Ann Inst Stat Math (2011) 63:431–479
DOI 10.1007/s10463-009-0263-z

Polynomial type large deviation inequalities and quasi-likelihood analysis for stochastic differential equations

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Received: 19 December 2005 / Revised: 15 January 2007 / Published online: 21 May 2010

Abstract The estimate of the probability of the large deviation or the statistical random field is the key to ensure the convergence of moments of the associated estimator, and it also plays an essential role to prove mathematical validity of the asymptotic expansion of the estimator. For non-linear stochastic processes, it involves technical difficulties to show a standard exponential type estimate; besides, it is not necessary for these purposes. In this paper, we propose a polynomial-type large deviation inequality which is easily verified by the L^p-boundedness of certain functionals; usually they are simple additive functionals. We treat a statistical random field with multi-grades and discuss M and Bayesian type estimators. As an application, we show the behavior of those estimators, including convergence of moments, for the statistical random field in the quasi-likelihood analysis of the stochastic differential equation that is possibly multi-dimensional and non-linear. The results are new even for stochastic differential equations, while they obviously apply to other various statistical models.

Keywords Large deviation · Quasi-likelihood analysis · Random field · Diffusion process