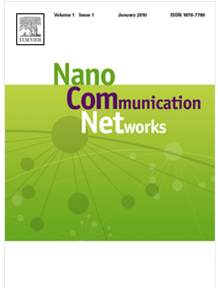
Accepted Manuscript



Design and evaluation of a new structure for fault-tolerance full-adder based on quantum-dot cellular automata

Saeid Seyedi, Nima Jafari Navimipour

PII: S1878-7789(17)30154-0
DOI: https://doi.org/10.1016/j.nancom.2018.02.002
Reference: NANCOM 203

To appear in: *Nano Communication Networks*

Received date : 7 November 2017
Revised date : 12 January 2018
Accepted date : 8 February 2018

Please cite this article as: S. Seyedi, N.J. Navimipour, Design and evaluation of a new structure for fault-tolerance full-adder based on quantum-dot cellular automata, *Nano Communication Networks* (2018), https://doi.org/10.1016/j.nancom.2018.02.002

Design and evaluation of a new structure for fault-tolerance full-adder based on quantum-dot cellular automata

Saeid Seyedi[1] and Nima Jafari Navimipour[2]*

1- Young Researchers and Elite Club, Tabriz Branch, Islamic Azad University, Tabriz, Iran, Stu.SaeidSeyedi@iaut.ac.ir

2- Department of Computer Engineering, Tabriz Branch, Islamic Azad University, Tabriz, Iran, jafari@iaut.ac.ir

Abstract

Quantum-dot Cellular Automata (QCA) has emerged as an attractive alternative to Complementary Metal Oxide Semiconductor (CMOS) technology in the nanoscale era. In designing arithmetic circuits, an efficient adder can play a significant role. The next generation of digital systems will be used QCA as desired technology. The QCA computational and arithmetic systems will be facilitated using an efficient QCA-based full-adder. The defects of manufacturing and variations still remain as a problem in QCA-based circuits. Being unreliable and error-prone are the weaknesses of these circuits. Therefore, in this paper, a novel QCA-based fault-tolerant full-adder design using cells redundancy is suggested. Three elements such as misalignment, missing and dislocation cells are important in analyzing the fault properties. Further, this paper aims to study the functionality and the fault-tolerant property of the proposed full-adder in the presence of QCA deposition faults. The obtained results using QCADesigner have demonstrated the proposed full-adder has better performance in terms of latency, complexity, and area in comparison to the previous full-adder designs. Also, the redundant version of full-adder has simple and strong structure compared to standard styles.

Keywords: Quantum-dot cellular automata; Full-adder; Fault-tolerant circuits; Nanoelectronic circuits; Design and modeling.

1. Introduction

Nanoelectronic refer to the use of nanotechnology in electronic components and have very important in computer architecture and nanocommunications [1, 2]. In nanoscale, Quantum-dot Cellular Automata (QCA) as a new device architecture is proper for nanometer computer architectures. A four-dot squared cell is the main factor in QCA [3]. Two free identical charges are included in that cell. The occupation of dots is done diagonally by these electrons, which is the result of Coulombic interaction [4]. Unlike Complementary Metal Oxide Semiconductor (CMOS) technology, the relative formation of the charges instead of current is used to encode the binary information by QCA. Low energy consumption, fast operation, and small dimensions are the objects of QCA circuit [5, 6]. The majority and