Fault tolerant dynamical decoders for topological quantum memories

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http://arxiv.org/abs/1511.05579 [2]

Active error correction of topological quantum codes - in particular the toric code - remains one of the most viable routes to large scale quantum information processing. In this work, we introduce the concept of a dynamical decoder as a promising route for achieving fault-tolerant quantum memories. We analyze a specific dynamical decoder based on a discrete time cellular automaton decoder and provide evidence of a threshold above 0.05% with measurement errors. Without measurement errors, the threshold increases by a factor of roughly 1.5. We stress that (asynchronous) dynamical decoding gives rise to a Markovian dissipative process, hence equating cellular automaton decoding to a fully dissipative topological quantum memory, which removes errors continuously. Finally, we analyze the required resources, and speculate about an ideal constant resource dynamical decoder.

- Quantum Computation [3]
- 13.30.+t Fault-tolerant quantum computation [4]
- Result [5]
- SIQS [6]

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