Stochastic Representations And A Geometric Parametrization

Surface topography is, generally, composed of many length scales starting from its physical geometry, to its microscopic or atomic scales known by roughness. The spatial and geometrical evolution of the roughness topography of engineered surfaces avail comprehensive understanding, and interpretation of many physical and engineering problems such as friction, and wear mechanisms during the mechanical contact between adjoined surfaces. Obviously, the topography of rough surfaces is of random nature. It is composed of irregular hills/valleys being spatially correlated. The relation between their densities and their geometric properties are the fundamental topics that have been developed, in this research study, using the theory of random fields and their geometry.

The aim of the book is to study some aspects of geometric evolutions, such as mean curvature flow and anisotropic mean curvature flow of hypersurfaces. We analyze the origin of such flows and their geometric and variational nature. Some of the most important aspects of mean curvature flow are described, such as the comparison principle and its use in the definition of suitable weak solutions. The anisotropic evolutions, which can be considered as a generalization of mean curvature flow, are studied from the view point of Finsler geometry. Concerning singular perturbations, we discuss the convergence of the Allen–Cahn (or Ginsburg–Landau) type equations to (possibly anisotropic) mean curvature flow before the onset of singularities in the limit problem. We study such kinds of asymptotic problems also in the static case, showing convergence to prescribed curvature-type problems.

This book covers different, current research directions in the context of variational methods for non-linear geometric data. Each chapter is authored by leading experts in the respective discipline and provides an introduction, an overview and a description of the current state of the art. Non-linear geometric data arises in various applications in science and engineering. Examples of nonlinear data spaces are diverse and include, for instance, nonlinear spaces of matrices, spaces of curves, shapes as well as manifolds of probability measures. Applications can be found in biology, medicine, product engineering, geography and computer vision for instance. Variational methods on the other hand have evolved to being amongst the most powerful tools for applied mathematics. They involve techniques from various branches of mathematics such as statistics, modeling, optimization, numerical mathematics and analysis. The vast majority of research on variational methods, however, is focused on data in linear spaces. Variational methods for non-linear data is currently an emerging research topic. As a result, and since such methods involve various branches of mathematics, there is a plethora of different, recent approaches dealing with different aspects of variational methods for nonlinear geometric data. Research results are rather scattered and appear in journals of different mathematical communities. The main purpose of the book is to account for that by providing, for the first time, a comprehensive collection of different research directions and existing approaches in this context. It is organized in a way that leading researchers from the different fields provide an introductory overview of recent research directions in their respective discipline. As such, the book is a unique reference work for both newcomers in the field of variational methods for non-linear geometric data, as well as for established experts that aim at to exploit new research directions or collaborations. Chapter 9 of this book is available open access under a CC BY 4.0 license at link.springer.com.

Some twenty years have elapsed since the first attempts at planning were made by researchers in artificial intelligence. These early programs concentrated on the development of plans for the solution of puzzles or toy problems, like the rearrangement of stacks of blocks. These early programs provided the foundation for the work described in this book, the automatic generation of plans for industrial assembly. As one reads about the complex and sophisticated planners in the current gen eration, it is important to keep in mind that they are addressing real-world problems. Although these systems may become the "toy" systems of tomor row, they are providing a solid foundation for future, more general and more advanced planning tools. As demonstrated by the papers in this book, the field of computer-aided mechanical assembly planning is maturing. It now may include: • geometric descriptions of parts extracted from or compatible with CAD programs; • constraints related to part interference and the use of tools; • fixtures and jigs required for the assembly; • the nature of connectors, matings and other relations between parts; • number of turnovers required during the assembly; • handling and gripping requirements for various parts; • automatic identification of subassemblies. This is not an exhaustive list, but it serves to illustrate the complexity of some of the issues which are discussed in this book. Such issues must be considered in the design of the modern planners, as they produce desirable assembly sequences and precedence relations for assembly.

This paper introduces time-continuous numerical schemes to simulate stochastic differential equations (SDEs) arising in mathematical finance, population dynamics, chemical kinetics, epidemiology, biophysics, and polymeric fluids. These schemes are obtained by spatially discretizing the Kolmogorov equation associated with the SDE in such a way that the resulting semi-discrete equation generates a Markov jump process that can be realized exactly using a Monte Carlo method. In this construction the jump size of the approximation can be bounded uniformly in space, which often guarantees that the schemes are numerically stable for both finite and long time simulation of SDEs.

