MR2846497

"Towards automatic global error control: Computable weak error expansion for the tau-leap method"

by J. Karlsson and R. Tempone

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Review

Chemical kinetics in the form of jump stochastic differential equations driven by independent Poisson processes is considered. The paper analyzes the forward Euler method (tau-leap method) and designs computable *a posteriori* error estimates for expectation values of smooth functions. The forward Kolmogorov equation (master equation) and its backward dual equation are naturally employed in the derivation.

Under the assumptions of a bounded population and polynomial propensities both *a priori* estimates (which aid in choosing between an exact or an approximative evolution of the system) and *a posteriori* error estimates are obtained. Using these estimates, an analysis of the complexity of the tau-leap method is also proposed. As the author remarks, the latter bounds appear to be pessimistic in that they imply that the tau-leap solution complexity for systems with quadratic propensities is on par with exact simulation techniques.

Two simple numerical examples conclude the paper. As expected, for a non-transient (namely, a linear decay) problem, the resulting method is of limited interest. Better performance is obtained for a non-linear problem with a transient behavior.

MSC 2010 classification: 65C40 (primary); 65Y20 (secondary).