LARGE DEVIATIONS FOR THE SQUARED RADIAL ORNSTEIN-UHLENBECK PROCESS

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Large deviation; Parameter estimation:

The generalized squared radial Ornstein-Uhlenbeck process, also known as the Cox-Ingersoll-Ross process, is the strong solution of the stochastic differential equation

$$\mathrm{d}X_t = (a + bX_t)\mathrm{d}t + 2\sqrt{X_t}\,\mathrm{d}B_t \tag{1}$$

where the initial state $X_0 = x \geq 0$, the dimensional parameter $a > 0$, the drift coefficient $b \in \mathbf{R}$ and $(B_t)_t$ is a standard Brownian motion. The behaviour of the process has been widely investigated and depends on the values of both coefficients a and b. We shall restrict ourself to the most tractable situation where $a > 2$ and $b < 0$. In this case, the process is geometrically ergodic and never reaches zero. We estimate parameters a and b at the same time using a trajectory of the process over the time interval $[0, T]$. We establish large deviation principles for the couple of the maximum likelihood estimators (MLE) of dimensional and drift coefficients, as well as other simplified estimators based on the MLE. In contrast to the previous literature, we state large deviation principles when both dimensional and drift coefficients are estimated simultaneously.