Editorial

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Published online: 1 October 2019
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Chief Editor and Special Editor

We are indeed happy to bring to you the September 2019 issue of CSI Transactions on ICT with outstanding brief reports from work in progress in India in various institutions and laboratories. I am sure the readers will find it interesting to notice that so much cutting edge research is going on in our country. The credit for summarization goes to Prof Navakant Bhat, who serves on the Academic Committee of the Sir Visvesvaraya Program and readily agreed to be our Special Editor. Happy reading.

The first paper titled “Design of a minimally invasive ECG regulated Ventricular Assistive Device” by P. Sharma et al., explores the design of a novel electromechanical device to assist pumping of weak heart. The conventional ventricular assistive device suffers from disadvantages such as infection, blood clotting, internal bleeding. The proposed design utilizes the inflation and deflation of a balloon wrapped around the heart, which is

controlled through a real time feedback subsystem driven by the ECG signal. The proposed design is validated through a 3D modelled heart integrated with pressure sensor, imparting a maximum pressure of 6.44/3.39 mm of Hg during systole and diastole duration.

The second paper, “Optimal designs of analogue and digital fractional order filters for Signal Processing Applications”, by R. Kar, propose optimal design of fractional order (FO) DSP system using differentiators and integrators in the discrete domain with improved frequency response performances. Optimal integer-order rational transfer function is used to realize analogue butterworth filter with fractional stepping in the transition band. A generalized approach to determine the coefficients of the reduced order enables reduced hardware overhead in practical implementation.

B. Tamma et al. present various architectures and traffic steering mechanisms for efficient interworking of LTE and Wi-Fi networks in their paper “On Convergence and Coexistence of LTE and Wi-Fi Networks” and evaluate their performance for carrying TCP traffic. The proposed Radio Level Integration combines different architectures to enable efficient and dynamic traffic steering based on link parameters like bandwidth, loss rate, delay, jitter. The packet steering solution using virtual congestion control mechanism, is shown to improve the performance of both LTE and Wi-Fi links, while supporting TCP traffic efficiently.

The next paper, “Design and Fabrication of AlGaN/GaN High Electron Mobility Transistors for Biosensing Applications” by C Periasamy and A Varghese, explores the use of GaN HEMT device for pH and biomarker sensing application. Technology CAD based simulation and modeling has been used to optimize various structural layers, using appropriate process techniques. A pH sensitivity of

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1.5–2 mA/pH has been achieved for 3 μ m gate length AlGaIn/GaN HEMT device.

The fifth paper by C. Nutakki, “Modeling fMRI BOLD signals and temporal mismatches in the cerebellar cortex” explores the connection between neuronal population in the brain, their interconnect circuit network leading to specific cellular response, with a motivation to understand the large brain activity and the network models. As an illustration, the authors use bio-realistic computational models of cerebellum granule cell, to compute in vivo spike train patterns and then translated into functional Magnetic Resonance Imaging (fMRI), Blood Oxygen-Level Dependent (BOLD) signals.

The next paper “Analog Front-End Design for Biomedical Signal Acquisition Systems”, by M. Ansari, presents a summary of ongoing and future work in realizing ultra-low power front end signal conditioning circuits. The design of Operational Transconductance on 180 nm CMOS technology is presented to achieve an ultra-low transconductance of 1.36–5.59 nA/V.

The seventh paper by M. Rao presents the summary of research carried out in 3D VLSI interconnect technology and assistive medical devices. In the 3D interconnect technology, a detailed modeling methodology is presented for the Through Silicon Vias (TSV), composed of Copper and Carbon Nano Tubes, to predict interconnect delay as a function of capacitive loading. In the area of assistive technology, several devices such as assistive upper limb device, lower limb device for deep vein thrombosis, tactile educational kit and ventricular assistive devices are explored.

The paper by M. Kumar, titled “An Investigation of Reliability and Variability issues in Nanoscale SOI and Multi-gate MOSFETs: Modelling, Simulation and Characterization” presents the performance of different device architectures, and their reliability and variability in different working conditions, using measurements and Technology CAD simulations. The heavy-ion irradiation reliability for outer space applications has been evaluated for 180-nm Fully and Partially-Depleted SOI MOSFETs with a focus on the single event effects (SEE) on 6T SRAM cell. For sub-10 nm devices such as nanowire FET, FinFET, the reliability due to self-heating (SH) is studied. The effect of process variations have been analysed through Monte Carlo simulation using compact models.

R. Sharma in his paper titled “Design of Energy-Aware Interconnects for Next Generation Micro Systems” evaluates the effect of surface roughness in ultra-scaled Copper (Cu) interconnects. Through simulations, it is demonstrated that surface roughness can severely degrade the electrical

and thermal performance of Cu interconnects, thus impacting overall system performance.

The tenth paper in this issue by B. Bhowmick, explores emerging devices namely FinFET and Tunnel FET devices for biosensor and infrared photodetector application. The device parameter optimization is considered through simulation based exercise.

“Recent Advances in Multimodal Big Data Analysis for Cancer Diagnosis” by P. Maji presents techniques for large scale data analysis in the context of medical diagnosis. It is highlighted that the simultaneous analysis of multimodal data, such as imaging, RNA and DNA analysis, can provide unique insights for the biological systems. The combination of multimodal data may potentially provide a more complete and discriminatory description and diagnosis of the intrinsic characteristics of patterns in diseases such as cancer.

The next paper by B. Deka, “Sparse Representations and Compressive Sensing in Multi-dimensional Signal Processing” presents compute efficient techniques for big data analysis. Multi-dimensional signal processing involving Magnetic Resonance Imaging, Body Area Network, remote sensing images etc. takes significant amount of computational time because of their raw data size. Through exhaustive simulations, exploiting sparse representation substantial performance enhancement is demonstrated for three case studies : MRI reconstruction, multi-lead EEG signal compression for wireless transmission and multispectral image super resolution in remote sensing.

The paper by P Rajalakshmi, “On Building a Smarter Ecosystem Using the Internet of Intelligent Things: Progress and Future Challenges” presents Internet of Intelligent Things (IIoT) platforms for healthcare, smart building and farming applications. For healthcare, the scanning information obtained from wireless ultrasound transducers is used to develop AI enabled computer aided diagnosis framework. For smart buildings, non-invasive monitoring of electrical faults is developed. For smart agriculture unmanned aerial vehicles and drones are utilized to obtain high throughput crop phenotyping and management system for smart and precision agriculture.

The last paper “Text Summarization using Multiobjective Optimization”, by S. Saha explores different types of summarization systems available, such as document summarization, microblog summarization, multimodal summarization, figure-assisted summarization. Various techniques based on supervised natural language processing are discussed, along with the motivation for unsupervised automatic summarization techniques used in this work.