

The Skorohod oblique reflection problem in time-dependent domains

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The deterministic Skorohod problem plays an important role in the construction and analysis of diffusion processes with reflection. In the form studied here, the multidimensional Skorohod problem was introduced, in time-independent domains, by H. Tanaka [61] and further investigated by P.-L. Lions and A.-S. Sznitman [42] in their celebrated article. Subsequent results of several researchers have resulted in a large literature on the Skorohod problem in time-independent domains. In this article we conduct a thorough study of the multidimensional Skorohod problem in time-dependent domains. In particular, we prove the existence of $c\{a}d\{a}g$ solutions (x, λ) to the Skorohod problem, with oblique reflection, for (D, Γ, w) assuming, in particular, that D is a time-dependent domain (Theorem 1.2). In addition, we prove that if w is continuous, then x is continuous as well (Theorem 1.3). Subsequently, we use the established existence results to construct solutions to stochastic differential equations with oblique reflection (Theorem 1.9) in time-dependent domains. In the process of proving these results we establish a number of estimates for solutions to the Skorohod problem with bounded jumps and, in addition, several results concerning the convergence of sequences of solutions to Skorohod problems in the setting of time-dependent domains.

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