Split time-step schemes for McKean-Vlasov SDE

Gonçalo dos Reis[1],

[1] University of Edinburgh, UNITED KINGDOM

We present two fully probabilistic Euler schemes, an explicit and an implicit split-step explicit Euler scheme, for the simulation of McKean?Vlasov Stochastic Differential Equations (MV-SDEs) with drifts of super-linear growth (in space) and random initial condition. The general split-step scheme attains the standard 1/2 rate in stepsize and closes the gap left in the literature regarding efficient implicit methods and their convergence rate for this class of McKean-Vlasov SDEs. The explicit Euler scheme, under certain structural conditions (but with non-constant diffusion matrix), draws on ideas from splitting operators to produce an order 1 Euler convergent method. Several numerical examples are presented including a comparative analysis of other known algorithms for this class (taming and adaptive time-stepping) across parallel and non-parallel implementations.

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