The purpose of this volume is to give an up-to-date introduction to tensor valuations and their applications. Starting with classical results concerning scalar-valued valuations on the families of convex bodies and convex polytopes, it proceeds to the modern theory of tensor valuations. Product and Fourier-type transforms are introduced and various integral formulae are derived. New and

well-known results are presented, together with generalizations in several directions, including extensions to the non-Euclidean setting and to non-convex sets. A variety of applications of tensor valuations to models in stochastic geometry, to local stereology and to imaging are also discussed.
It was originally planned that the Theory of Stochastic Processes would consist of two volumes: the first to be devoted to general problems and the second to specific cJasses of random processes. It became apparent, however, that the amount of material related to specific problems of the theory could not possibly be incJuded in one volume. This is how the present third volume came into being. This voJume contains the theory of martingales, stochastic integrals, stochastic differential equations, diffusion, and continuous Markov processes. The theory of stochastic processes is an actively developing branch of mathe matics, and it would be an unreasonable and impossible task to attempt to encompass it in a single treatise (even a multivolume one). Therefore, the authors, guided by their own considerations concerning the relative importance of various results, naturally had to be selective in their choice of material. The authors are fully aware that such a selective process is not perfecL Even a number of topics that are, in the authors' opinion, of great importance could not be incJuded, for example, limit theorems for particular cJasses of random processes, the theory of random fields, conditional Markov processes, and information and statistics of random processes. With the publication of this last volume, we recall with gratitude oUf associates who assisted us in this endeavor, and express our sincere thanks to G.N. Sytaya, L.V. Lobanova, P.V. Boiko, N.F. Ryabova, N.A. Skorohod, V.V. Skorohod, N.I. Portenko, and L.I. Gab.
This book presents a self-contained introduction to the analytic foundation of a level set approach for various surface evolution equations including curvature flow equations. These equations are important in many applications, such as material sciences, image processing and differential geometry. The goal is to introduce a generalized notion of solutions allowing singularities, and to solve the initial-value problem globally-in-time in a generalized sense. Various equivalent definitions of solutions are studied. Several new results on equivalence are also presented. Moreover, structures of level set equations are studied in detail. Further, a rather complete introduction to the theory of viscosity solutions is contained, which is a key tool for the level set approach. Although most of the results in this book are more or less known, they are scattered in several references, sometimes without proofs. This book presents these results in a synthetic way with full proofs. The intended audience are graduate students and researchers in various disciplines who would like to know the applicability and detail of the theory as well as its flavour. No familiarity with differential geometry or the theory of viscosity solutions is required. Only prerequisites are calculus, linear algebra and some basic knowledge about semicontinuous functions.
Abstract Biological vision is a rather fascinating domain of research. Scientists of various origins like biology, medicine, neurophysiology, engineering, math

ematics, etc. aim to understand the processes leading to visual perception process and at reproducing such systems. Understanding the environment is most of the time done through visual perception which appears to be one of the most fundamental sensory abilities in humans and therefore a significant amount of research effort has been dedicated towards modelling and repro ducing human visual abilities. Mathematical methods play a central role in this endeavour. Introduction David Marr's theory v^as a pioneering step tov^ards understanding visual percep tion. In his view human vision was based on a complete surface reconstruction of the environment that was then used to address visual subtasks. This approach was proven to be insufficient by neuro-biologists and complementary ideas from statistical pattern recognition and artificial intelligence were introduced to bet ter address the visual perception problem. In this framework visual perception is represented by a set of actions and rules connecting these actions. The emerg ing concept of active vision consists of a selective visual perception paradigm that is basically equivalent to recovering from the environment the minimal piece information required to address a particular task of interest.

This unique two-volume set presents the subjects of stochastic processes, information theory, and Lie groups in a unified setting, thereby building bridges between fields that are rarely studied by the same people. Unlike the many excellent formal treatments available for each of these subjects individually, the emphasis in both of these volumes is on the use of stochastic, geometric, and group-theoretic concepts in the modeling of physical phenomena. Stochastic Models, Information Theory, and Lie Groups will be of interest to advanced undergraduate and graduate students, researchers, and practitioners working in applied mathematics, the physical sciences, and engineering. Extensive exercises and motivating examples make the work suitable as a textbook for use in courses that emphasize applied stochastic processes or differential geometry.

