IEEE DL Harish Krishnaswamy Visits SSCS Utah Chapter

Distinguished Lecturer (DL) Harish Krishnaswamy gave an IEEE Solid-State Circuit Society (SSCS) presentation to the SSCS Utah Chapter on 10 January 2018. The lecture, “Integrated Non-Reciprocal Components Based on Linear Time-Varying Circuits,” was given on the University of Utah campus in the Merrill Engineering Building. The audience of 25 local members of the SSCS comprised students, faculty, and engineers from local industry. They were quite interested in Krishnaswamy’s successes in breaking time reciprocity on IC.

Abstract

Lorentz reciprocity is a fundamental property of linear time-invariant passive circuits and systems constructed from conventional materials. However, nonreciprocal components, such as circulators, enable new wireless communication paradigms, such as full duplex wireless. Conventionally, nonreciprocal circulators have been realized using ferrite materials that exhibit the magneto-optic Faraday effect and are consequently incompatible with complementary-metal-oxide semiconductors (CMOSs), bulky, and expensive. Recent research has shown that reciprocity can be broken and nonreciprocal circulators can be built in CMOS using linear periodically time-varying (LPTV) circuits. This represents an interesting and unique property of LPTV circuits beyond the traditionally exploited tunable high-quality filtering in the so-called N-path filters. The fundamental physical principles from a recent 2016 Nature Communications paper will be described, as well as three generations of CMOS circulators and circulator-based wireless systems published in IEEE International Solid-State Circuits Conference (ISSCC) 2016 and ISSCC 2017 that target emerging full-duplex and 5G mm-wave applications.

—Jeffrey Walling

SSCS Utah Chapter Chair

Prof. Dennis Sylvester Speaks at Tsinghua University

On 10 November 2017, the IEEE Solid-State Circuits Society (SSCS) Tsinghua University Student Chapter hosted Prof. Dennis Sylvester, University of Michigan, Ann Arbor, to give the lecture “Ultra-Low Power IC Design 101.” More than 30 people attended the talk, including faculty, graduate students, and undergraduate students.

Sylvester started by reviewing recent progress in ultra-low power circuits and system design. He introduced applications using the Internet of Things and wireless-sensing microsystems. He also talked about
several specific circuit topics, including relaxation oscillators; digital logic/sequential; and power management, including energy harvesting, memories, and interface circuits. Sylvester shared different design case analysis, discussing the key barriers and potential solutions to the issue of microsystems miniaturization.

After the lecture, Sylvester participated in the Meet the Masters Tea Forum for undergraduate students. The tea forum is a joint activity organized by the local student union in the Department of Electronic Engineering, Tsinghua University, and the SSCS Tsinghua Student Chapter. Its goal is to provide an opportunity for junior and senior undergraduate students who plan to continue their graduate study abroad to learn about overseas options and what programs and schools are best suited for them and meet their interests. It is also a great opportunity for students to interact with successful scholars. Dr. Jan Van der Spiegel, past president of the SSCS, was invited as the guest master for the inaugural gathering. The forum was hosted by Zijian Tang, SSCS Tsinghua University Student Chapter chair, and Shuhao Chang, minister of Public Affairs of the student union. Dr. Milin Zhang, from the local Electronic Engineering Department with an expertise close to Sylvester’s, was invited as a guest host.

Sylvester introduced the University of Michigan, Ann Arbor, and talked about the university’s history as well as its master’s and Ph.D. programs. Students asked Sylvester many questions, including how to choose a research direction in hardware design, how to prepare to attend a university abroad, and the difference between master’s and Ph.D. programs.

—Milin Zhang

SSCS Piet Wambacq Gives a Lecture at BEE Week 2017 in Bordeaux

The IEEE Solid-State Circuits Society Bordeaux University Student Branch organized a technical talk on 15 November 2017 by Prof. Piet Wambacq, of Vrije Universiteit Brussel and a principal member of Technical Staff of Interuniversity Microelectronics Centre in Leuven.

His talk, “Millimeter-Wave High-Datarate Wireless Communication Using Beamforming,” took place during the three-day conference called Bordeaux Electrical Engineering (BEE) Week. The unlicensed spectrum around 60 GHz has provided many IC design researches in complementary metal–oxide semiconductors. In this context, Wambacq explained the basics of beamforming together with several implementations of the beamforming control. This control is operating in the analog part of the transceivers.

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