Efficient Quantum Dot Cellular Automata Swap Circuit with Fredkin Gates

VLSI Project Report
Batch 23

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Novel idea proposed Report

Abstract: This proposal introduces a novel approach to designing energy-efficient swap circuits in Quantum Dot Cellular Automata (QCA) through the utilization of Fredkin gates. Leveraging the inherent advantages of QCA, known for its low power consumption and nanoscale integration potential, our design significantly reduces circuit size while minimizing energy consumption. The incorporation of Fredkin gates facilitates a streamlined and energy-conscious swap operation, contributing to the overall efficiency of quantum-dot-based architectures. This innovative concept not only advances quantum computing circuitry but also introduces a versatile building block for various quantum information processing tasks.

Introduction: This study proposes a pioneering design for an energy-efficient swap circuit in Quantum Dot Cellular Automata (QCA), leveraging the distinctive capabilities of Fredkin gates. By harnessing the inherent advantages of QCA, known for its low power consumption and nanoscale integration, our approach seeks to optimize circuit size and energy utilization. The incorporation of Fredkin gates introduces a streamlined and efficient swap operation, contributing to the advancement of quantum-dot-based architectures.

Circuit Diagram:

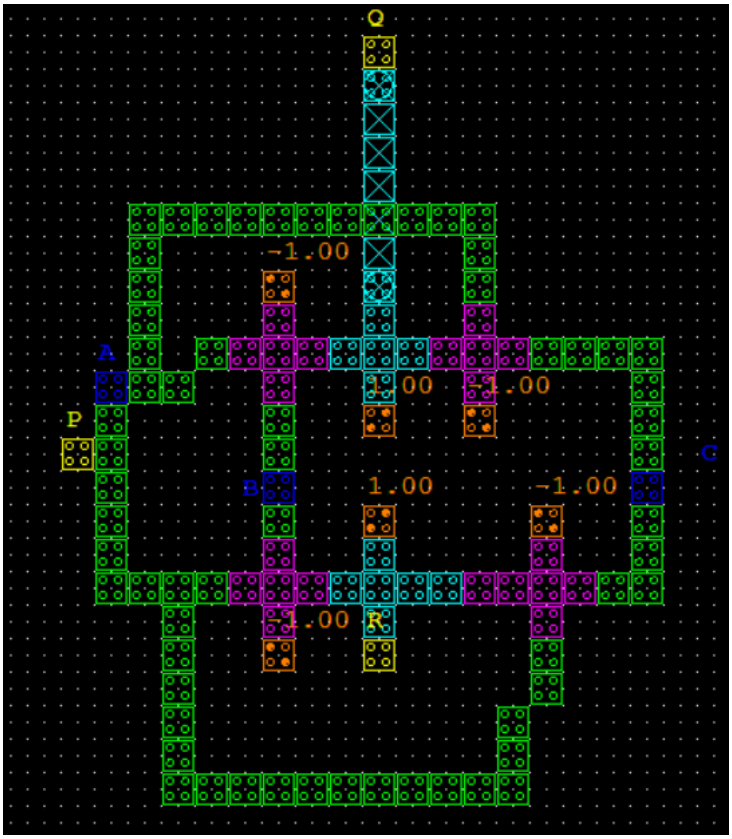
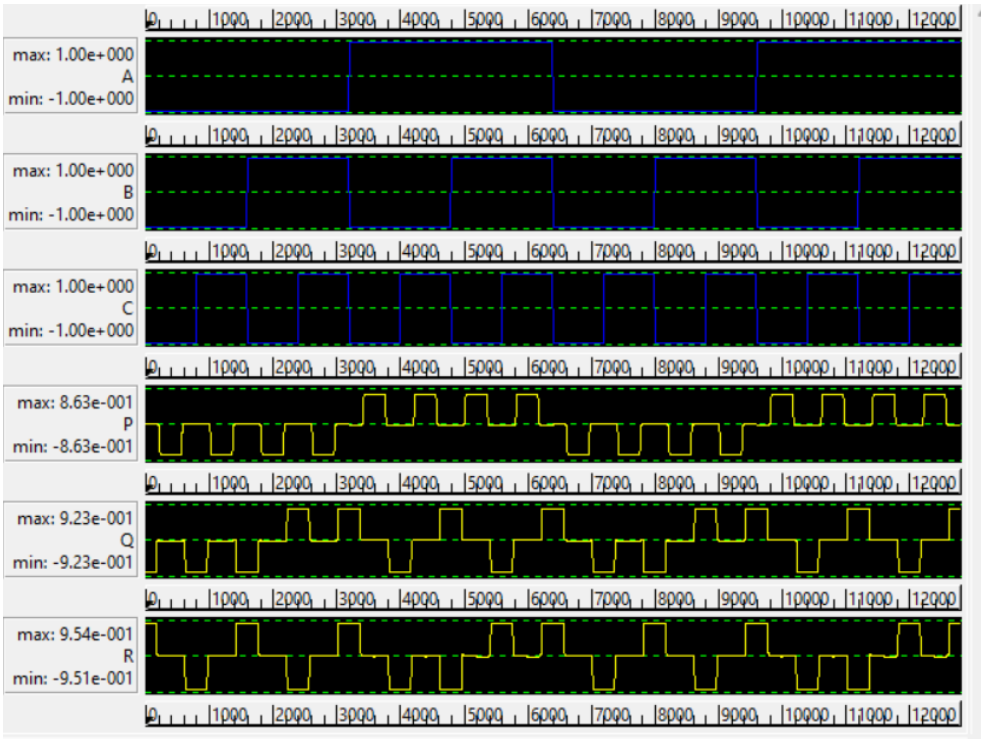


Figure:1 Swap circuit using Fredkin Simulation

Simulation Results :



Conclusion: In conclusion, our collaborative efforts have yielded a novel swap circuit concept in Quantum Dot Cellular Automata, employing Fredkin gates. This innovative design addresses challenges in quantum computing, presenting an efficient and scalable solution for future architectures. Our successful implementation highlights the team's ingenuity and dedication to advancing quantum computing circuits, offering practical applications in emerging technologies. This accomplishment signifies the potential impact of our work and underscores the importance of pioneering solutions in the Quantum Dot Cellular Automata domain.