PEC: Probabilistic Error Cancellation

Quantum Error Mitigation Summary

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Overview

Probabilistic Error Cancellation (PEC) is a technique where noisy quantum operations are expanded into a quasiprobability mixture of ideal operations. These are sampled and reweighted to cancel noise.

Mathematical Formulation

Let $\mathcal{E}$ be a noisy operation and $\mathcal{I}$ an ideal one. We express:

$$\mathcal{I} \approx \sum_i q_i \mathcal{E}_i \quad \text{where} \quad \sum_i q_i = 1,\ q_i \in \mathbb{R}$$

During execution, operations $\mathcal{E}_i$ are sampled with probability $|q_i|$ and reweighted by $\text{sign}(q_i)$.

Implementation

- Use `mitiq.pec.execute_with_pec()` with a callable executor and a list of `OperationRepresentation`.