

IEEE Transactions on Circuits and Systems I: Regular Papers



CALL FOR PAPERS



for Special Issue on

Learning, Optimization, and Implementation for Circuits and Systems driven by Artificial Intelligence

Theme: Circuits and systems cover various kinds of circuits and systems, such as multidimensional and nonlinear systems, large-scale integration circuits, and power networks, playing a significant role in the whole spectrum from basic scientific theory to various real applications. With the increasing demand from applications, it is vital to develop circuits and systems with high accuracy, stability, flexibility and security by efficient learning, design optimization and integrated implementation, which requires high-precision modelling and low-cost parallelism with low-power computation. Artificial intelligence (AI) has rapidly progressed over the past three decades, from perceptron-based neural networks and neuro-fuzzy systems to today's deep neural networks (DNNs) and brain-inspired computing. From theory and applications, circuits and systems and AI supplement each other. On the one hand, the research of circuits and systems on efficient learning, design optimization and integrated implementation driven by AI has gained significant development, where energy-efficient circuits and systems have a very broad range of applications, including such as electrical load prediction, coordinated control of photovoltaic/battery systems, image/video/audio processing, and brain-machine interfaces. On the other hand, the utilization of AI to real-world applications has become inseparable from the optimization and implementation of circuits and systems with high efficiency and low-power computation. 1) *From the perspective of efficient learning*, a feasible and efficient way for signal processing, dynamic modeling and nonlinear analysis for circuits and systems, is based on DNNs. For example, video technologies for circuits and systems, such as image/video analysis and synthesis, cover filtering, transforms and pruning techniques, are driven by AI. The time series prediction of uncertain factors, such as photovoltaic and wind power generation in power networks relies on the learning efficiency of DNNs. 2) *From the perspective of design optimization*, the current design of circuits suffers from the challenges in terms of memory footprints and power consumption. Hence, there is an urgent need to develop AI-driven design optimization for circuits and systems to ensure that complex calculations are performed with less memory footprint, higher energy efficiency, and faster computation speed. 3) *From the perspective of integrated implementation*, both hardware and software implementation for circuits and systems need to take into account the utilization, adaptability and compatibility. When the applications of deep learning techniques are extended to platforms that are more resource- and energy-constrained like mobile devices, it is necessary to design lightweight DNN models with efficient network compression technologies and improve efficient hardware utilization and suitability for potential applications. Overall, through advanced learning, optimization and implementation driven by AI, efficient circuits and systems running in real time with low power can be realized for wider applications. All such timely important topics are considered within the scope of the present Special Issue.

Authors are invited to submit Regular Papers following the IEEE Transactions on Circuits and Systems I: Regular Papers (TCAS-I) guidelines, within the remit of this Special Issue call. Topics within the scopes of “Learning, Optimization, and Implementation for Circuits and Systems driven by Artificial Intelligence” include (but are not limited to):

- Cooperative modelling and analysis of circuits and systems driven by AI
- AI-based learning for circuits and systems with low power consumption
- AI-driven computer-aided circuits and systems design and optimization
- AI-based test analysis, fault traceability and root cause analysis for circuits and systems
- Computational analysis and physical architectures of memristive neural networks
- Design AI System-on-Chip with higher utilization of computation resources
- Reinforcement learning-based power management policy for circuit and systems
- Image/video processing via AI based on circuits and systems
- Energy and computational resource efficient circuits and systems for AI accelerators
- Quantum circuit implementation with high-efficient computation process
- Circuits implementation based on brain-inspired computing
- Energy-efficient circuits and systems for biological neural simulation
- Attack-resilient analysis, estimation, optimization, and control of power networks
- Interpretable learning and optimization of power networks
- Emerging techniques for circuits and systems like metaverse
- Applications to typical integrated circuits

Timetable:

- Paper submission: 30 July, 2023
- Completion of first round of review: 30 September, 2023
- Completion of final review: 30 November, 2023
- Target Publication: 30 January, 2024

Manuscript Preparation and Submission:

All submitted manuscripts must (1) conform to TCAS-I's normal formatting requirements and page count limits; (2) incorporate no less than 80% of new (previously unpublished) material; (3) validate principal claims with experimental results and all secondary, difficult-to-test claims with simulations; (4) be submitted online at: <https://iee.atyponrex.com/journal/tcas1>. Please note that you need to select “Learning, Optimization, and Implementation for Circuits and Systems driven by Artificial Intelligence” when you submit a paper to this Special Issue.

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