

## Scenes from ISSCC 2018

The 2018 International Solid-State Circuits Conference (ISSCC) was held 11–15 February 2018 at the San Francisco Marriott Marquis. The conference was jam packed with a wide array of forums, technical and tutorial presentations, short courses, an exciting plenary session, and opportunities to network with leading experts in the field. The chair of the conference, as well as for the plenary session, was Anantha Chandrakasan, Massachusetts Institute of Technology, Cambridge. Alison Burdett, of Sensium Healthcare, Abingdon, United Kingdom, was the International Technical Program chair and associate chair of the plenary session.

### Plenary Session

The plenary session at ISSCC 2018 was held on Monday, 12 February 2018, and began with welcoming remarks from Chandrakasan. He spoke about ISSCC's 65th anniversary this year and how much the conference has grown since its start in 1954. In 1954, there were 600 attendees, 20 papers, and a US\$4 registration fee. Chandrakasan also talked about 2018 conference highlights, including digital architectures and systems; digital circuits; imagers, microelectromechanical systems, and displays; memory; radio frequency; technology directions; wireless; and wireline.

Next, Burdett provided a summary of the 2018 technical program. She said that, for 2018, there were 207 accepted papers in 31 sessions, with a 33% acceptance rate. She also talked about what was new this year at ISSCC: the Power Management Subcommittee, the ISSCC app, the Thursday Edu-

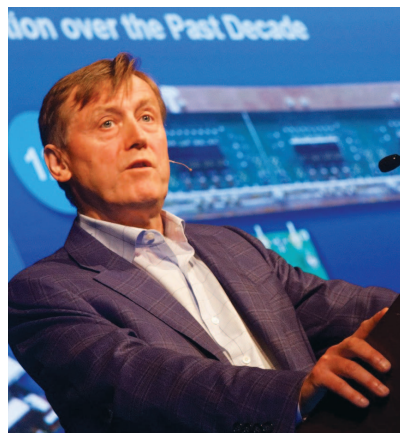
cational Events All-Access Pass, the Sunday evening Workshop (Circuits for Social Good), and the Monday evening Industry Showcase session.

The 2018 plenary session featured four distinguished speakers—Vincent Roche, president and CEO, Analog Devices, Norwood, Massachusetts; Barbara De Salvo, deputy director for Science and Long Term Research, CEA-Leti, Grenoble, France; Yukihiro Kato, executive director, DENSO, Aichi, Japan; and David Patterson, Google, Mountainview, California, and the University of California, Berkeley. This lineup of speakers covered a wide range of topics, from semiconductor industry challenges and brain-inspired computing to future automotive transportation and the history and future of computer architectures.

Vincent Roche gave the talk “Semiconductor Innovation: Is the Party Over or Just Getting Started?” It is becoming increasingly difficult to meet the demands of a world where businesses, governments, and societies are digitizing very quickly. In today's competitive global environment, business pressures are driving the semiconductor

industry to avoid risk and develop new products following a model of making small changes to a project rather than big ones. Roche argued that these pressures must be resisted, especially if the semiconductor industry continues to grow. He said that certain application challenges, such as the spread of pervasive ubiquitous sensing, rapid advances in intelligence, heterogeneous integration, and the continued impact of digitization, will require more semiconductor innovation.

Barbara De Salvo presented “Brain-Inspired Technologies: Towards Chips that Think.” In her talk, De Salvo discussed recent developments in cognitive and neuro sciences and how the human brain processes information through connected pathways. She talked about how these new discoveries are driving new models of semiconductor computing and touched upon a research strategy encompassing algorithms, circuits, and components that aims to develop brain-inspired technologies to meet the needs of today's applications. She gave several examples to illustrate how brain-inspired



Vincent Roche presented “Semiconductor Innovation: Is the Party Over or Just Getting Started?”



Barbara De Salvo's lecture was “Brain-Inspired Technologies: Towards Chips that Think.”



The winners of the 2017 Lewis Winner Award for Outstanding Paper with ISSCC Conference Chair Anantha Chandrakasan (right).



The recipients of the 2017 Distinguished Technical Award with Conference Chair Anantha Chandrakasan (right).



Nicolas Butzen (left) and Michiel Steyart (not pictured) received the 2017 Jan Van Vessel Award for Outstanding Paper. Conference Chair Anantha Chandrakasan (right) presented the award.

technologies are developed using a holistic approach, where process development and integration, circuit design, system architecture, and learning algorithms are simultaneously optimized.

After De Salvo's talk, awards were presented.

