Preface

This book is a collection of survey articles on several fields of mathematics in which spectral structures appear and topological methods are applied. Those were the over-arching themes under which a large group of researchers joined their efforts in the Collaborative Research Centre (SFB) 701 over three funding periods from 2005 until 2017. The topics span diverse mathematical disciplines from stochastics and dynamical systems via global analysis and representation theory to arithmetic geometry. Each article exposes recent results obtained by members and guests of the SFB 701 and embeds them into the general state of the art in the pertinent field. The interrelations between seemingly disparate areas are demonstrated by the introduction, by several joint papers and by various cross-references between the individual articles.

For example, universal probability distributions (Chapter 1) have conjectural connections to the zero distribution of zeta functions in number theory, and the special values of those zeta functions carry arithmetic information (Chapter 16). Zeta functions are also used to study the growth of the number of representations of a group depending on the degree (Chapter 15). Noncrossing partitions appear in representation theory (Chapter 11), asymptotic distributions (Chapters 1, 11) and geometric group theory (Chapters 11, 13). Another example are generating operators of stochastic processes, which are studied in the framework of stochastic differential equations (Chapter 2), of Markov processes in continuum (Chapter 4) and of processes on more general spaces such as fractals (Chapter 3). Thus, the current volume gives insight into recent developments, and highlights the unity of mathematics. We hope that the joint index helps to enhance the usefulness of this publication.

The editors would like to use this occasion to express their gratitude to the numerous people who made the SFB run smoothly, including Nadja Epp and Stephan Merkes, who managed the general administration including the visitor programme, the student assistants, who ran the IT infrastructure, and the secretaries of the members, in particular Anita Lydia Cole, who supported the speaker. Also, we express our gratitude to Britta Heitbreder for her expert LaTeX work in preparing this volume. Last not least, we thank the German Research Foundation (DFG) for having invested in this project and for efficient and supportive procedures.

Michael Baake   Friedrich Götze   Werner Hoffmann