

Guest Editorial

Introduction to the Special Section on the 2020 IEEE BCICTS Conference

THIS Special Section of the IEEE JOURNAL OF SOLID-STATE CIRCUITS (JSSC) features expanded versions of key invited papers that were presented at the 2020 IEEE BiCMOS and Compound Semiconductor Integrated Circuits and Technology Symposium (BCICTS), which was held virtually on November 16–19, 2020.

BCICTS offers a unique gathering of researchers engaged in a wide range of technologies and applications. BCICTS covers the latest research on SiGe and III–V/CMOS IC technologies including materials, device fabrication, device phenomena, TCAD modeling, and compact modeling, and their use in state-of-the-art integrated circuit design, testing, and system applications including wireless, analog, RF, microwave, high-speed digital, mixed-signal, optoelectronic, millimeter-wave, and THz electronics.

Three outstanding articles were selected for publication in this Special Issue of the journal, each offering additional materials such as mathematical analysis, in-depth circuit descriptions, more experimental results, and benchmarking data.

The first article from the University of Stuttgart, Germany, presents a SiGe BiCMOS 128 GS/s 1-to-4 analog demultiplexer suitable for interleaving bandwidth-limited ADCs in wireline and optical applications. The integrated circuit uses a front-end consisting of four current-mode track and hold amplifiers as well as the required multi-phase clock generation blocks. The circuit achieves a large-signal 3-dB bandwidth of 36 GHz and a 6-dB bandwidth of 50 GHz. The reception of 128 Gb/s NRZ/OOK and 256 Gb/s PAM4 signals are demonstrated using offline DSP reconstruction.

The second article from Saarland University, Germany, presents the design considerations for a 120 Gs/s 2:1 analog multiplexer in SiGe BiCMOS technology with an emphasis on achieving high linearity and resolution. The circuit operates at 120 GS/s with the highest effective resolution reported for an mm-wave AMUX in any semiconductor technology to date. A frequency-domain model to analyze the impact of mismatch, timing error, and other nonidealities on the overall ENOB is also presented.

The final article from Mitsubishi Electric Corp., Japan, presents a pair of 70 W/30 W Ku-band GaN power amplifiers offering low IMD3 performance at wide frequency offsets up to 400 MHz. The internally matched power amplifiers also employ several carefully tuned short-circuit output matching circuits to achieve wide offset IMD3 improvements. The PAs achieve a linear output power of 40 and 36 dBm with IMD3 performance better than -26 and -27 dBc, respectively.

In my role as the Guest Editor, I wish to thank the authors for their commitment to write excellent articles under a tight publication schedule. Furthermore, I would like to extend my gratitude to the anonymous reviewers for their constructive feedback to help improve the quality of the articles. Special thanks go to the 2020 BCICTS Organizing Committee, Technical Program Committee, and Conference Co-Chairs Bruce Green, Craig Steinbeiser, and Simon Wood. Furthermore, great thanks to Dr. Pavan Hanumolu, JSSC Editor-in-Chief for his guidance and the JSSC administrators for their excellent assistance in publishing this issue.

We hope that this JSSC Special Section provides a flavor of the state-of-the-art developments in SiGe and III–V/CMOS IC technologies and their usage in integrated circuit designs and system applications. I would like to encourage readers to attend the 2021 BCICTS Symposium that will be held on December 5–8 in Monterey, CA, USA. For more information, please visit the conference website at <https://bcicts.org/>. See you all in Monterey!

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Shahriar Shahramian (Senior Member, IEEE) received the Ph.D. degree from the University of Toronto, Toronto, ON, Canada, in 2010, where he focused on the design of mm-wave data converters and transceivers.

He has been with Nokia Bell Laboratories, Murray Hill, NJ, USA, since 2009. He is currently the Director of the Communication and Sensing ASICs Research Group. He was also an Adjunct Associate Professor at Columbia University, New York, NY, USA. His research focus includes the design of mm-wave wireless and wireline integrated circuits and systems.

Dr. Shahramian was a recipient of the Ontario Graduate Scholarship, the University of Toronto Fellowship, and the Best Paper Award at the CSICS Symposium in 2005 and 2015, at the RFIC Symposium in 2015 and 2020, and at ISSCC in 2018. He was also a recipient of the IEEE MTT Young Engineer Award in 2020. He has received several teaching awards and is the founder and host of the signal path educational video series. He is the Chair of the mm-wave and THz subcommittee of IEEE BCICTS and a member of the Technical Program Committee of IEEE

RFIC and ISSCC. He is also a Guest Editor of the IEEE Journal of Solid-State Circuits (JSSC). He is a Bell Labs Fellow and leads the design and architecture of several state-of-the-art ASICs for optical coherent and wireless backhaul products. He has also presented short courses and workshops at the IEEE CSICS, BCTM, BCICTS, RFIC/IMS, and ISSCC conferences.