The subject of this book is Osserman semi-Riemannian manifolds, and in particular, the Osserman conjecture in semi-Riemannian geometry. The treatment is pitched at the intermediate graduate level and requires some intermediate knowledge of differential geometry. The notation is mostly coordinate-free and the terminology is that of modern differential geometry. Known results toward the complete proof of Riemannian Osserman conjecture are given and the Osserman conjecture in Lorentzian geometry is proved completely. Counterexamples to the Osserman conjuncture in generic semi-Riemannian signature are provided and properties of semi-Riemannian Osserman manifolds are investigated.

Collecting together contributed lectures and mini-courses, this book details the research presented in a special semester titled “Geometric mechanics – variational and stochastic methods” run in the first half of 2015 at the Centre Interfacultaire Bernoulli (CIB) of the Ecole Polytechnique Fédérale de Lausanne. The aim of the semester was to develop a common language needed to handle the wide variety of problems and phenomena occurring in stochastic geometric mechanics. It gathered mathematicians and scientists from several different areas of mathematics (from analysis, probability, numerical analysis and statistics, to algebra, geometry, topology, representation theory, and dynamical systems theory) and also areas of mathematical physics, control theory, robotics, and the life sciences, with the aim of developing the new research area in a concentrated joint effort, both from the theoretical and applied points of view. The lectures were given by leading specialists in different areas of mathematics and its applications, building bridges among the various communities involved and working jointly on developing the envisaged new interdisciplinary subject of stochastic geometric mechanics.

Focusing on fundamental principles, Hydro-Environmental Analysis: Freshwater Environments presents in-depth information about freshwater environments and how they are influenced by regulation. It provides a holistic approach, exploring the factors that impact water quality and quantity, and the regulations, policy and management methods that are necessary to maintain this vital resource. It offers a historical viewpoint as well as an overview and foundation of the physical, chemical, and biological characteristics affecting the management of freshwater environments. The book concentrates on broad and general concepts, providing an interdisciplinary foundation. The author covers the methods of measurement and classification; chemical, physical, and biological characteristics; indicators of ecological health; and management and restoration. He also considers common indicators of environmental health; characteristics and operations of regulatory control structures; applicable laws and regulations; and restoration methods. The text delves into rivers and streams in the first half and lakes and reservoirs in the second half. Each section centers on the characteristics of those systems and methods of classification, and then moves on to discuss the physical, chemical, and biological characteristics of each. In the section on lakes and reservoirs, it examines the characteristics and operations of regulatory structures, and presents the methods commonly used to assess the environmental health or integrity of these water bodies. It also introduces considerations for restoration, and presents two unique aquatic environments: wetlands and reservoir tailwaters. Written from an engineering perspective, the book is an ideal introduction to the aquatic and limnological sciences for students of environmental science, as well as students of environmental engineering. It also serves as a reference for engineers and scientists involved in the management, regulation, or restoration of freshwater environments.

Stochastic geometry deals with models for random geometric structures. Its early beginnings are found in playful geometric probability questions, and it has vigorously developed during recent decades, when an increasing number of real-world applications in various sciences required solid mathematical foundations. Integral geometry studies geometric mean values with respect to invariant measures and is, therefore, the appropriate tool for the investigation of random geometric structures that exhibit invariance under translations or motions. Stochastic and Integral Geometry provides the mathematically oriented reader with a rigorous and detailed introduction to the basic stationary models used in stochastic geometry – random sets, point processes, random mosaics – and to the integral geometry that is needed for their investigation. The interplay between both disciplines is demonstrated by various fundamental results. A chapter on selected problems about geometric probabilities and an outlook to non-stationary models are included, and much additional information is given in the section notes.

