Parameter estimation problem for some time-periodic-drift Langevin type stochastic differential equation

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Abstract

In this work we investigate the large-sample behavior of the maximum likelihood estimate (MLE) of the unknown parameter θ for processes following the model

$$d\xi_t = \theta f(t)\xi_t\, dt + d\mathrm{B}_t$$

where $f : \mathbb{R} \to \mathbb{R}$ is a continuous function with period, say $P > 0$, and observed through continuous time $[0, T]$ as $T \to \infty$. Here the periodic function $f(\cdot)$ is assumed known. We establish the consistency of the MLE and we point out its minimax efficiency. These results comply with the well-established case when the function $f(\cdot)$ is constant non null. However the case when $F(P) = 0$ and $f(\cdot)$ is not identically null presents some particularities. For instance in this case whatever is the value of θ, the rate of convergence of the MLE is T as in the case when $\theta = 0$ and $F(P) \neq 0$. Futhermore when $F(P) = 0$, the MLE is locally efficient for the quadratic risk.