
Contents

A Primer on Stochastic Partial Differential Equations

| | |
|--|----|
| <i>Davar Khoshnevisan</i> | 1 |
| 1 What is an SPDE? | 1 |
| 2 Gaussian Random Vectors | 2 |
| 3 Gaussian Processes | 2 |
| 4 Regularity of Random Processes | 8 |
| 5 Martingale Measures | 14 |
| 6 A Nonlinear Heat Equation | 23 |
| 7 From Chaos to Order | 32 |
| References | 36 |

The Stochastic Wave Equation

| | |
|---|----|
| <i>Robert C. Dalang</i> | 39 |
| 1 Introduction | 39 |
| 2 The Stochastic Wave Equation | 41 |
| 3 Spatially Homogeneous Gaussian Noise | 47 |
| 4 The Wave Equation in Spatial Dimension 2 | 49 |
| 5 A Function-Valued Stochastic Integral | 56 |
| 6 The Wave Equation in Spatial Dimension $d \geq 1$ | 58 |
| 7 Spatial Regularity of the Stochastic Integral ($d = 3$) | 61 |
| 8 Hölder-Continuity in the 3-d Wave Equation | 70 |
| References | 71 |

Application of Malliavin Calculus to Stochastic Partial Differential Equations

| | |
|--|----|
| <i>David Nualart</i> | 73 |
| 1 Introduction | 73 |
| 2 Malliavin Calculus | 73 |
| 3 Application of Malliavin Calculus to Regularity of Probability Laws | 83 |
| 4 Stochastic Heat Equation | 92 |

5 Spatially Homogeneous SPDEs 99
 References 108

**Some Tools and Results for Parabolic Stochastic Partial
 Differential Equations**

Carl Mueller 111
 1 Introduction 111
 2 Basic Framework 113
 3 Duality 115
 4 Large Deviations for SPDEs 125
 5 A Comparison Theorem 129
 6 Applications 131
 References 142

**Sample Path Properties of Anisotropic Gaussian Random
 Fields**

Yimin Xiao 145
 1 Introduction 145
 2 Examples and General Assumptions 148
 3 Properties of Strong Local Nondeterminism 160
 4 Modulus of Continuity 164
 5 Small Ball Probabilities 168
 6 Hausdorff and Packing Dimensions of the Range and Graph 170
 7 Hausdorff Dimension of the Level Sets and Hitting Probabilities .. 183
 8 Local Times and Their Joint Continuity 194
 References 207

List of Participants 213

Index 215