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Out-of-equilibrium simulations to fight topological freezing

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Calculations of topological observables in lattice gauge theories with traditional Monte Carlo algorithms have long been known to be a difficult task, owing to the effects of long autocorrelations times. Several mitigation strategies have been put forward, including the use of open boundary conditions and methods such as parallel tempering. In this contribution we examine a new approach based on out-of-equilibrium Monte Carlo simulations. Starting from thermalized configurations with open boundary conditions on a line defect, periodic boundary conditions are gradually switched on. A sampling of topological observables is then shown to be possible with a specific reweighting-like technique inspired by Jarzynski's equality. We discuss the efficiency of this approach using results obtained for the 2-dimensional CP^{N-1} model. Furthermore, we outline the implementation of our proposal in the context of Stochastic Normalizing Flows, as they share the same theoretical framework of the non-equilibrium transformations we perform, and can be thought of as their generalization.

Topical area

Algorithms and Artificial Intelligence

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