Preface

The week before Easter 2004 a conference on spatial point process modelling and its applications was held in Benicàssim (Castellón, Spain). The organizers targeted two aims. The first goal was to bring together most of the known people to guarantee the high scientific quality of the meeting to foster the theoretical and practical use of spatial point processes. The second one consisted of enabling young researchers to present their work and to obtain a valuable feed-back coming from the reknown specialists in the domain. The contributions of all the participants were published in the proceedings book of the conference.

The majority of the contributions in this book represents the reviewed version of the papers presented during the conference. In order to offer the reader a larger spectrum of this domain, authors that could not attend the conference were also invited to contribute.

The book is constituted by 16 chapters divided in three parts and gathering 44 authors coming from 13 different countries.

The first part of the volume – represented by its two first contributions – is dedicated to basic notions and tools for understanding and manipulating spatial point processes.

In the first contribution, D. Stoyan presents a general overview of the theoretical foundations for spatial point process. The author defines a point process and a marked point process, and describes the construction of the first and second order moment measures, which leads to the nowadays well known summary statistics such as the K-function, L-function or the pair-correlation function. The Poisson point process plays an important role, since in practice it is often used as null model for hypothesis testing and as reference model for the construction of realistic models for point patterns.

The second contribution, written by A.J. Baddeley and R. Turner, enters directly in the "flesh" of the problem presenting the concrete use of spatial point processes for modelling spatial point patterns, via the spatstat package – a software library for the R language. Four main points can be tackled by this package: basic manipulation of point patterns, exploratory data analysis,

parametric model-fitting and simulation of spatial point processes. The very important issue of model validation is also addressed. The contribution contains also the necessary mathematical details and/or literature references in order to avoid the use of this software as a "black box". Two complete case studies are presented at the end of the contribution.

There is no serious practical application without a rigourous theoretical development. Therefore the second part of the book is more oriented towards theoretical and methodological advances in spatial point processes theory. Topics of this part of the book contain *analytical properties of the Poisson process* (presented in the contribution by S. Zuyev), *Bayesian analysis of Markov point processes* (by K. K. Berthelsen and J. Møller), *statistics for locally scaled point processes* (by M. Prokěsová, U. Hahn and E. B. Vedel Jensen), *nonparametric testing of distribution functions in germ-grain models* (by Z. Pawlas and L. Heinrich), and *principal component analysis applied to point processes through a simulation study* (by J. Illian, E. Benson, J. Crawford and H. Staines). Remarkable is the fact, that almost all these contributions show direct applications of the presented development.

The third part of this volume is entirely dedicated to concrete, precise case studies, that are solved within the point processes theory. The presented applications are of big impact: *material science* (by F. Ballani), *human epidemiology* (by M. A. Martínez-Beneito *et al.*) , *social sciences* (by N.A.C. Cressie, O. Perrin and C. Thomas-Agnan), *animal epidemiology* (by Webster *et al.* and P.J. Diggle, S. J. Eglen and J. B. Troy), *biology* (by F. Fleischer *et al.* and by A. Stein and N. Georgiadis), and *seismology* (by J. Zhuang, Y. Ogata and D. Vere-Jones and by A. Veen and F.P. Schoenberg). In their contributions, the authors show skill and cleverness in using, combining and continuously evolving the point processes tools in order to answer the proposed questions.

We hope the reader will enjoy reading the book and will find it instructive and inspiring for going a step further in this very open research field.

The Editors are grateful to all the authors that made possible finishing the book within an acceptable time scheduling. A word of thanks is given to Springer-Verlag and, in particular, to John Kimmel for creating the opportunity of making this project real.

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