**Multilevel Monte Carlo Methods for Chaotic Dynamical Systems**

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Special session: Multilevel methods for SDEs and SPDEs

We consider the computational efficiency of the Multilevel Monte Carlo (MLMC) algorithm applied to chaotic systems of the form $x'(t) = f(x(t))$, $t \in [0, T]$. Here, $f : \mathbb{R}^m \to \mathbb{R}^m$ is a Lipschitz function satisfying the dissipativity condition, but not the following contractivity condition:

$$\langle x - y, f(x) - f(y) \rangle \leq -\lambda \|x - y\|^2, \quad \forall x, y \in \mathbb{R}^m. \tag{1}$$

A direct application of MLMC to such systems is challenging due to the exponential increase of the variance of the level estimators with respect to the final time, $T$, and hence of the corresponding computational complexity. To alleviate this issue, Fang and Giles [1] proposed the change of measure technique for the stochastic variant of the deterministic dynamical system, which recovers the contractivity of the path. Building on their work, our aim is to compute quantities of interest of the deterministic system with and without random coefficients, using its stochastic variant as a control variate. We apply our method to Lorenz63, a three-dimensional system modelling convection rolls in the atmosphere.

[1] Fang, Wei, & Giles, Michael B. (2019). *Multilevel Monte Carlo method for ergodic SDEs without contractivity.* Journal of Mathematical Analysis and Applications 476, 149-176.