Guest Editor's Introduction: Special Section on VLSI for Next Generation CE

VLSI for Next Generation CE

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The current research in VLSI explores emerging trends and novel ideas and concepts covering a broad range of topics in the area of VLSI: from VLSI circuits, systems, and design methods, to system-level design and system-on-chip issues, to bringing VLSI methods to new areas and technologies such as nano and molecular devices, MEMS, and quantum computing. Future design methodologies are also key topics of Very Large Scale Integration (VLSI) research, as well as new Electronic Design Automation (EDA) tools to support them.

The purpose of this Special Section is to provide an insight into current research and development in aspects related to ISVLSI. This Special Section includes four papers that were presented in the 2017 edition of the Symposium. The four articles were appropriately selected (based on their quality) in order to cover various topics of the Symposium.

ARTICLES OF THIS SPECIAL SECTION

The article "A Brain Computer Interface Framework Based on Compressive Sensing and Deep Learning" proposes an approach to save transmission bandwidth and storage of spike signals recorded from multiple sources. This is achieved by compressing the brain–computer interface (BCI) signals. However, precise reconstruction of the compressed signal is also crucial as these data are further used for spike detection and/or classification. Conventional compressive sensing (CS) techniques for reconstructing the compressed BCI signals are computationally expensive. The authors devise a framework based on convolutional neural networks that is able to reconstruct spike signals that have been highly compressed using the proposed CS technique.

The article "CONDENSE: A Moving Target Defense Approach for Mitigating Cache Side-Channel Attacks" develops a viable and low-overhead technique for mitigating security vulnerabilities in caches. CONDENSE takes advantage of runtime reconfigurable caches to provide a moving target defense against side-channel attacks, while also optimizing the cache's energy consumption. Using the last-level cache as a case study, the article explores the benefits of CONDENSE for introducing noise into the side channel. To obfuscate the cache's behavior and mitigate attacks, CONDENSE dynamically changes the cache configuration at runtime to a randomly selected configuration from a predetermined subset of cache configurations. The experimental results of the article reveal that

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employing cache configurability as a defense mechanism is promising.

The article "High-Performance Hardware for Block LMS Adaptive Noise Canceller for In-Ear Headphones" presents a high-performance hardware design of block least mean square adaptive noise canceller for in-ear headphones. It is based on distributed arithmetic, which stores filter partial products in look-up tables (LUTs). The proposed technique splits LUTs into two smaller LUTs and stores the filter partial products in an offset binary-coded form. A novel strategy is also presented to update the LUT contents. The authors perform a comprehensive evaluation of the proposed techniques and compare the solution with the best existing designs.

The article "Optimizing the Operational Time of AAL Robots" presents an FPGA-based implementation for increasing the operational time of ambient assisting living (AAL) robots. The article describes a profile-driven approach to minimize the usage of the excessively power-consuming components, thus drastically extending the time duration the AAL robot can operate without requiring recharging during the day. The proposed methodology takes as inputs: i) the daily activity patterns of the patient, ii) information about the domestic environment, and iii) the power profile of the robotic platform and outputs the robot operational time. The key idea has been implemented as dedicated hardware components in a Zynq FPGA that was integrated in the robotic platform. During the periods of inactivity (e.g., when the monitored person is sleeping or watching TV), the robot goes into the sleep mode, and the role of the dedicated hardware components is to perform an early detection of a possibility for a new event (e.g., the person is standing up), so that the main and power-hungry processing engines of robot can be invoked.

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