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Semiconductor-inspired superconducting quantum computing

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Superconducting circuits offer tremendous design flexibility in the quantum regime culminating most recently in the demonstration of few qubit systems supposedly approaching the threshold for fault-tolerant quantum information processing. Competition in the solid-state comes from semiconductor qubits, where nature has bestowed some very useful properties which can be utilized for spin qubit based quantum computing. Here we present an architecture for superconducting quantum computing based on selective design principles deduced from spin-based systems [1]. We propose an encoded qubit approach realizable with state-of-the-art tunable Josephson junction qubits. Our results show that this design philosophy holds promise, enables microwave-free control, and offers a pathway to future qubit designs with new capabilities such as with higher fidelity or, perhaps, operation at higher temperature. The approach is especially suited to qubits based on variable super-semi junctions. [1] Yun-Pil Shim and Charles Tahan, arXiv:1507.07923