Preface to the Second Edition

Since the first edition of this book appeared in 1996, white noise theory and its applications have expanded to several areas. Important examples are

(i) White noise theory for fractional Brownian motion. See, e.g., Biagini et al. (2008) and the references therein.
(ii) White noise theory as a tool for Hida–Malliavin calculus and anticipative stochastic calculus, with applications to finance. See, e.g., Di Nunno et al. (2009) and the references therein.
(iii) White noise theory for Lévy processes and Lévy random fields, with applications to SPDEs.

The last area (iii) fits well into the scope of this book, and it is natural to include an account of this interesting development in this second edition. See the new Chapter 5. Moreover, we have added a remarkable, new result of Lanconelli and Proske (2004), who use white noise theory to obtain a striking general solution formula for stochastic differential equations. See the new Section 3.7. In the new Chapter 5 we provide an introduction to the more general theory of white noise based on Lévy processes and Lévy random fields, and we apply this theory to the study SPDEs driven by this type of noise. This is an active area of current research.

We show that the white noise machinery developed in the previous chapters is robust enough to be adapted, after some basic modifications, to the new type of noise. In particular, we obtain the corresponding Wick product, generalized Skorohod integration and Hermite transform in the Lévy case, and we get the same general solution procedure for SPDEs. The method is illustrated by a study of the (stochastic) Poisson equation, the wave equation and the heat equation involving space or space-time Lévy white noise.

In this second edition we have also improved the presentation at some points and corrected misprints. We are grateful to the readers for their positive responses and constructive remarks. In particular we would like to thank (in alphabetical order) Atle Gyllensten, Jørgen Haug, Frank Proske, Mikael Signahl, and Gjermund Våge for many interesting and useful comments.

Trondheim
Oslo
Bergen
Manchester

Helge Holden
Bernt Øksendal
Jan Ubøe
Tusheng Zhang

January 2009
Stochastic Partial Differential Equations
A Modeling, White Noise Functional Approach
Holden, H.; Øksendal, B.; Ubøe, J.; Zhang, T.
2010, XV, 305 p. 17 illus., Softcover
ISBN: 978-0-387-89487-4