## Awards

The 2017 Lewis Winner Award for Outstanding Paper went to "A 28 GHz 32-Element Phased-Array Transceiver IC with Concurrent Dual Polarized Beams and 1.4 Degree Beam-Steering Resolution for 5G Communication" by Bohisatwa Sadhu, Yahya Tousi, Joakim Hallin, Stefan Sahl, Scott Reynolds, Orjan Renstrom, Kristoffer Sjogren, Olov Haapalahti, Nadav Mazor, Bo Bokinge, Gustaf Wiebull, Hakan Bengtsson, Anders Carlinger, Eric Westesson, Jan-Erik Thillberg, Leonard Rexberg, Mark Yeck, Xiaoxiong Gu, Daniel Friedman, and Alberto Valdes-Garcia.

The 2017 Distinguished Technical Paper Award went to "A 12b 10GSs Interleaved Pipeline ADC in 28 nm CMOS Technology" by Siddharth Devarajan, Larry Singer, Dan Kelly, Jose Silva, Janet Brunsilius, Daniel Rey-Losada, Frank Murden, Jeff Bray, Eric Otte, Nevena Rakuljic, Phil Brown, Todd Weigandt, Qicheng Yu, Donald Paterson, Corey Petersen, and Jeffrey Gealow.

The 2017 Jan Van Vessel Award for Outstanding Paper was awarded to "A 1.1 W/mm<sup>2</sup>-Power-Density 82%-Efficiency Fully Integrated 3:1 Switched-Capacitor DC-DC Converter in Baseline 28 nm CMOS Using Stage Outphasing and Multiphase Soft-Charging" by Nicolas Butzen and Michiel Steyaert.

The 2017 Takuo Sugano Award for Outstanding Far-East Paper recipients were Mo Huang, Yan Lu, Seng-Pan U, and Rui P. Martins.

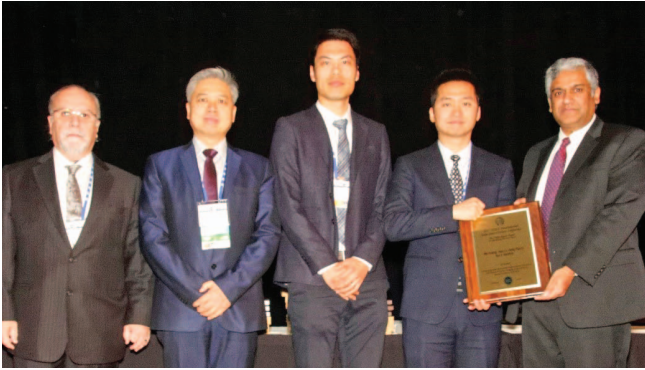
The 2017 Jack Kilby Award for Outstanding Student Paper was given

to Hossein Kassiri, M. Reza Pazhouhandeh, Nima Soltani, M. Tariqus Salam, Peter Carlen, Jose Luiz Perez Velazquez, and Roman Genov for "All-Wireless 64-Channel 0.013 mm<sup>2</sup>/ch Closed-Loop Neurostimulator with Rail-to-Rail DC Offset Removal."

The winner of the 2017 ISSCC Award for Outstanding Forum Presenter was given to Marcel Pelgrom for "Pushing the Boundaries of Performance—A Technology Perspective."

The winner of the 2017 ISSCC Award for Outstanding Forum Presenter was given to Nicola Da Dalt for "High-Performance Clock Generation and Distribution in Very-High-Speed Wireline Transceivers."

The 2017 Evening Session Award went to "Return of Survey Says." The organizers for the session were Harry Lee and Matt Straayer. The moderator was Chris Mangelsdorf, and the panelists were Robert Adams, Lucien



The recipients of the 2017 Takuo Sugano Award for Outstanding Student Paper with Conference Chair Anantha Chandrakasan (right).



The winners of the 2017 Jack Kilby Award for Outstanding Student Paper with Conference Chair Anantha Chandrakasan (right).



Nicola Da Dalì received the 2017 ISSCC Award for Outstanding Forum Presenter.

Breems, Yun Chiu, Michael Choi, Ian Galton, Shanthi Pavan, Kathleen Phillips, and Ken Poulton.

The 2017 Demonstration Certificate of Recognition was given to Tomohiro Yamazaki for “A 1 ms High-Speed Vision Chip with 3D Stacked 140GOPS Column-Parallel Processor for Spatio-Temporal Image Processing.” Contributing authors were Hironobu Katayama, Tatsushi Nose, Masatsugu Kobayashi,

Sayaka Shida, Masaki Odahara, Kenichi Takamiya, Yasuaki Hisamatsu, Shiznoru Matsumoto, Leo Miyashita, Yoshihiro Watanabe, Takashi Izawa, Yoshinori Muramatsu, and Masatoshi Ishikawa.

