

Conservative Logic Gate for Design of Quantum Dot Cellular Automata Circuits

Researchers at the University of South Florida have developed a novel conservative logic element to design concurrently testable Circuits, for Quantum Dot Cellular Automata (QCA) computing.

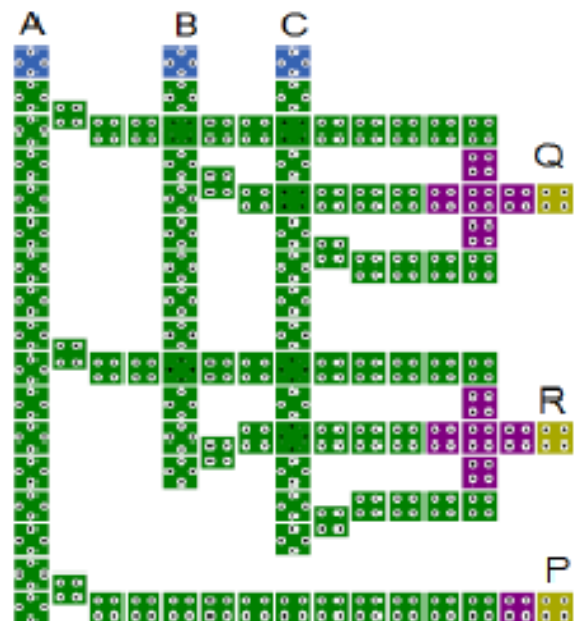
CMOS devices suffer from heat generation as they have to discharge all the stored energy when flipping from 1 to 0. Quantum dot cellular automata (QCA) is one of the emerging nanotechnologies where it has a significant advantages in terms of power dissipation as it does not have to dissipate all its signal energy. Nano-scale manufacturing is prone to significant error rates and nanotechnologies including QCA require extremely low device error rate. In the manufacturing of QCA, defects can occur during the synthesis and deposition phases, with a greater likelihood during the deposition phase. QCA devices are also prone to transient faults caused by thermodynamic effects and radiation effects. Hence there is a need for a logic element which would help in concurrent testing of these faults.

Inventors at USF have developed a conservative logic element termed conservative QCA (CQCA) for concurrent testing of permanent and transient faults in QCA circuits. The CQCA element has been proven to be more effective than the popular Fredkin element, in terms of speed and area. Our researchers have also developed several other methods of detecting faults at the inputs and outputs and have incorporated them into their invention.

ADVANTAGES:

- **Better Performance than the standard Fredkin element**
- **Concurrent detection of transient and permanent faults**
- **Low cost of implementation**

Conservative Quantum Computing



QCA Layout of CQCA Gate

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