Introduction to the Special Section on the 26th Bipolar/BiCMOS Circuits and Technology Meeting

THIS September Issue of the IEEE JOURNAL OF SOLID-STATE CIRCUITS contains a Special Section for the 26th Bipolar/BiCMOS Circuits and Technology Meeting (BCTM), held on September 30 to October 3, 2012, in Portland, Oregon, USA. The 27th BCTM conference will be held on September 30 to October 3, 2013, in Bordeaux, France (http://2013.ieee-bctm.org/).

The 2012 BCTM started with a one-day short course on "Millimeter-wave system: modeling, characterization and circuit design." Barrie Gilbert of Analog Devices delivered the keynote speech on "Translinearity in Transition." The two-day technical sessions covered the latest advances in physics, design, performance, fabrication, characterization, modeling, and application of Si/SiGe bipolar and BiCMOS integrated circuits. The Emerging Technologies session presented state-of-the-art research results on carbon nanotubes, thin-film solar cells, biologically inspired ICs, and heterogeneous integration. A brand-new special third-day event featured presentations and demonstrations on industry applications, as well as a joint session with the Workshop on Compact Modeling for RF/Microwave Applications.

We are pleased to introduce this Special Section with four papers selected from the 2012 BCTM. The Special Section begins with a paper entitled "A Terahertz Detector Array in a SiGe HBT Technology." In this paper, R. A. Hadi *et al.* present HBT terahertz power detectors arranged in a 3×5-pixel array with on-chip ring antennas and hyperhemispherical silicon lens. Due to the nonlinearity of the HBT base-emitter junction, the detector works as a mixer, directly down-converting terahertz input frequencies to DC. Referred to the collecting aperture of the lens, a maximum optical current responsivity of 1 A/W and a minimum noise equivalent power of about 50 pW/$\sqrt{\text{Hz}}$ have been measured at 0.7 THz with a 125-kHz chopping frequency.

The second paper, by S. P. Voinigescu *et al.*, presents design optimization strategies and performance comparisons of SiGe HBT voltage-controlled oscillators (VCOs) as potential low-noise signal sources at sub-millimeter wave frequencies. The fundamental frequency Colpitts VCO covers a 12% tuning range between 218 and 246 GHz with up to -3.6 dBm output power and 0.8% efficiency. The Colpitts-Clapp VCO followed by a buffer amplifier and a doubler achieves the best phase noise of -101 dBc/Hz at 10 MHz offset, the largest output power of -1.7 dBm, and a wide tuning range of 7.5% around 290 GHz. Finally, the push-push Colpitts-Clapp VCO exhibits the highest operation frequency, from 309 to 325 GHz, but with reduced efficiency of 0.07% and tuning range of 5%.

The third paper, by G. Liu *et al.*, addresses design and characterization of two broadband millimeter-wave SiGe LNAs that employ T-type matching topologies to achieve wide bandwidths at V-band (47 to 77 GHz) and W/F-band (70 to 140 GHz), respectively. The measured maximum gain for both LNAs is about 23 dB. The measured noise figure is below 7.2 dB for the V-band LNA and below 7 dB for the W/F-band LNA. The LNAs consume 52/54 mW DC power.

This Special Section concludes with the fourth paper, on a highly efficient silicon-based envelope-tracking power amplifier (ET-PA) for broadband wireless applications. In this paper, R. Wu *et al.* investigate several envelope shaping methods such as DC shifting, envelope scaling, envelope clipping and envelope attenuation at back-off for optimizing the ET-PA system performance. In the continuous-wave (CW) measurement, the PA achieves a saturated output power around 2 W with power-added-efficiency (PAE) above 65% across the bandwidth of 0.7–1.0 GHz. With the LTE 16 QAM 5/10/20 MHz input signals, the ET-PA outputs 28 dBm linear power, while meeting the stringent LTE linearity specs with an average composite system PAE of 42.3%/41.1%/40.2%, respectively.

As the Guest Editor, I would like to thank the authors for their contributions to this Special Section. I would like to express my gratitude to the reviewers for their valuable comments and suggestions that greatly improved the quality of the manuscripts. I also would like to acknowledge John D. Cressler, 2012 BCTM General Chair, Bruce Hecht, 2012 BCTM TPC Chair, and the entire BCTM Technical Program Committee for their advice and support.

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Digital Object Identifier 10.1109/JSSC.2013.2265491

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From 1997 to 2000, he was with Hughes Network Systems of Hughes Electronics, Germantown, MD, USA, where he was a Member of Technical Staff in very large scale integration (VLSI), designing analog and digital ICs for wireless and satellite communications. From 2000 to 2001, he was with YAFO Networks, Hanover, MD, USA, where he was a Technical Manager and a Principal Engineer in VLSI designs, leading high-speed SiGe IC designs for fiber communications. From 2001 to 2002, he was with Cognio Inc., Gaithersburg, MD, USA, designing radio frequency (RF) ICs for integrated multi-band MIMO wireless transceivers. From 2002 to 2004, he was an RFIC consultant for Cognio Inc. In August 2002, he joined Auburn University, Auburn, AL, USA, where he is currently a Professor in electrical and computer engineering. His research interests include VLSI circuits for analog and mixed-signal applications, RFIC designs for wireless and broadband networks, ultra-high-frequency synthesis and mixed-signal built-in self-test (BIST). He co-authored the book *Integrated Circuit Design for High-Speed Frequency Synthesis* (Artech House Publishers, 2006).

Dr. Dai served as Guest Editor for the IEEE JOURNAL ON SOLID-STATE CIRCUITS in 2012 and 2013. He served as Guest Editor for the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS in 2001, 2009, and 2010. He served on the technical program committee of the IEEE Symposium on VLSI Circuits from 2005 to 2008. He currently serves on the executive committee as well as the technical program committee of the IEEE Bipolar/BiCMOS Circuits and Technology Meeting (BCTM) and the technical program committee of the IEEE Custom Integrated Circuits Conference (CICC). He holds six U. S. patents and received the Senior Faculty Research Award for Excellence from the College of Engineering of Auburn University in 2009.