Refining building blocks of quantum algorithms for electronic structure computation

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Quantum computing holds promise for addressing challenges in quantum chemistry. The foundational Quantum Phase Estimation (QPE) algorithm, established early on, remains the state-of-the-art for this field. However, there are considerable opportunities for refinement across its building blocks, spanning from the preparation of initial states to the circuit decomposition of general quantum oracles. In particular, bridging the gap between efficient classical pre-computation and asymptotically advantageous quantum post-processing seems to be a natural approach towards achieving an advantage during the early stages of fault-tolerant quantum computing.