Abstract

Speed and accuracy will always be the interest of research workers in computer science and engineering. The basics to the computer development are the arithmetic circuits. These circuits consist of operations like addition, subtraction, multiplication, division, squaring, and square rooting. In this presentation, we will give the history of the development of computing circuits during the last about 50 years.

The computer circuits were developed using arrays. The authors and co-workers designed a generalized pipeline array in early 70s. This work was very well cited in various international journals and books.

The author continued its work with his research students at Wayne State University both for teaching and research. Recently, the author and his students and co-workers extended the array from 5 rows to 9 rows to make it more generalized. Ideally the array can be extended to any number of bits. The authors and the students developed FPGA and VLSI implementation for this array using Verilog language. Recently, there has been interest in nanotechnology. The authors extended their previous work to nanocircuits. The simulation results for nanoarrays are given in this presentation. It is hopeful that this work will be useful for research workers doing research in the areas of high speed computing circuits. The possible applications of the nano arrays are in the field of biosensors.
Abstract

Photonic antennas are critical in applications such as spectroscopy, photovoltaics, optical communications, holography, sensors and integrated LIDARs. In most of those applications, metallic antennas have been employed due to their reduced sizes. Nevertheless, compact metallic antennas suffer from high dissipative loss, wavelength-dependent radiation pattern, and they are difficult to integrate with CMOS technology.

All-dielectric antennas have been proposed to overcome those disadvantages because, they are CMOS-compatible, easier to integrate with typical silicon waveguides, and present a broader wavelength range of operation. These advantages are achieved, however, at the expense of larger footprints that prevent dense integration. To overcome this drawback, we employed topological optimization to design an all-dielectric compact antenna with vertical emission over a broad wavelength range.

This novel design has been fully verified experimentally. On the other hand, phased-array antennas are essential for applications in which gain, power loss, or information security are key requirements. However, fabrication of photonic single antennas and their feeding network require long separations among elements, leading to the appearance of secondary radiation lobes and, consequently, undesired crosstalk and interference. We experimentally have shown that by arranging the elements according to the Fermat’s spiral, the side lobe level can be significantly reduced.