Compilation of algorithm specific graph states for quantum circuits

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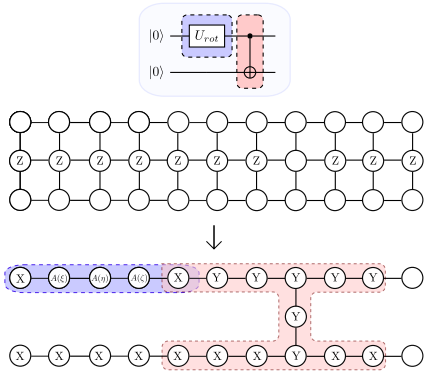
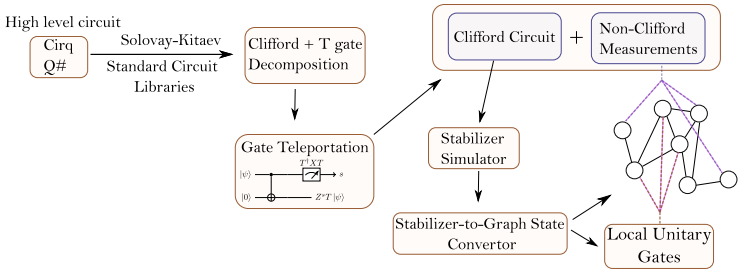
The circuit based model of quantum computing (QC) has been well developed over the last decade with multiple software tools and frameworks for its implementation and analysis. Measurement based quantum computing (MBQC) [1] is an equivalent, alternate model of QC for which such tools are not yet readily available. In MBQC the canonical resource is a lattice cluster state which is transformed through Pauli measurements into an algorithm-specific graph state (ASGS). Computation is then carried out by single qubit measurements on this ASGS. In this work we develop a workflow for compiling ASGSs from a quantum circuit. In juxtaposition with the traditional treatment of MBQC where the circuit is etched on to a square lattice, we take an alternate approach and take advantage of gate teleporation circuits to simulate the Clifford part of the quantum circuit classically leaving only the generation of the ASGS and non-Pauli basis measurements for a quantum device. This ASGS based approach to quantum algorithms allows for new ways to develop, analyse, optimise as well as benchmark quantum algorithms.

[1] Raussendorf, R., & Briegel, H. J. (2001). A one-way quantum computer. Physical review letters, 86(22), 5188.



(a) Traditional compilation strategy.



(b) Compilation of the algorithm-specific graph state.