Convergence and stability of micro-macro acceleration method for scale-separated SDEs

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Many dynamical systems of current interest exhibit behavior on a wide range of time scales and cannot be simulated directly on long (macroscopic) time intervals. I present and discuss a multi-scale method to efficiently simulate the macroscopic observables of SDEs having strong separation between time-scales.
The method couples short bursts of stochastic path simulation with extrapolation of spatial averages forward in time. After each extrapolation, a new microscopic state is obtained by matching the last available microscopic distribution with the extrapolated macroscopic state. The matching is an inference procedure that renders a minimal perturbation of a prior microscopic state (available just before the extrapolation) consistent with the extrapolated macroscopic state.
I introduce the matching operator based on minimization of Kullback-Leibler divergence and indicate why it provides a convenient numerical approach. Then, I discuss the relation of the method to coarse graining, establish the convergence in the numerically weak sense, and inquire about the stability for appropriately chosen test models.