Guest editorial

Artificial intelligence in semiconductor industry – Materials to applications

This issue of "Artificial Intelligence in semiconductor industry – Materials to applications" contains a collection of seven extended papers on how the semiconductor industry benefits from artificial intelligence (AI) adoption and also discusses about the methodologies with which the semiconductor companies may position themselves to capitalize on the growing AI industry.

The main theme of this special issue is to develop a smart and intelligent semiconductor industry, which refers to the development of a set of innovative practices and end-to-end solutions to satisfy the emerging storage, memory and specialized computing requirements of semiconductor industries. Specifically, this special issue has solicited the research works that discusses about the applications of machine learning (ML), deep learning and other AI in all the areas of semiconductor demand-forecasting and optimization related to its hardware manufacturing, automation of chip design and verification, operational efficiency in semiconductor fabrication, methods to shorten processing time, automated detection of defects in semiconductor circuits and other such innovative methodologies to fasten piloting, real-time inference and scalable deployment.

There are many recent successful applications of AI and ML to solve both the hardware challenges in semiconductor domain. For instance, ML methods can be implemented to avoid time-consuming iterations, expedite yield ramp-up and lower the expenses that are required to sustain yield by reducing faults and out-of-tolerance process steps. They may incorporate the ability to automate the time-consuming procedures of physical-layout design and verification.

The seven papers in this special issue cover the novel algorithms to enhance the chip design. Wherein, the first paper titled "Efficient VLSI architecture for FIR filter design using modified differential evolution ant colony optimization algorithm" discusses about the efficient finite impulse response (FIR) filter architecture in combination with the differential evolution ant colony algorithm with a primary aim to satisfy the economic power utilization and also the specifications in the frequency domain and gain a quick convergence speed. The second paper titled "Optimized DA-reconfigurable FIR filters for software defined radio channelizer applications" describes about the different methods used for reconfigurable finite impulse response (RFIR) filter design. This research work has integrated both RFIR and SDR as a single system and implemented on Artix-7 development board of XC7A100tCSG324 to exploit the advantages in area-delay, power speed products and energy efficiency. Furthermore, the proposed DA-based RFIR filter is validated using Chipscope Pro software tool on Artix-7 FPGA in Xilinx ISE design suite and compared constraint parameters with the existing state-of-art results. The third paper titled "Grid Connected Operation and Performance of Hybrid DG having PV and PEMFC" integrates the distributed generation (DG) and the utility grid to provide reliable and secured power. This research work is more focused on the adequacy and security in the grid-integrated hybrid DG having photovoltaic and proton exchange membrane fuel cell. Furthermore, the simulation of this grid-connected hybrid DG is performed by using MATLAB/Simulink environment. The fourth paper titled "High speed Data Encryption Technique with Optimized Memory Based RSA algorithm for Communications" has proposed the novel RSA algorithm with lookup table, which is an extension to the Chinese remainder algorithm that works better for image and video in terms of time complexity. Moreover, the proposed method shows better performance compared to other standard methods with a minimal processing time. The fifth paper titled "A 10-bit 200 MS/s pipelined ADC with parallel sampling and switched op-amp sharing technique" describes a 10-bit 200-MS/s pipeline analog-to-digital (A/D) converter for optimizing the power in the architectural level by incorporating extensively parallelism and op-amp sharing circuit in the S/H circuit and the component ADCs. The converter achieves better results when compared with the other existing switching converters. The sixth paper titled "Orthogonal Mode Dual Band MIMO Antenna System for 5 G Smartphone Applications Using Characteristic Mode Analysis" develops a novel multi-antenna design approach to obtain efficient and uncorrelated antennas for 5 G mobile applications. With proper excitations for different characteristic modes that remain orthogonal to each other, well-matched MIMO antennas with low coupling and correlation have been achieved. The seventh paper titled "Design and implementation of artificial magnetic conductor surface as decoupling structure in microstrip antenna arrays" describes the technical perspective and recent works on AMC for antenna applications. Also, this research work has proposed novel theoretical aspect, simulation design procedure and the measurement setup used to characterize the AMC unit cell. From the results, it is evident that the employment of AMC as a decoupling structure has solved many issues while overcoming the major limitations in the conventional antenna design.

We thank the Emerald publications and the editors for facilitating the publication of extended special issue in *Circuit World Journal*. We hope that the readers will gain state-of-the-art research knowledge from this special issue.

The current issue and full text archive of this journal is available on Emerald Insight at: **https://www.emerald.com/insight/0305-6120.htm**

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