The 2017 Demonstration Session Certificate of Recognition was given to Linxiao Zhang and Harish Krishnaswamy for “A 0.1-to-3.1 GHz 4-Element MIMO Receiver Array Supporting Analog/RF Arbitrary Spatial Filtering.”

Next, IEEE Solid-State Circuits Society (SSCS) President Bram Nauta took the stage and talked about the benefits of being a member of SSCS, including access to world-class SSCS publications (such as *IEEE Journal of Solid-State Circuits*, *IEEE Solid-State Circuits Letters*, and *IEEE Journal on Exploratory Solid-State Computational Devices and Circuits*), the opportunity to attend members-only SSCS webinars, and free access to SSCS educational content (such as tutorials and short courses). He then presented the SSCS awards.

The 2016 Journal of Solid-State Circuits Best Paper Award went to “A

2.2 GHz Continuous-Time  $\Delta\Sigma$  ADC With  $-102$  dBc THD and 25 MHz Bandwidth,” published in the December 2016 issue of *IEEE Journal of Solid-State Circuits*, vol. 51, no. 12, pp. 2906–2916. The authors of the paper are Lucien Breems, Muhammed Bolatkale, Hans Brekelmans, Shagun Bajoria, Jan Niehof, Robert Rutten, Bert Oude-Essink, Franco Fritschij, Jagdip Singh, and Gerard Lassache.

The recipient of the 2017 SSCS Outstanding Chapter of the Year Award was the SSCS Beijing Chapter. The Chapter chair is Hanjun Jiang.

To conclude the awards portion of the plenary, IEEE President and CEO Jim Jeffries presented the IEEE Technical Field Awards.

The recipient of the 2018 IEEE Daniel E. Noble Award for Emerging Technologies was Rajiv V. Joshi, IBM T.J. Watson Research Center, Yorktown Heights, New York, for “contributions to predictive failure analytics, VLSI memory design, and technology.

The corecipients of the 2018 IEEE Donald O. Pederson Award in Solid-State



The 2017 Evening Session Award went to “Return of Survey Says.”

Circuits were William S. Carter and Stephen M. Trimberger, Xilinx, San Jose, California, for “contributions to field-programmable gate array technology.”

The 2018 IEEE Frederik Philips Award was awarded to Ian A. Young, Intel, Hillsboro, Oregon, for “leadership in research and development

on circuits and processes for the evolution of microprocessors.”

The 2018 newly elevated IEEE Fellows were also recognized. For a list of



The 2017 Demonstration Certificate of Recognition was awarded to Tomohiro Yamazaki (left).



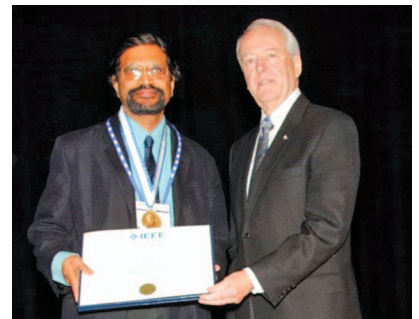
(From left) Harish Krishnaswamy and Linxiao Zhang were awarded the 2017 Demonstration Session Certificate of Recognition. Conference Chair Anantha Chandrakasan presented the award.



SSCS President Bram Nauta presented SSCS awards and talked about Society benefits.



IEEE President and CEO Jim Jeffries presented the IEEE Technical Field Awards.



Rajiv V. Joshi (left) received the 2018 IEEE Daniel E. Noble Award for Emerging Technologies. IEEE President and CEO Jim Jeffries presented the award.



Shagun Bajoria (left) accepted the 2016 Journal of Solid-State Circuits Best Paper Award from SSCS President Bram Nauta.



SSCS Beijing Chapter Chair Hanjun Jiang (left) received the 2017 SSCS Outstanding Chapter of the Year Award. SSCS President Bram Nauta presented the award.



The corecipients of the 2018 Donald O. Pederson Award in Solid-State Circuits were (from left) Stephen M. Trimberger and William S. Carter. IEEE President and CEO Jim Jeffries presented the award.



IEEE President and CEO Jim Jeffries (right) presented the 2018 IEEE Frederik Philips Award to Ian Young.

IEEE fellows who are SSCS members, please see the article “Congratulations to the 13 SSCS Members Elevated to IEEE Fellow” in the “Society News” column.

