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On the Use of Shor States for the [7,1,3] Quantum Error Correcting Code YAAKOV WEINSTEIN, MITRE, SIDNEY BUCHBINDER, California Institute of Technology — We explore the effect of Shor state construction methods on logical state encoding and quantum error correction for the [7,1,3] Calderbank-Shor-Steane quantum error correction code in a nonequiprobable error environment. We determine the optimum number of verification steps to be used in Shor state construction and whether Shor states without verification are usable for practical quantum computation. These results are compared to the same processes of encoding and error correction where Shor states are not used. We demonstrate that the construction of logical zero states with no first order error terms may not require the complete edifice of quantum fault tolerance. With respect to error correction, we show for a particular initial state that error correction using a single qubit for syndrome measurement yields a similar output state accuracy to error correction using Shor states as syndrome qubits. In addition, we demonstrate that error correction with Shor states has an inherent sensitivity to bit-flip errors.

Yaakov Weinstein
MITRE

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