This volume is devoted to stochastic and chaotic oscillations in dissipative systems. Chapter 1 deals with mathematical models of deterministic, discrete and distributed dynamical systems. In Chapter 2, the two basic trends of order and chaos are considered. The next three chapters describe stochasticity transformers, amplifiers and generators, turbulence, and phase portraits of steady-state motions and their bifurcations. Chapter 6 treats the topics of stochastic and chaotic attractors, and this is followed by two chapters dealing with routes to chaos and the quantitative characteristics of stochastic and chaotic motions. Finally, Chapter 9, which comprises more than one-third of the book, presents examples of systems having chaotic and stochastic motions drawn from mechanical, physical, chemical and biological systems. The book concludes with a comprehensive bibliography. For mathematicians, physicists, chemists and biologists interested in stochastic and chaotic oscillations in dynamical systems.

An extensive update to a classic text Stochastic geometry and spatial statistics play a fundamental role in many modern branches of physics, materials sciences, engineering, biology and environmental sciences. They offer successful models for the description of random two- and three-dimensional micro and macro structures and statistical methods for their analysis. The previous edition of this book has served as the key reference in its field for over 18 years and is regarded as the best treatment of the subject of stochastic geometry, both as a subject with vital applications to spatial statistics and as a very interesting field of mathematics in its own right. This edition: Presents a wealth of models for spatial patterns and related statistical methods. Provides a great survey of the modern theory of random tessellations, including many new models that became tractable only in the last few years. Includes new sections on random networks and random graphs to review the recent ever growing interest in these areas. Provides an excellent introduction to theory and modelling of point processes, which covers some very latest developments. Illustrate the forefront theory of random sets, with many applications. Adds new results to the discussion of fibre and surface processes. Offers an updated collection of useful stereological methods. Includes 700 new references. Is written in an accessible style enabling non-mathematicians to benefit from this book. Provides a companion website hosting information on recent developments in the field www.wiley.com/go/cskm Stochastic Geometry and its Applications is ideally suited for researchers in physics, materials science, biology and ecological sciences as well as mathematicians and statisticians. It should also serve as a valuable introduction to the subject for students of mathematics and statistics.

This book presents a treatise on the theory and modeling of second-order stationary processes, including an exposition on selected application areas that are important in the engineering and applied sciences. The foundational issues regarding stationary processes dealt with in the beginning of the book have a long history, starting in the 1940s with the work of Kolmogorov, Wiener, Cramér and his students, in particular Wold, and have since been refined and complemented by many others. Problems concerning the filtering and modeling of stationary random signals and systems have also been addressed and studied, fostered by the advent of modern digital computers, since the fundamental work of R.E. Kalman in the early 1960s. The book offers a unified and logically consistent view of the subject based on simple ideas from Hilbert space geometry and coordinate-free thinking. In this framework, the concepts of stochastic state space and state space modeling, based on the notion of the conditional independence of past and future flows of the relevant signals, are revealed to be fundamentally unifying ideas. The book, based on over 30 years of original research, represents a valuable contribution that will inform the fields of stochastic modeling, estimation, system identification, and time series analysis for decades to come. It also provides the mathematical tools needed to grasp and analyze the structures of algorithms in stochastic systems theory.

Unlike much of the existing literature, Stochastic Finance: A Numeraire Approach treats price as a number of units of one asset needed for an acquisition of a unit of another asset instead of expressing prices in dollar terms exclusively. This numeraire approach leads to simpler pricing options for complex products, such as barrier, lookback, quant

This book constitutes the refereed proceedings of the 16th European Workshop on Computer Performance Engineering, EPEW 2019, held in Milan, Italy, in November 2019. The 10 papers presented in this volume together with one invited talk were carefully reviewed and selected from 13 submissions. The papers presented at the workshop reflect the diversity of modern performance engineering, with topics ranging from modeling and analysis of network/control protocols and high performance/BigData information systems, analysis of scheduling, blockchain technology, analytical modeling and simulation of computer/network systems.

This largely self-contained book provides a unified framework of semi-Lagrangian strategy for the approximation of hyperbolic PDEs, with a special focus on Hamilton-Jacobi equations. The authors provide a rigorous discussion of the theory of viscosity solutions and the concepts underlying the construction and analysis of difference schemes; they then proceed to high-order semi-Lagrangian schemes and their applications to problems in fluid dynamics, front propagation, optimal control, and image processing. The developments covered in the text and the references come from a wide range of literature.

