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Random walks in the quarter-plane. Algebraic methods, boundary value problems and applications. (English) [Zbl 0932.60002](#)

Applications of Mathematics. 40. Berlin: Springer. xvi, 160 p. (1999).

From the authors' introduction: "Two-dimensional random walks in domains with non-smooth boundaries are encountered in pure probabilistic problems, as well as in applications involving queueing theory. This monograph aims at promoting original mathematical methods to determine the invariant measure of such processes. Moreover, these methods can also be employed to characterize the transient behavior."

Contents of the book: Chapter 1 and the Section 2.1 contain some material necessary for the rest of the book and it is explained how the functional equations appear and why they bring complete knowledge about the initial problem. In Section 2.2 it is presented the restriction of the functional equation to the algebraic curve which is studied in Sections 2.3 and 2.5. The notion of the group of the random walk is introduced in Section 2.4. Chapter 3 is exclusively devoted to the analytic continuation of the unknown functions. The subject of Chapter 4 is to present the algebraic theory for solving the fundamental equations when the group of the random walk is finite. The case of an arbitrary group is made in Chapter 5, by reduction to a Riemann-Hilbert boundary value problem in the complex plane. Chapter 6 concerns degenerate but practically important cases, when the genus of the algebraic curve is zero. Some related problems and ideas like the asymptotic behaviour of the probability distribution are discussed in the final Chapter 7.

Reviewer: [G.Oprişan \(Bucureşti\)](#)

MSC:

- 60-02** Research exposition (monographs, survey articles) pertaining to probability theory
- 60G50** Sums of independent random variables; random walks
- 30D05** Functional equations in the complex plane, iteration and composition of analytic functions of one complex variable
- 35Q15** Riemann-Hilbert problems in context of PDEs
- 30F10** Compact Riemann surfaces and uniformization
- 60K25** Queueing theory (aspects of probability theory)

Cited in **9** Reviews
Cited in **95** Documents

Keywords:

random walks; boundary value problems; integral equations; queueing; Wiener-Hopf equations