Contribution ID: **45** Type: **not specified**

Adaptive measurement strategy for quantum subspace methods

Thursday, 28 March 2024 10:40 (20 minutes)

Estimating physical properties for unknown quantum states is a crucial matter spanning various domains, including quantum information processing, quantum physics, and quantum chemistry. In the realm of quantum computation, existing research has predominantly focused on comprehensive state tomography or estimating specific observables with known classical descriptions. However, a notable gap exists in addressing problems where the target for estimation depends on the measurement outcome. In this study, we introduce an adaptive optimization approach for measurements, specifically useful for quantum subspace methods, which are variational simulation techniques that involve classical postprocessing of measurement outcomes. Our proposed method initially establishes the measurement protocol for classically simulatable states. Subsequently, it adaptively updates the protocol based on the Quantum Subspace Expansion (QSE) method using the outcomes of quantum measurements. Through numerical experiments, we demonstrate that our approach achieves two significant outcomes: (i) a substantial reduction in the number of required measurements, by constructing an effective measurement strategy; (ii) successful convergence of the adaptive iteration, even for strongly correlated molecules like H_4 during excited-state simulations. This work emphasizes the potential enhancement of the QSE method through sophisticated measurement protocols, paving the way for further exploration of efficient quantum measurement techniques in practical computations.

Primary authors: NAKAMURA, Yuma (Healthcare & Life Science, IBM Japan); Mr YANO, Yoshichika (Department of Applied Physics, University of Tokyo,); Mr YOSHIOKA, Nobuyuki (Department of Applied Physics, University of Tokyo,)

Presenter: NAKAMURA, Yuma (Healthcare & Life Science, IBM Japan)

Session Classification: Symposia talks

Track Classification: Contributed talk