Stochastic geometry involves the study of random geometric structures, and blends geometric, probabilistic, and statistical methods to provide powerful techniques for modeling and analysis. Recent developments in computational statistical analysis, particularly Markov chain Monte Carlo, have enormously extended the range of feasible applications. Stochastic Geometry: Likelihood and Computation provides a coordinated

collection of chapters on important aspects of the rapidly developing field of stochastic geometry, including: o a "crash-course" introduction to key stochastic geometry themes o considerations of geometric sampling bias issues o tesselations o shape o random sets o image analysis o spectacular advances in likelihood-based inference now available to stochastic geometry through the techniques of Markov chain Monte Carlo
Based on a conference held in honor of Professor Tarow Indow, this volume is organized into three major topics concerning the use of geometry in perception: * space -- referring to attempts to represent the subjective space within which we locate ourselves and perceive objects to reside; * color -- dealing with attempts to represent the structure of color percepts as revealed by various experimental procedures; and * scaling -- focusing on the organization of various bodies of data -- in this case perceptual -- through scaling techniques, primarily multidimensional ones. These topics provide a natural organization of the work in the field, as well as one that corresponds to the major aspects of Indow's contributions. This book's goal is to provide the reader with an overview of the issues in each of the areas, and to present current results from the laboratories of leading researchers in these areas.
Stochastic differential equations, and Hoermander form representations of diffusion operators, can determine a linear connection associated to the underlying (sub)-Riemannian structure. This is systematically described, together with its invariants, and then exploited to discuss qualitative properties of stochastic flows, and analysis on path spaces of compact manifolds with diffusion measures. This should be useful to stochastic analysts, especially those with interests in stochastic flows, infinite dimensional analysis, or geometric analysis, and also to researchers in sub-Riemannian geometry. A basic background in differential geometry is assumed, but the construction of the connections is very direct and itself gives an intuitive and concrete introduction. Knowledge of stochastic analysis is also assumed for later chapters.
Somebody had to do it. The Chinese speak of deep water wells called "grandfather wells" because they take three generations of diggers to complete. Imagine the thought of such a well being abandoned incomplete by the third generation. What a loss! This book is like a grandfather well except that it has taken only two generations, John Hilliard's and mine, to finish. When I saw his manuscript lying in a heap, I decided that I must spend the time to put it and his notes into a publishable form. Now, it is done. This book is mostly about performing spatial measurements through the statistical sampling of images; it is a text on classical stereology as John Hilliard saw it. His vision of the subject was broad. Consequently, its title is broad too. It presents this subject and some of its modem extensions from the classical perspective of the one of the founders of the field, and my first advisor at Northwestern University, John Hilliard. There is nothing new in this book but much that may have been lost over time. It rediscovers many useful discussions about such subjects as the variances of stereo logical measurements, anisotropy etc. It recovers some of the dialogues between John Hilliard and his students on such topics as fractals and Monte Carlo simulations. It recaptures a little of John Hilliard's unique and subtle wit.
The material collected in this volume reflects the active present of this area of mathematics, ranging from the abstract theory of gradient flows to stochastic representations of non-linear parabolic PDE's. Articles will highlight the present as well as expected future directions of development of the field with particular emphasis on

applications. The article by Ambrosio and Savaré discusses the most recent development in the theory of gradient flow of probability measures. After an introduction reviewing the properties of the Wasserstein space and corresponding subdifferential calculus, applications are given to evolutionary partial differential equations. The contribution of Herrero provides a description of some mathematical approaches developed to account for quantitative as well as qualitative aspects of chemotaxis. Particular attention is paid to the limits of cell's capability to measure external cues on the one hand, and to provide an overall description of aggregation models for the slim mold Dictyostelium discoideum on the other. The chapter written by Masmoudi deals with a rather different topic - examples of singular limits in hydrodynamics. This is nowadays a well-studied issue given the amount of new results based on the development of the existence theory for rather general systems of equations in hydrodynamics. The paper by DeLellis addreses the most recent results for the transport equations with regard to possible applications in the theory of hyperbolic systems of conservation laws. Emphasis is put on the development of the theory in the case when the governing field is only a BV function. The chapter by Rein represents a comprehensive survey of results on the Poisson-Vlasov system in astrophysics. The question of global stability of steady states is addressed in detail. The contribution of Soner is devoted to different representations of non-linear parabolic equations in terms of Markov processes. After a brief introduction on the linear theory, a class of non-linear equations is investigated, with applications to stochastic control and differential games. The chapter written by Zuazua presents some of the recent progresses done on the problem of controllabilty of partial differential equations. The applications include the linear wave and heat equations,parabolic equations with coefficients of low regularity, and some fluid-structure interaction models. - Volume 1 focuses on the abstract theory of evolution - Volume 2 considers more concrete probelms relating to specific applications - Volume 3 reflects the active present of this area of mathematics, ranging from the abstract theory of gradient flows to stochastic representations of non-linear PDEs

