

**Applebaum, David**

**Lévy processes and stochastic calculus. 2nd ed.** (English) Zbl 1200.60001

**Cambridge Studies in Advanced Mathematics** 116. Cambridge: Cambridge University Press (ISBN 978-0-521-73865-1/pbk). xxx, 460 p. (2009).

This volume is the second edition of the author's celebrated monography about "Lévy Processes and Stochastic Calculus" [Cambridge Studies in Advanced Mathematics 93. Cambridge: Cambridge University Press (2004; [Zbl 1073.60002](#))], which has become one of the standard references in the field. The organization of the book in six chapters has been maintained to a large extent, nevertheless quite some material had been added.

In the introductory Chapter 1 about Lévy processes, there is a new subsection about regularly varying functions, their representations and regularly varying Lévy processes. Chapter 2 "Martingales, stopping times and random measures" includes new material about finite variation Lévy processes and the existence of moments. Chapter 4 on stochastic integration contains new estimates of the stochastic integral with respect to a Lévy process due to recent results by Kunita. Major extensions are provided to Chapter 5 "Exponential martingales, change of measure and and financial applications". The author includes the proof of the Itô and martingale representation theorem for general complex-valued  $L^2$  martingales. In the sequel this is applied to multiple (Lévy-) Wiener-Itô integrals and a proof of the Wiener chaos decomposition. In Section 5.5 the author gives a brief introduction to Mallavin's calculus for the Brownian case. A slight extension of the Black-Scholes formula with jumps is also provided. Chapter 6 has also seen several revisions. In particular the proof of Kunita's theorem on the continuous dependence on the initial data had been streamlined exploiting the before mentioned estimates on the Lévy stochastic integral. A new section on Lyapunov functions for SDE provides tools for asymptotic stability analysis of the solutions.

This textbook on Lévy processes continues to be an indispensable exposition equally fit for students and scientists to get acquainted with the enormously rich theory of Lévy processes and their SDE along this highly efficient and elegantly written mathematical text.

Reviewer: [Michael Högele \(Berlin\)](#)

**MSC:**

- 60-02 Research exposition (monographs, survey articles) pertaining to probability theory
- 60H10 Stochastic ordinary differential equations (aspects of stochastic analysis)
- 60H05 Stochastic integrals
- 60G44 Martingales with continuous parameter
- 60G55 Point processes (e.g., Poisson, Cox, Hawkes processes)
- 60G57 Random measures
- 60G52 Stable stochastic processes

Cited in <b>1</b> Review Cited in <b>459</b> Documents
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**Keywords:**

[stochastic integration for Lévy processes](#); [stochastic ordinary differential equations for Lévy processes](#); [regular variation](#); [Lyapunov function for SDE](#)

**Full Text:** [DOI](#)