Design and Development of 4-Bit Adder Programmable QCA Design using ALU Technique

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INTRODUCTION

QCA is a field of nanotechnology that is utilised in contemporary sciences, proven in the present, and occasionally taught in CMOS semiconductor . The most crucial aspect of constructing circuits is reaching a dimension where possibility is a problem. High power and leakage current are used. It is a well-known, practical technology with few flaws. A QCA cell is made up of a few free electrons that are most likely constrained in a potential . It uses CMOS technology, and an ALU design is used to manage QCA processes. Four clocking systems are performed on polarised data on a periodic basis. Every digital logic design involves a lot of work. Engineers were able to reduce the size of the semiconductor thanks to considerable new work in the field of frilled technology. Finding a 4-bit adder using carbon nanotubes and QCA cells based on the existing CMOS-based VLSI technology is unique since it may boost scaling by reducing or preventing high power consumption.

Problem

- The performance of computers hasn't seen a considerable jump since the I series of processors by Intel with the nehalem architecture.

- Existing R and D is put into reducing the size of oxide layer namely the nm length which can be seen as a saturating solution.

Solutions

- Providing an alternate working for the most basic unit of a processor ie the ALU which consists of adders and multipliers among many other components.

- This will create a domino effect which will bring about big improvements upon development and implementation.

Method of approach

This method basically proposes specialized architecture procedure to program devices and simulation is also done to tune QCA cells aimed for this specialized development design meaning it can be manipulated to serve many operations and not specifically manufactured for a particular implementer.

Subtopics under QCA which we will research upon

- QCA Cells: It is used as a fundamental unit of QCA block for growth or maturation of small number of constituent particles applied in a circuit (computing wires).

- QCA Clocking : is defined as the areas where the conduction happens, in other words it can be explained as they are the conductive materials which modulate electron tunneling barriers of QCA cell in operation.

The advantages of QCA over Standard CMOS transistors:

- The main advantage of having QCA cells is that it uses minimum power for adder circuits of 4-bits which are integrated more to form CPUs.

- By using Moore's law we know that the total transistors gets an increase by 50% in CMOS rising to size reduction and high power dissipation .

- In ALU design in QCA cells the transistors used are far less and are adaptive to work under a range of temperature and are efficient.

Future Scope in This Area:

- With the use of the ALU technique, several QCA design techniques are used, including the 3 bit, 4 bit, and 5 bit binary to grey converter and the grey to BCD converter. To save exact data and information through codes, this is helpful.
- Using the QCA Designer tool, the suggested layout is simulated and the layout circuits are designed. The suggested designs are created using the least amount of cells and the shortest possible clock delays. Studies indicate that the designs have high switching speeds and are both area-efficient and fast. K-maps and truth tables are used to double-check the expected findings. A detailed explanation of the implementation is provided by QCA code converters logic circuits. These could reduce error detection in the not too distant future, leading to technology that is mistake-free. ALU is essentially employed in all software applications, and the integration of QCA cells made it possible to combine computer science and electronics in the near future thanks to the development of the VLSI technology network globally.

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