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Title:

Numerical braiding of Majorana Fermions on finite size nanowires

Abstract:

Superconductors hosting long-sought excitations called Majorana fermions may be ultimately used as qubits of fault-tolerant topological quantum computers. A crucial challenge toward the topological quantum computer is to equip quantum operation of nearly degenerate quantum states as a dynamical process of Majorana fermions. We investigate the braiding dynamics of Majorana fermions on superconducting nanowires. Surprisingly, a non-adiabatic dynamical process dominates the non-Abelian braiding that operates qubits of Majorana fermions. Our simulations clarify how qubits behave in the real-time braiding process, and elucidate the optimum condition of superconducting nanowires for efficient topological quantum operation.