This volume and Stochastic Processes, Physics and Geometry: New Interplays. I present state-of-the-art research currently unfolding at the interface between mathematics and physics. Included are select articles from the international conference held in Leipzig (Germany) in honor of Sergio Albeverio's sixtieth birthday. The theme of the conference, ``Infinite Dimensional (Stochastic) Analysis and Quantum Physics'', was chosen to reflect Albeverio's wide-ranging scientific interests. The articles in these books reflect that broad range of interests and provide a detailed overview highlighting the deep interplay among stochastic processes, mathematical physics, and geometry. The contributions are written by internationally recognized experts in the fields of stochastic analysis, linear and nonlinear (deterministic and stochastic) PDEs, infinite dimensional analysis, functional analysis, commutative and noncommutative probability theory, integrable systems, quantum and statistical mechanics, geometric quantization, and neural networks. Also included are applications in biology and other areas. Most of the contributions are high-level research papers. However, there are also some overviews on topics of general interest. The articles selected for publication in these volumes were specifically chosen to introduce readers to advanced topics, to emphasize interdisciplinary connections, and to stress future research directions.

Volume I contains contributions from invited speakers; Volume II contains additional contributed papers.

Stochastic Geometry is the mathematical discipline which studies mathematical models for random geometric structures. This book collects lectures presented at the CIME summer school in Martina Franca in September 2004. The main lecturers covered Spatial Statistics, Random Points, Integral Geometry and Random Sets. These are complemented by two additional contributions on Random Mosaics and Crystallization Processes. The book presents a comprehensive and up-to-date description of important aspects of Stochastic Geometry.

This volume is an attempt to provide a graduate level introduction to various aspects of stochastic geometry, spatial statistics and random fields, with special emphasis placed on fundamental classes of models and algorithms as well as on their applications, e.g. in materials science, biology and genetics. This book has a strong focus on simulations and includes extensive codes in Matlab and R which are widely used in the mathematical community. It can be seen as a continuation of the recent volume 2068 of Lecture Notes in Mathematics, where other issues of stochastic geometry, spatial statistics and random fields were considered with a focus on asymptotic methods.

Presenting important trends in the field of stochastic analysis, this collection of thirteen articles provides an overview of recent developments and new results. Written by leading experts in the field, the articles cover a wide range of topics, ranging from an alternative set-up of rigorous probability to the sampling of conditioned diffusions. Applications in physics and biology are treated, with discussion of Feynman formulas, intermittency of Anderson models and genetic inference. A large number of the articles are topical surveys of probabilistic tools such as chaining techniques, and of research fields within stochastic analysis, including stochastic dynamics and multifractal analysis. Showcasing the diversity of research activities in the field, this book is essential reading for any student or researcher looking for a guide to modern trends in stochastic analysis and neighbouring fields.

This volume and Stochastic Processes, Physics and Geometry: New Interplays. II present state-of-the-art research currently unfolding at the interface between mathematics and physics. Included are select articles from the international conference held in Leipzig (Germany) in honor of Sergio Albeverio's sixtieth birthday. The theme of the conference, ``Infinite Dimensional (Stochastic) Analysis and Quantum Physics'', was chosen to reflect Albeverio's wide-ranging scientific interests. The articles in these books reflect that broad range of interests and provide a detailed overview highlighting the deep interplay among stochastic processes, mathematical physics, and geometry. The contributions are written by internationally recognized experts in the fields of stochastic analysis, linear and nonlinear (deterministic and stochastic) PDEs, infinite dimensional analysis, functional analysis, commutative and noncommutative probability theory, integrable systems, quantum and statistical mechanics, geometric quantization, and neural networks. Also included are applications in biology and other areas. Most of the contributions are high-level research papers. However, there are also some overviews on topics of general interest. The articles selected for publication in these volumes were specifically chosen to introduce readers to advanced topics, to emphasize interdisciplinary connections, and to stress future research directions. Volume I contains contributions from invited speakers; Volume II contains additional

contributed papers.

