instability for typical perturbations of five-dimensional integrable systems (two and a half degrees of freedom). This proof realizes a plan John Mather announced in 2003 but was unable to complete before his death. Kaloshin and Zhang follow Mather's strategy but emphasize a more Hamiltonian approach, tying together normal forms theory, hyperbolic theory, Mather theory, and weak KAM theory. Offering a complete, clean, and modern explanation of the steps involved in the proof, and a clear account of background material, this book is designed to be accessible to students as well as researchers. The result is a critical contribution to mathematical physics and dynamical systems, especially Hamiltonian systems.*

Diffusion and growth phenomena abound in the real world surrounding us. Someexamples: growth of the world's population, growth rates of humans, public interest in news events, growth and decline of central city populations, pollution of rivers, adoption of agricultural innovations, and spreading of epidemics and migration of insects. These and numerous other phenomena are illustrations of typical growth and diffusion problems confronted in many branches of the physical, biological and social sciences as well as in various areas of agriculture, business, education, engineering medicine and public *health. The book presents a large number of mathematical models to provide frameworks forthe analysis and display of many of these. The models developed and utilizedcommence with relatively simple exponential, logistic and normal distribution functions. Considerable attention is given to time dependent growth coefficients and carrying capacities. The topics of discrete and distributed time delays, spatial-temporal diffusion and diffusion with reaction are examined. Throughout the book there are a great many numerical examples. In addition and most importantly, there are more than 50 in-depth "illustrations" of the application of a particular framework ormodel based on real world problems. These examples provide the reader with an appreciation of the intrinsic nature of the phenomena involved. They address mainly readers from the physical, biological, and social sciences, as the only mathematical background assumed is elementary calculus. Methods are developed as required, and the reader can thus acquire useful tools for planning, analyzing, designing,and evaluating studies of growth transfer and diffusion phenomena. The book draws on the author's own hands-on experience in problems of environmental diffusion and dispersion, as well as in technology transfer and innovation diffusion.*

An undergraduate text focussing on mathematical modelling stimulated by contemporary industrial problems.

The book lies at the interface of mathematics, social media analysis, and data science. Its authors aim to introduce a new dynamic modeling approach to the use of partial differential equations for describing information diffusion over online social networks. The eigenvalues and eigenvectors of the Laplacian matrix for the underlying social network are used to find communities (clusters) of online users. Once these clusters are embedded in a Euclidean space, the mathematical models, which are reaction-diffusion equations, are developed based on intuitive social distances between clusters within the Euclidean space. The models are validated with data from major social media such as Twitter. In addition, mathematical analysis of these models is applied, revealing insights into information flow on social media. Two applications with geocoded Twitter data are included in the book: one describing the social movement in Twitter during the Egyptian revolution in 2011 and another predicting influenza prevalence. The new approach advocates a paradigm shift for modeling information diffusion in online social networks and lays the theoretical groundwork for many spatio-temporal modeling problems in the big-data era.

Initial Value Problems and Local Regularity Theory

Numerical Solution of Time-Dependent Advection-Diffusion-Reaction Equations

Mathematical Frameworks and Applications

Case Studies in the Diffusion of Heat and Matter
Schrödinger Equations and Diffusion Theory
Introduction to Monte Carlo Methods for Transport and Diffusion Equations
Convection-diffusion Problems
An Introduction to the Standard Theoretical Models
Fractional Diffusion Equations and Anomalous Diffusion
Degenerate Nonlinear Diffusion Equations

Though it incorporates much new material, this new edition preserves the general character of the book in providing a collection of solutions of the equations of diffusion and describing how these solutions may be obtained.

Many physical problems involve diffusive and convective (transport) processes. When diffusion dominates convection, standard numerical methods work satisfactorily. But when convection dominates diffusion, the standard methods become unstable, and special techniques are needed to compute accurate numerical approximations of the unknown solution. This convection-dominated regime is the focus of the book. After discussing at length the nature of solutions to convection-dominated convection-diffusion problems, the authors motivate and design numerical methods that are particularly suited to this c.

The aim of these notes is to include in a uniform *presentation style several topics related to the theory of degenerate nonlinear diffusion equations, treated in the mathematical framework of evolution equations with multivalued m-accretive operators in Hilbert spaces. The problems concern nonlinear parabolic equations involving two cases of degeneracy. More precisely, one case is due to the vanishing of the time derivative coefficient and the other is provided by the vanishing of the diffusion coefficient on subsets of positive measure of the domain. From the mathematical point of view the results presented in these notes can be considered as general results in the theory of degenerate nonlinear diffusion equations. However, this work does not seek to present an exhaustive study of degenerate diffusion equations, but rather to emphasize some rigorous and efficient techniques for approaching various problems involving degenerate nonlinear diffusion equations, such as well-posedness, periodic solutions, asymptotic behaviour, discretization schemes, coefficient identification, and to introduce relevant solving methods for each of them.*

Schrödinger Equations and Diffusion Theory addresses the question "What is the Schrödinger equation?" in terms of diffusion processes, and shows that the Schrödinger equation and diffusion equations in duality are equivalent. In turn, Schrödinger's conjecture of 1931 is solved. The *theory of diffusion processes for the Schrödinger equation tell us that we must go further into the theory of systems of (infinitely) many interacting quantum (diffusion) particles. The method of relative entropy and the theory of transformations enable us to construct severely singular diffusion processes which appear to be equivalent to Schrödinger equations. The theory of large deviations and the propagation of chaos of interacting diffusion particles reveal the statistical mechanical nature of the Schrödinger equation, namely, quantum mechanics. The text is practically self-contained and requires only an elementary knowledge of probability theory at the graduate level.*

From the reviews: "This book is an excellent presentation of the application of martingale theory to the theory of Markov processes, especially multidimensional diffusions. [...] This monograph can be recommended to graduate students and research workers but also to all interested in Markov processes from a more theoretical point of view." Mathematische Operationsforschung und Statistik

Transient Techniques in Electrochemistry
Diffusion of Chloride in Concrete
Stochastic Processes and Applications
The Porous Medium Equation
And Higher Order Models