Blanchet, Jose; **Chen, Xinyun**; **Dong, Jing**

ε-strong simulation for multidimensional stochastic differential equations via rough path analysis. (English) Zbl 1436.65012

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Given a multidimensional Itô problem with continuous drift and variance that defines a stochastic process X, the authors use rough path analysis to construct a family of processes Y that depend on a tolerance parameter E lying in the interval $(0, 1)$. This is known as tolerance enforced simulation. Here Y is piecewise constant with a finite number of discontinuities and where $\sup ||X - Y|| < E$ in the infinity norm. The approach uses the Itô-Lyons map and its continuity properties are studied through Lyon's rough path theory. This theory allows us to characterise the solution of the stochastic differential equation on a path by path basis, free of probability, by imposing constraints on the iterated integrals that arise with respect to the underlying Wiener processes that define the problem. The Itô-Lyons map is known to be continuous under a suitable Hölder metric defined on the space of rough paths and the size of the tolerance E is related to size of the index of this Hölder metric.

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MSC:

65C30 Numerical solutions to stochastic differential and integral equations
60L20 Rough paths
65C05 Monte Carlo methods

Keywords:

tolerance enforced stochastic simulation; rough paths

Full Text: DOI