Hybrid Computational Framework for Quantum and Resonance Simulation

Abstract

This technical paper discloses a novel hybrid computational framework, designated "Quantum Playground," designed for the interactive simulation of quantum phenomena and physical resonance. It implements a synthesis of symbolic quantum computing, physics-based modeling, and probabilistic search techniques. The framework's defining characteristic is its employment of symbolic representations for quantum amplitudes and dynamic variables, enabling a uniquely interpretable and flexible approach to hybrid computation. The system includes a proof-of-concept user interface based on React Native for visualization and control. However, the core contribution resides in the underlying computational architecture, scientific methodology, and novel data handling strategies.

1 Introduction

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2 Background and Prior Art

Prior art in quantum simulation predominantly involves numerical simulations using fixed-precision amplitudes (e.g., vector-based representations) or symbolic tools focused on algebraic manipulations of quantum operations (e.g., Qiskit, Cirq).

Similarly, in physical modeling, existing methods rely on finite element analysis (FEA) or similar techniques with predominantly numerical representations. Probabilistic searching primarily employs classical algorithms or specialized quantum hardware.

There is a notable absence of an integrated computational system that combines symbolic quantum simulation with dynamic physical modeling using symbolic variables. The Quantum Playground fills this gap by introducing a novel approach that encodes relationships between quantum and physical phenomena while maintaining interpretability and flexibility.