Abstract Submitted
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A Universal Operator Theoretic Framework for Quantum Fault Tolerance.[1] GERALD GILBERT, MITRE Quantum Information Science Group, ROBERT CALDERBANK, VANEET AGGARWAL, Princeton University, MICHAEL HAMRICK, YAAKOV WEINSTEIN, MITRE Quantum Information Science Group — We introduce a universal operator theoretic framework for quantum fault tolerance. This incorporates a top-down approach that implements a system-level criterion based on specification of the full system dynamics, applied at every level of error correction concatenation. This leads to more accurate determinations of error thresholds than could previously be obtained. The basis for the approach is the Quantum Computer Condition (QCC), an inequality governing the evolution of a quantum computer. In addition to more accurate determination of error threshold values, we show that the QCC provides a means to systematically determine optimality (or non-optimality) of different choices of error correction coding and error avoidance strategies. This is possible because, as we show, all known coding schemes are actually special cases of the QCC. We demonstrate this by introducing a new, operator theoretic form of entanglement assisted quantum error correction.

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