

**Durrett, Richard**

**Brownian motion and martingales in analysis.** (English) Zbl 0554.60075

The Wadsworth Mathematics Series. Belmont, California: Wadsworth Advanced Books & Software. A Division of Wadsworth, Inc. XI, 328 p. \$ 47.20 (1984).

The book presents a number of applications of probability theory, especially the theory of Brownian motion, to classical analysis. Probabilistic proofs are in a sense more complicate as they rely on measures on infinite dimensional spaces like the Wiener measure and rather delicate concepts like the strong Markov property. On the other hand they often appear more transparent, at least to probabilists who have got some feeling for the behavior of the Brownian motion and diffusion processes. The author's book is a beautiful presentation of the connections between probability theory and classical analysis. A nice example is the interplay between Brownian motion and complex analysis in Lévy's theorem on winding numbers.

The book starts with Brownian motion and stochastic integration. This part can be used as an easy introduction into these topics, especially because the results are not presented for the most general cases, e.g. by considering only continuous martingales. This leaves aside many technical problems. The second part treats the boundary behavior of harmonic functions. Crucial for this is a discussion of the conditioned Brownian motion, i.e. h-path transforms. The third part is devoted to Hardy spaces, BMO-spaces and various inequalities connected with them. The book closes by discussing applications to second order parabolic and elliptic PDE's and the connections with the theory of stochastic differential equations.

Reviewer: [E.Bolthausen](#)

**MSC:**

- 60J65** Brownian motion
- 60-02** Research exposition (monographs, survey articles) pertaining to probability theory
- 60H10** Stochastic ordinary differential equations (aspects of stochastic analysis)
- 60H15** Stochastic partial differential equations (aspects of stochastic analysis)
- 35Jxx** Elliptic equations and elliptic systems

Cited in **3** Reviews  
Cited in **118** Documents

**Keywords:**

[strong Markov property](#); [Lévy's theorem on winding numbers](#); [boundary behavior of harmonic functions](#); [Hardy spaces](#); [BMO-spaces](#)