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Extended Hubbard model simulations of charge-qubit circuits: from idealism to realism[1] ZAHRA SHATERZADEH-YAZDI, BARRY C. SANDERS, University of Calgary, Institute for Quantum Information Science — Charge qubits are promising quantum logical elements for performing quantum computation or as intermediate states to prepare and read other qubit realizations such as spin or flux. Instead of idealizing the charge qubits at the outset and using standard quantum circuit theory, we use the extended Hubbard model as a first-principles model of charge qubit dynamics and model idealized proposals for charge-qubit circuits using this second-quantized description with short- and medium-range interactions. In particular we study how one- and two-qubit gates would perform for realistic systems, and we apply our theory to teleportation of a single charge qubit in a three-qubit system. We also discuss how to incorporate phonon noise into the model.

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