A strong order 1/2 method for SDEs with discontinuous drift and degenerate diffusion

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Abstract

When solving certain stochastic optimization problems, e.g., in mathematical finance, the optimal control policy is of threshold type, meaning that it depends on the controlled process in a discontinuous way. The stochastic differential equations (SDEs) modeling the underlying process then typically have discontinuous drift and degenerate diffusion parameter. This motivates the study of a more general class of such SDEs. We prove an existence and uniqueness result, based on certain a transformation of the state space by which the drift is "made continuous". As a consequence the transform becomes useful for the construction of a numerical method. The resulting scheme is proven to converge with strong order $1/2$. This is the first result of that kind for such a general class of SDEs. In examples we show the necessity of the geometric conditions we pose.

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