Consists of papers given at the ICMS meeting held in 1994 on this topic, and brings together some of the world's best known authorities on stochastic partial differential equations.

This is a very basic and accessible introduction to option pricing, invoking a minimum of stochastic analysis and requiring only basic mathematical skills. It covers the theory essential to the statistical modeling of stocks, pricing of derivatives with martingale theory, and computational finance including both finite-difference and Monte Carlo methods.

This volume corresponds to the invited lectures and advanced research papers presented at the NATD Advanced Study Institute on Nonlinear Stochastic Problems with emphasis on Identification, Signal Processing, Control and Nonlinear Filtering held in Algarve (Portugal), on May 1982. The book is a blend of theoretical issues, algorithmic implementation aspects, and application examples. In many areas of science and engineering, there are problems which are intrinsically nonlinear 3nd stochastic in nature. Clear examples arise in identification and mOdeling, signal processing, nonlinear filtering, stochastic and adaptive conLrol. The meeting was organized because it was felt that there is a need for discussion of the methods and philosophy underlying these different areas, and in order to communicate those approaches that have proven to be effective. As the computational technology progresses, more general approaches to a number of problems which have been treated previously by linearization and perturbation methods become feasible and rewarding.

Stochastic Representation and Analysis of Rough Surface TopographyLAP Lambert Academic Publishing

Topics include matrix-geometric invariant vectors, buffer models, queues in a random environment and more.

This volume offers a unique and accessible overview of the most active fields in Stochastic Geometry, up to the frontiers of recent research. Since 2014, the yearly meeting of the French research structure GDR GeoSto has been preceded by two introductory courses. This book contains five of these introductory lectures. The first chapter is a historically motivated introduction to Stochastic Geometry which relates four classical problems (the Buffon needle problem, the Bertrand paradox, the Sylvester four-point problem and the bicycle wheel problem) to current topics. The remaining chapters give an application motivated introduction to contemporary Stochastic Geometry, each one devoted to a particular branch of the subject: understanding spatial point patterns through intensity and conditional intensities; stochastic methods for image analysis; random fields and scale invariance; and the theory of Gibbs point processes. Exposing readers to a rich theory, this book will encourage further exploration of the subject and its wide applications.

Stochastic geometry is the branch of mathematics that studies geometric structures associated with random configurations, such as random graphs, tilings and mosaics. Due to its close ties with stereology and spatial statistics, the results in this area are relevant for a large number of important applications, e.g. to the mathematical modeling and statistical analysis of telecommunication networks, geostatistics and image analysis. In recent years – due mainly to the impetus of the authors and their

collaborators – a powerful connection has been established between stochastic geometry and the Malliavin calculus of variations, which is a collection of probabilistic techniques based on the properties of infinite-dimensional differential operators. This has led in particular to the discovery of a large number of new quantitative limit theorems for high-dimensional geometric objects. This unique book presents an organic collection of authoritative surveys written by the principal actors in this rapidly evolving field, offering a rigorous yet lively presentation of its many facets.
?This book collects some recent developments in stochastic control theory with applications to financial mathematics. We first address standard stochastic control problems from the viewpoint of the recently developed weak dynamic programming principle. A special emphasis is put on the regularity issues and, in particular, on the behavior of the value function near the boundary. We then provide a quick review of the main tools from viscosity solutions which allow to overcome all regularity problems. We next address the class of stochastic target problems which extends in a nontrivial way the standard stochastic control problems. Here the theory of viscosity solutions plays a crucial role in the derivation of the dynamic programming equation as the infinitesimal counterpart of the corresponding geometric dynamic programming equation. The various developments of this theory have been stimulated by applications in finance and by relevant connections with geometric flows. Namely, the second order extension was motivated by illiquidity modeling, and the controlled loss version was introduced following the problem of quantile hedging. The third part specializes to an overview of Backward stochastic differential equations, and their extensions to the quadratic case.?