A New Design of 2-Bit Universal Shift Register Using Rotated Majority Gate Based on Quantum-Dot Cellular Automata Technology

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Abstract

Quantum-dot Cellular Automata (QCA) is emerging nanotechnology that can represent binary information using quantum cells without current flows. It is known as a promising alternative of Complementary Metal–Oxide Semiconductor (CMOS) to solve its drawbacks. On the other hand, the shift register is one of the most widely used practical devices in digital systems. Also, QCA has the potential to achieve attractive features than transistor-based technology. However, very small-scale and Nano-fabrication limits impose a hurdle to the design of QCA-based circuits and necessitate for fault-tolerant analysis is appeared. Therefore, the aim of this paper is to design and simulate an optimized a D-flip-flop (as the main element of the shift register) based on QCA technology, which is extended to design an optimized 2-bit universal shift register. This paper evaluates the performance of the designed shift register in the presence of the QCA fault. Collected results using QCADesigner tool demonstrate the fault-tolerant feature of the proposed design with minimum clocking and area consumption.