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Characterisation of quantum circuits in a quantum-classical algorithm

Recent advances in hybrid (quantum-classical) algorithms allow us to infer the ground states of Hamiltonians which are of relevance in quantum chemistry. A possible approach is defined by a systematic search on the full Hilbert space via the sequential application of single-qubit rotations and multi-qubit entangling gates. First results indicate that the high dimensionality of the molecular Hilbert space necessitates a large number of such entanglement blocks. The thus imposed critical circuit depth on state of the art quantum architectures with limited coherence times implies important restrictions for possible applications. In order to reduce the number of gate operations, we investigate different entanglement schemes and evaluate their properties by means of a set of descriptors that includes entanglement quantifiers, site occupation, and convergence efficiency.