Deterministic quadrature rules for marginals of SDEs based on weak Ito-Taylor steps

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We consider the problem of approximating the expectation $Ef(X(1))$ of a function f of the solution X of a d-dimensional system of stochastic differential equations (SDE) at time point 1 based on finitely many evaluations of the coefficients of the SDE, the integrand f and their derivatives. We present a deterministic algorithm, which produces a quadrature rule by iteratively applying simplified weak Ito-Taylor steps together with strategies to reduce the diameter and the size of the support of a discrete measure.

We essentially assume that the coefficients of the SDE are s-times continuously differentiable and that the integrand f is r-times continuously differentiable. In the case $r \leq (s-2) \cdot d/(d+2)$ we almost achieve an error of order $\min(r,s)/d$ in terms of the computational cost, which is optimal in a worst case sense.

This is joint work with Thomas Müller-Gronbach, Uni Passau.