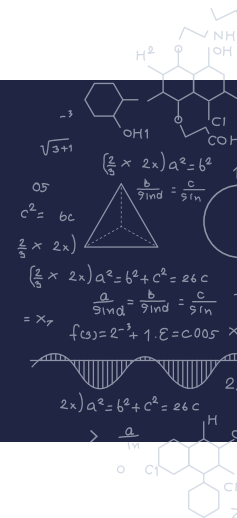


LICENSING OPPORTUNITY: NEARLY OPTIMAL TIME-INDEPENDENT REVERSAL OF A SPIN CHAIN



DESCRIPTION

Problem

Fast and accurate transfer of quantum states across a physical system is critical for designing quantum computers and networks. Traditional methods for moving qubits through a “spin chain” often face significant hurdles:

- **Speed & Efficiency:** Naive approaches using standard “SWAP” gates are slow.
- **Complexity:** Many fast protocols require constant “dynamical control” (active manipulation during the process), which is difficult to implement and introduces extra noise.
- **Data Integrity:** Existing protocols often assume the intermediate qubits are “empty,” making them unusable if those qubits already contain important data that needs to be preserved or moved.

Invention

This technology is a time-independent protocol that reverses the order of qubits in a chain (e.g., changing the order \$1, 2, 3\$ to \$3, 2, 1\$). It uses a pre-engineered “Hamiltonian”—a specific set of fixed magnetic fields and interactions between neighboring qubits—to naturally evolve the system into its reversed state.

BENEFITS

Potential Commercial Applications

- **Qubit Routing:** A vital subroutine for moving data around quantum chips with limited physical connectivity.
- **Quantum Network Nodes:** Improving the speed and reliability of information transfer within the nodes of a quantum network.
- **Error Reduction:** Serving as a tool to establish long-range entanglement or perform quantum simulations more robustly.

Competitive Advantage

- **3x Speed Increase:** This protocol implements state reversal three times faster than standard swap-gate methods.
- **Simpler Hardware Requirements:** Because it is time-independent, it removes the need for complex, high-speed dynamical control systems, reducing both costs and potential sources of error.
- **Robustness:** The protocol is more resistant to “static disorder” (manufacturing imperfections) than traditional gate-based methods.
- **Hardware Agnostic:** While highly suitable for superconducting qubits, it can also be implemented in other systems like Rydberg atom arrays.

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