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CALL for PAPERS

Integrated Devices, Circuits, and Systems for the 6G Era

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Scope and purpose

As 5G rolls out worldwide, teams of visionary experts are developing roadmaps and revolutionary applications for the next-generation wireless network: 6G. The 6G mobile networks will establish new standards to fulfill the unreachable performance required by the current 5G networks. This will lead to emerging new applications. We anticipate that 6G technology will be capable of supporting extremely high-performance connectivity with massive numbers of connected devices.

In the current 5G era, CMOS technology has driven progressive advances at the device level. Undoubtedly, CMOS technology is the densest and most cost-effective, offering unbeatable performance for digital signal processing. However, today's CMOS-based integrated circuits (ICs) and manufacturing processes increasingly reach their full potential. The performance improvement becomes marginal for building blocks used for analog signal processing, especially radio-frequency integrated circuits (RFICs). Although the spectrum allocated for 6G has not been finalized yet, it is likely that the spectrum reserved for 5G New Radio (NR) will be continually used in the 6G era, and the spectrum at sub-THz (90-300 GHz) will be further explored. To exploit the spectrum range above 90 GHz, 6G must address multiple challenges, such as substantial path loss and design complexity compared with the 5G NR. Therefore, it raised several critical questions, and we expect to find solutions to these questions in this Special Issue.

Due to device-level limitations of the silicon process, would CMOS still be the dominant technology for IC design in the 6G era, especially in RFIC design? Could CMOS still deliver the necessary energy efficiency and power-handling capability at 90+ GHz? There are a few pioneering works that have been reported at 90+ GHz. These works have shown that the performance, especially for the building blocks used in RFICs can be significantly improved using compound semiconductor technologies, such as GaAs, GaN, InP, and SiGe. Therefore, it enables analog signal processing where wide bandwidth, high gain, low noise, and high output power, etc. are required.

Moreover, Artificial Intelligence (AI) is poised as a tool of choice for many applications. As is often seen with social media, the so-called machine learning technology can be a powerful tool to assist decision-making. There is no exception for IC design. In the 6G era, large antenna arrays will be used at a system level to support

massive multiple-input multiple-output (MIMO). Some initial activities have demonstrated that the AI-assisted digital pre-distortion (DPD) approach works very well for massive MIMO systems. Also, on-chip passive components can be independently designed using machine learning. Would optimizing a large antenna array or a complicated on-chip passive structure without running tedious electromagnetic (EM) simulation iterations be possible? Such activities will be further accelerated in the 6G era and eventually used to assist the current design capabilities. In summary, as 6G technology is still in its infancy, many technical challenges need to be fully addressed at the device, circuit, and system levels.

Topics of interest

This Special Issue covers a wide range of topics for multi-disciplinary research activities, including devices, circuits, and systems. Topics of interest to this special issue include, but are not limited to:

- **Advanced concepts for 6G architectures.**
- **AI-assisted design methodologies for 6G applications.**
- **Antenna-in-package design for 6G applications.**
- **Circuits and systems for 6G applications.**
- **Co-integrated communications/sensing platforms for 6G applications.**
- **Digitally assisted transceiver design for 6G applications.**
- **Heterogeneous integration for 6G applications.**
- **Multi-band/multi-purpose circuits for 6G applications.**
- **Transceiver architectures for 6G applications.**

Submission procedure

Prospective authors are invited to submit their papers following the instructions provided on the JETCAS website: https://mc.manuscriptcentral.com/jetcas. The submitted manuscripts should not have been previously published, nor should they be currently under consideration for publication elsewhere.

Important dates

- **Manuscript submissions due:** **2023-09-01**
- **First round of reviews completed:** **2023-11-01**
- **Revised manuscripts due:** **2023-12-01**
- **Second round of reviews completed:** **2024-01-30**
- **Final manuscripts due:** **2024-02-15**
- **Target publication date:** **2024-03-01**

Request for information

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