Quantum Computing

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***Abstract*—Quantum circuit qubit mapping (also known as qubit allocation and routing) is an essential step in NISQ-era compilers, required to execute circuits on hardware with limited qubit connectivity. Two-qubit (entangling) gates can only be performed on specific pairs of physical qubits defined by a device's coupling graph. When logical qubits require interaction across non-adjacent physical qubits, the compiler inserts additional SWAP operations, increasing both gate count and circuit depth. These added operations introduce more opportunities for error, thereby reducing the fidelity of the executed algorithm.**

I. Introduction

This is the main.tex content - quantum computing paper.

A. SABRE and LightSABRE

Some content here.

B. Need for Error-Aware Routing

More content here.

II. CAES Heuristic Algorithm

At the core of the Cost-Aware Error-Sensitive (CAES) approach lies a modified heuristic for evaluating the cost of candidate SWAP operations during qubit routing. The original SABRE algorithm selects a SWAP that minimizes a combined distance metric by summing the shortest paths in the coupling graph between logical qubits requiring interaction. However, this approach treats all edges and qubits equally, ignoring device-specific error characteristics that significantly impact the quality of quantum computations.