
Contents

Basic Notations	XIII
1 Parametric Stochastic Differential Equations.....	1

Part I Continuous Sampling

2 Rates of Weak Convergence of Estimators in Homogeneous Diffusions	15
2.1 Introduction	15
2.2 Berry-Esseen Bounds for Estimators in the Ornstein-Uhlenbeck Process	16
2.3 Rates of Convergence in the Bernstein-von Mises Theorem for Ergodic Diffusions	26
2.4 Rates of Convergence of the Posterior Distributions in Ergodic Diffusions	33
2.5 Berry-Esseen Bound for the Bayes Estimator	41
2.6 Example: Hyperbolic Diffusion Model	47
3 Large Deviations of Estimators in Homogeneous Diffusions	49
3.1 Introduction	49
3.2 Model, Assumptions and Preliminaries	50
3.3 Large Deviations for the Maximum Likelihood Estimator	51
3.4 Large Deviations for Bayes Estimators	57
3.5 Examples	59
4 Local Asymptotic Mixed Normality for Nonhomogeneous Diffusions	61
4.1 Introduction	61
4.2 Model, Assumptions and Preliminaries	63

4.3	Asymptotics of the Maximum Likelihood Estimator	67
4.4	The Bernstein-von Mises Type Theorem and Asymptotics of Bayes Estimators	68
4.5	Asymptotics of Maximum Probability Estimator	74
4.6	Examples	75
5	Bayes and Sequential Estimation in Stochastic PDEs	79
5.1	Long Time Asymptotics	79
5.1.1	Introduction	79
5.1.2	Model, Assumptions and Preliminaries	80
5.1.3	Bernstein-von Mises Theorem	82
5.1.4	Asymptotics of Bayes Estimators	84
5.2	Sequential Estimation	85
5.2.1	Sequential Maximum Likelihood Estimation	85
5.2.2	Example	87
5.3	Spectral Asymptotics	88
5.3.1	Introduction	88
5.3.2	Model and Preliminaries	90
5.3.3	The Bernstein-von Mises Theorem	93
5.3.4	Bayes Estimation	95
5.3.5	Example: Stochastic Heat Equation	96
6	Maximum Likelihood Estimation in Fractional Diffusions	99
6.1	Introduction	99
6.2	Fractional Stochastic Calculus	100
6.3	Maximum Likelihood Estimation in Directly Observed Fractional Diffusions	109
6.4	Maximum Likelihood Estimation in Partially Observed Fractional Diffusions	113
6.5	Examples	118

Part II Discrete Sampling

7	Approximate Maximum Likelihood Estimation in Nonhomogeneous Diffusions	125
7.1	Introduction	125
7.2	Model, Assumptions and Definitions	127
7.3	Accuracy of Approximations of the Itô and FS Integrals	135
7.4	Accuracy of Approximations of the Log-likelihood Function	142
7.5	Accuracy of Approximations of the Maximum Likelihood Estimate	146
7.6	Example: Chan-Karloyi-Longstaff-Sanders Model	148
7.7	Summary of Truncated Distributions	155

8	Rates of Weak Convergence of Estimators in the Ornstein-Uhlenbeck Process	159
8.1	Introduction	159
8.2	Notations and Preliminaries	160
8.3	Berry-Esseen Type Bounds for AMLE1.....	162
8.4	Berry-Esseen Type Bounds for AMLE2.....	173
8.5	Berry-Esseen Type Bounds for Approximate Minimum Contrast Estimators	178
8.6	Berry-Esseen Bounds for Approximate Bayes Estimators	192
9	Local Asymptotic Normality for Discretely Observed Homogeneous Diffusions	201
9.1	Introduction	201
9.2	Model, Assumptions and Preliminaries	202
9.3	Weak Convergence of the Approximate Likelihood Ratio Random Fields	207
9.4	Asymptotics of Approximate Estimators and Bernstein-von Mises Type Theorems	221
9.5	Example: Logistic Diffusion	223
10	Estimating Function for Discretely Observed Homogeneous Diffusions	225
10.1	Introduction	225
10.2	Rate of Consistency	233
10.3	Berry-Esseen Bound	238
10.4	Examples.....	240
	References	245
	Index	263