A call for papers is now open for the *IEEE Journal on Exploratory Solid-State Computational Devices and Circuits* Special Topic on "Non-traditional Devices, Circuits, and Architectures for Energy Efficient Computing"

Aims and Scope

Recently, novel applications in the space of artificial intelligence (AI) such as solving constraint optimization problems, probabilistic inferencing, contextual adaptation and continual learning from noisy data are gaining momentum to address relevant real-world problems. A majority of these tasks are compute and/or memory intensive. While traditional deep learning has been fueled by the utilization of graphic processing units (GPU) to accelerate algorithms primarily in the cloud, today we see a surge in the development of application/domain-specific integrated-circuits and systems that aim at providing an order of magnitude improvement over traditional GPU-based approaches in terms of energy efficiency and latency. This growing branch of research taps into the realms of neuronal dynamics, collective computing using dynamical systems, harnessing stochasticity to enable probabilistic computing and even draws inspiration from quantum computing. We envision such specialized application/domain-specific systems to perform complex tasks such as solving NP-hard optimization problems, performing reasoning and cognition in the presence of uncertainty with superior energy-efficiency (and/or area and latency improvements) compared to conventional GPU-based approaches and von Neumann computing using traditional silicon-based devices, circuits and architectures. Of special interest is to utilize such non-traditional computing approach to reduce the time to obtain solution for computationally challenging problems that otherwise tend to grow exponentially with problem size. To support this vision, there needs to be fundamental advances in both non-traditional devices and circuit/architectures. Recent works have shown that novel circuit topologies and architectures involving non-Boolean, oscillatory, spiking, probabilistic or quantum-inspired computing are more suited towards tackling applications such as solving constraint optimization problems, performing energy-based learning, performing Bayesian learning and inference, lifelong continual learning and solving Quantum-inspired applications such as Quantum Monte Carlo. A flurry of current research highlights that compared to traditional silicon-based devices, emerging nanodevices utilizing novel quantum materials such as complex oxides, ferroelectric and spintronic materials can allow the realization of these novel circuits and architectures with lower foot-print area, higher energy-efficiency and lower latency.

This special issue of the IEEE Journal on Exploratory Computational Devices and Circuits (JXCDC) aims to call for the recent research advances in the field of non-traditional devices, circuits and architectures for energy efficient computing. Papers on the interaction and co-optimization of the materials and devices as well as circuits and architecture are solicited.

Topics of Interest include but are not limited to:

Prospective authors are invited to submit original works and/or extended works based on conference presentations on various aspects of non-Boolean computing, oscillatory or spiking neural networks, probabilistic computing and quantum-inspired computing. Emerging nanodevices utilizing novel quantum materials such as phase-transition oxides, complex oxides, ferroelectric materials, magnetic/spintronic materials and photonics. Review papers are also solicited (is it by a separate invitation??)

The following topics are specifically solicited:

- Materials and devices that can enable dynamical systems, e.g. oscillatory Ising machines and probabilistic computing

- Materials and devices exhibiting neuronal dynamics enabling Bayesian and continual learning
- Materials and devices supporting quantum-inspired computing
- Integration of emerging technologies with silicon for building energy-efficiency systems
- Array-level demonstration and/or architecture-level design for non-traditional energy-efficient computing
- Co-optimization of hardware and algorithms for non-traditional energy-efficient computing
- Benchmarking simulators for non-traditional energy-efficient computing
- New applications for non-traditional energy-efficient computing involving non-Boolean circuits, oscillatory or spiking neural networks, probabilistic and quantum-inspired systems.

Submission Guidelines

The IEEE Journal on Exploratory Solid-State Computational Devices and Circuits (JXCDC) IS AN OPEN ACCESS ONLY PUBLICATION: Charge for Authors: $1,850 USD per paper with the following discounts:

IEEE Members receive a 5% discount.
IEEE Society Members receive a 20% discount.
These discounts cannot be combined.

Paper submissions must be done through the ScholarOne Manuscripts website: https://mc.manuscriptcentral.com/jxcdc

Guidelines for papers and supplementary materials, as well as a paper template, are provided at this website (also on the next page).

Inquiries for the JxCDC Journal should be sent to: JXCDC@IEEE.ORG

Important Dates

Open for Submission: September 15th, 2022
Submission Deadline: December 1st, 2022
First Notification: January 15th, 2023
Revision Submission: February 1st, 2023
Final Decision: February 15th, 2023
Publication Online: March 1st, 2023

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