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Quantum Control Quantum Error Correction with Superconducting Circuits.

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We have developed an efficient quantum control scheme that allows for arbitrary operations on a cavity mode using strongly dispersive qubit-cavity interaction and time-dependent drives. In addition, we have discovered a new class of bosonic quantum error correcting codes, which can correct both cavity loss and dephasing errors. Our control scheme can readily be implemented using circuit QED systems and extended for quantum error correction to protect information encoded in bosonic codes. Moreover, engineered dissipation can also implement holonomic quantum computation using superconducting circuits.