

Central Limit Theorem for Diffusion Processes in Discontinuous Drift with Small Perturbation

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Abstract — For the system of d -dim stochastic differential equations

$$dX^\epsilon = b(X^\epsilon)dt + \epsilon dW(t); t \in [0; 1]$$

$$X^\epsilon = x^0 \in R^d$$

where $b(\cdot)$ is smooth except possibly along the hyperplane $x_1 = 0$ and satisfies the stability condition $b_1(x) < 0$ if $x_1 > 0$ and $b_1(x) > 0$ if $x_1 < 0$, we shall prove a central limit theorem for $X^\epsilon(t)$, i.e., we shall find a deterministic function $\phi(t)$ such that

$$\frac{1}{\epsilon} [X^\epsilon(t) - \phi(t)] = \xi(t) + R^\epsilon(t)$$

where $\xi(t)$ is an Orstein-Uhlenbeck process and $|R^\epsilon(t)| \rightarrow 0$ in L^1 as $\epsilon \rightarrow 0$ for each t . This extends our earlier work [1,2] on large deviation principle of such systems.

1. Chiang,T.S. and Sheu,S.J.,2000, Large Deviations of DiRusion Processes with Discontinuous drift and their occupation times, The Annals of Probability 28, No.1, 140-165.
2. Chiang,T.S. and Sheu,S.J.,2002, Small Perturbation of DiRusions in Inhomogeneous Media, Ann.I.H.Poincare PR 38,3, 285-318.

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