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Quantum fault-tolerant thresholds for universal concatenated schemes CHRISTOPHER CHAMBERLAND, TOMAS JOCHYM-O'CONNOR, Institute for Quantum Computing, University of Waterloo, RAYMOND LAFLAMME, Institute for Quantum Computing, University of Waterloo, Perimeter Institute — Fault-tolerant quantum computation uses ancillary qubits in order to protect logical data qubits while allowing for the manipulation of the quantum information without severe losses in coherence. While different models for fault-tolerant quantum computation exist, determining the ancillary qubit overhead for competing schemes remains a challenging theoretical problem. In this work, we study the fault-tolerance threshold rates of different models for universal fault-tolerant quantum computation. Namely, we provide different threshold rates for the 105-qubit concatenated coding scheme for universal computation without the need for state distillation. We study two error models: adversarial noise and depolarizing noise and provide lower bounds for the threshold in each of these error regimes. Establishing the threshold rates for the concatenated coding scheme will allow for a physical quantum resource comparison between our fault-tolerant universal quantum computation model and the traditional model using magic state distillation.

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