

Preface

In recent decades, two-dimensional random walks in domains with non-smooth boundaries became increasingly popular and are of interest to several groups in the mathematical community. In fact, these *Markovian* objects are encountered in pure probabilistic problems, as well as in applications involving queueing theory and, more recently, enumerative combinatorics. This monograph is the continuation of the first edition (1999), aiming to promote original mathematical methods to determine the invariant measure of such processes. Moreover, these methods can also be employed to characterize the transient behavior. *Complex function theory, boundary value problems, Riemann surfaces, functional equations, and Galois theory* are the main mathematical ingredients necessary for our purpose.

Backbone of the Book

This second edition contains 11 chapters and is divided into two parts.

Part I (Chaps. 1–8) presents the theoretical fundamentals of the methods. It essentially corresponds to the content of the first edition of 1999, except for Chap. 7 and Sects. 4.1–4.3, which are new. Chapter 8 briefly makes the link with several related problems.

Part II (Chaps. 9–11) deals with specific case studies borrowed from queueing theory and enumerative combinatorics.

Acknowledgements

- As for the first edition (1999), the authors are indebted to Martine Verneuille, who kindly managed to transform into readable L^AT_EX, a great deal of the manuscript, which was sometimes—and this is understatement—not easy to decipher, and to Angeal Thomin at Springer-Verlag for her kind assistance.

- This second enlarged edition owes much to the *supporters* of the analytic approach. In this respect, a special tribute goes to Kilian Raschel, for his enthusiasm and his technical skill. In particular, Chaps. 7 and 11 are borrowed from papers written in tight and friendly collaboration with the first author.

We express our gratitude to Irina Kurkova, who, from the very beginning, studied the techniques proposed in this book. Her careful reading helped to correct some errors and led to improvements of the first edition.

We also pay tribute to the memory of Philippe Flajolet, who was deeply interested in the methods involving BVPs, which he tirelessly promoted with his usual sharpness, skill, and humor.

The language and style of several chapters benefited from a sharp and scrupulous proofreading by Richard James, of Inria, and an anonymous copy editor, to whom we express our sincere gratitude.

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Random Walks in the Quarter Plane
Algebraic Methods, Boundary Value Problems,
Applications to Queueing Systems and Analytic
Combinatorics

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