

Preface

The Centro Internazionale Matematico Estivo (CIME) organized a Summer School on SPATIAL STOCHASTIC PROCESSES from July 1st to July 8th, 2001, at the Ducal Palace in Martina Franca (in the region of Apulia, South Italy). The theory of stochastic processes indexed by a partially ordered set has been the subject of much research over the past twenty years. The objective of this Summer School was to bring to a large audience of young probabilists the main parts of the general theory of spatial processes, including the theory of set-indexed martingales and to present some branches of applications of this theory. Spatial stochastic processes can be analysed in several ways. This book brings many different tools (stochastic geometry, martingale theory, spatial local time, Brownian sheet, infinite particle systems), enabling a broad variety of applications in environmental sciences, spatial statistics, social sciences, structure of material and image analysis. In this volume, the reader will find different approaches which foster the development of tools to modelling the spatial aspects of stochastic problems. The first chapter is a course in stochastic geometry on the main structures of spatially birth and growth processes. The up-to-date techniques in this subject are given and applications in the new and important domain of polymers crystallization processes are presented. The second and third chapters constitute an introduction to the set-indexed martingale theory. Different classes of martingales are defined and Doob-Meyer decompositions are studied. Two types of convergence are defined for set-indexed processes: functional and semi-functional convergence. The former is appropriate for processes whose sample paths satisfy a regularity property, and the latter for processes whose sample paths are badly behaved. Poisson and central limit theorems are then proven for set-indexed strong martingales. In chapter four a quite complete study of local time and sample path properties for multi-parameter processes is presented. Another direction (chapter five) is a quite complete study of local time and sample path properties for multi-parameter processes. Lastly, chapter six is a course devoted to the fine analysis mixing results for critical nearest particle systems using spectral gap estimates.

I am grateful to all of the authors for their very fine presentations. It was a pleasure for me to work with them. It was a pleasure for me to work with them. Thanks also to all the participants; their enthusiasm and ques-

tions were a source of formulating new problems and interests for all of us. Some of the participants gave some very interesting short seminars. I wish to thank the CIME for giving us the opportunity to bring together excellent and prominent lecturers and a large number of brilliant young mathematicians from 12 different countries. I acknowledge also the Italian Ministry for Foreign Affairs (MAE) and UNESCO, without whose financial support the course would have never taken place. I would like also to thank the Mayor, the General Secretariat and the complete staff of the Town Council of Martina Franca, which offered the 17th century Ducal Palace as the site of the course and for their warm hospitality. It is a great pleasure for me to thank, especially, Dr. Rosa Maria Minnini for her organizational skills and the assistance in all the details before and during the course – and all this with a smile. It's clear that without her, the course could not possibly have run so smoothly. Finally, I wish to thank my colleague and friend Prof. Vincenzo Capasso for his support, help and for the trust he places in me. I thank also Mrs. Miriam Beller for her expert assistance in the preparation of the volume for publication.

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