Editor's Column

Mladen Knezic

> It is hard for an individual to properly assess his intellectual abilities. Even a fool considers himself smart.
>
> *Milutin Milanković, Memories*

WE are pleased to present this new issue of the journal featuring four compelling papers that highlight significant advancements across integrated circuit simulation, high-efficiency digital signal processing architectures, reliable memory design for healthcare devices, and machine learning applications in precision agriculture.

The first paper, entitled "Virtual Simulation of Integrated Circuits Combining AP with DE Algorithm," authored by Peipei Hu, proposes a simulation method that combines the Affinity Propagation (AP) algorithm for circuit fault diagnosis with the Differential Evolution (DE) algorithm for circuit parameter optimization. The fusion of these algorithms aims to provide a more efficient and accurate virtual simulation method for Integrated Circuit (IC) design, helping to predict and solve problems early in the design phase, thus reducing manufacturing costs and shortening the research and development cycle. Experimental results confirm that the combined AP and DE approach achieved a precision of 94.26%, a recall rate of 93.41%, and a mean F1 value of 88.59%. Furthermore, the convergence speed was measured at 56.77 seconds, with a stability of 93.17%. The proposed fusion algorithm demonstrates better performance across these metrics when compared to several optimization methods, including standalone DE and AP, Genetic Algorithm (GA), Simulated Annealing Algorithm (SAA), Ant Colony Algorithm (ACA), Particle Swarm Optimization (PSO), and Artificial Neural Network (ANN).

The second contribution, "High-Performance and Resource-Efficient Squaring Architecture for FPGA Platforms," by Burhan Khurshid, introduces a novel approximate squaring architecture based on the CORDIC algorithm. By operating the CORDIC algorithm in linear mode, the architecture is modified to emulate the squaring function using only simple shift and add operations. The core design is an unfolded (pipelined) feed-forward architecture, converting the sequential iterative structure to a parallel one suited for high-speed Digital Signal Processing (DSP) applications. A Pareto analysis conducted on the 8-bit CORDIC square architecture found that 8 stages are optimal, achieving an Error Rate (ER) of 5%, meaning 95% of the results are accurate. This proposed architecture demonstrated superior efficiency, reporting a 25% reduction in Power-Delay-Area Product (PDAP) on ASIC platforms and a 38% reduction in PDAP on FPGA platforms, compared to the next best existing design. The design also recorded the lowest Mean Error Distance (MED) and Normalized Mean Error Distance (NMED) among the various compared 8-bit square architectures.

Next, the paper "Variation Tolerant SRAM with Enhanced Stability for Wearable Healthcare Devices," authored by M. Kavitha, S. Ramani, and P. K. Janani, addresses the crucial need for ultra-low power and robust memory cells in battery-powered wearable healthcare devices. The authors propose an asymmetrical nine-transistor Carbon Nanotube Field Effect Transistor (CNTFET) SRAM cell (PA9T SRAM) designed for enhanced stability and variation tolerance. The PA9T SRAM achieves power minimization by incorporating a multi-threshold voltage technique (using High Threshold Voltage (HVT) transistors in the cross-coupled inverters) and a stacking effect (via an HVT sleep transistor shared by all read ports). Compared to the conventional structure (CA9T SRAM), the proposed design showed remarkable improvements: power reduction during read and write operations was enhanced by 4.7x and 9.9x, respectively. Furthermore, the reduction in read delay and Power Delay Product (PDP) was improved by 10x. Stability metrics indicated that the hold, read, and write stability were enhanced by 1.4x, 1.2x, and 4.1x, respectively.

The final paper, "A GCN-Attention Model for Precision Irrigation Evaluation," by Ying Huang and Meng Liu, proposes the innovative and computationally efficient UFO-GCN-SPANet architecture for precise irrigation evaluation, specifically for resource-constrained precision agriculture. The architecture sequentially integrates a linear-complexity Unit Force Operated Vision Transformer (UFO-ViT) for efficient global spatio-temporal feature extraction (overcoming the $O(N^2)$ bottleneck of standard Transformers), Graph Convolutional Networks (GCNs) for spatial dependencies, and a Salient Positions-based Attention Network (SPANet) employing a Significant Position Selection (SPS) algorithm to focus computation on the most informative features. By transforming the soil water content prediction problem into a classification problem, the model guides dynamic irrigation strategy. Experimental results demonstrate the model's superior predictive performance on a collected tea plantation dataset, achieving an overall accuracy of 0.9596, average precision of 0.9205, average recall of 0.9410, and average F1-Score of 0.9239. This represents a significant improvement, including a 12.07% higher accuracy compared to the GCNConv model.

Finally, I thank the authors for their contributions to this issue of the journal and extend great appreciation to all the reviewers who participated in the editorial process by providing valuable comments in a timely manner to the editors and authors.