After the awards presentation, there was a short break and the two remaining plenary speakers spoke.

### Plenary Session, Continued

Yukihiro Kato gave the talk “Future Mobile Society Enabled by Semiconductor Technology.” Kato talked about how the automotive industry is currently going through a transformation. This transformation is the consequence of three main technology trends: electrification, driving automation, and vehicle interconnection. He explained how the semiconductor industry has a vital role to play in solving many technical challenges. These technical challenges must be overcome to become a “mobility-enhanced society.”

David Patterson gave the last talk of the plenary session with “50 Years of Computer Architecture: From Mainframe CPUs to Neural-Network TPUs.” Patterson reviewed 50 years of innovation in computer architectures—from mainframe computers in the 1960s to recent times. He described how the slowdown of improvements due to scaling (with the end of Moore’s law) is rejuvenating computer architectures and that future performance improvements do not come from scaling alone.

After the last talk, the plenary speakers were given plaques.

For more information on award recipients, visit: [http://isscc.org/wp-content/uploads/2018/02/isscc2018.awards\\_handout\\_v5.pdf](http://isscc.org/wp-content/uploads/2018/02/isscc2018.awards_handout_v5.pdf).

—Abira Sengupta

### Evening Sessions

#### Student Research Preview

- Chair: SeongHwan Cho, KAIST, Daejeon, South Korea.
- Secretary: Denis Daly, Omni Design Technologies, Massachusetts.
- Advisors: Anantha Chandrakasan, Massachusetts Institute of Technology, Cambridge, and Jan Van der Spiegel, University of Pennsylvania.
- Media/publications: Laura Fujino, University of Toronto, Canada.
- AV: Trudy Stetzler, Halliburton, Houston, Texas.
- Committee members: Jason Anderson, University of Toronto, Canada; Masoud Babaie, Delft University of Technology, The Netherlands; Andrea Baschirotto, University of Milan-Bicocca, Italy; Ben Calhoun, University of Virginia; SeongHwan Cho, KAIST, Korea; Hayun Chung,



Yukihiro Kato gave the lecture “Future Mobile Society Enabled by Semiconductor Technology.”



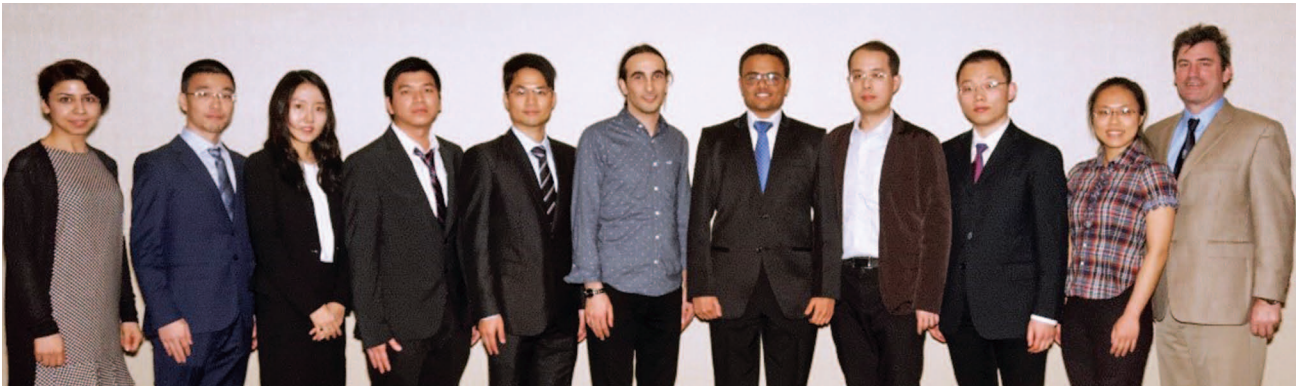
David Patterson gave the last talk at the plenary session, “50 Years of Computer Architecture: From Mainframe CPUs to Neural-Network TPUs.”



Prof. SeongHwan Cho opened the Student Research Preview evening session with introductory remarks.



**The 2018 SRP Committee (from left): Samira Zaliasi, Tinoosh Mohsenin, Chung-Yu Wu, Denis Daly, Jae-sun Seo, Jeff Weldon, Ben Calhoun, Laura Fujino, Anantha Chandrakasan, Cormac O'Connell, Yoonmyung Lee, Mondira Pant, SeongHwan Cho, Shahriar Mirabbasi, and Farhana Sheikh.**



**Session 3 of the SRP (from left): Chair Samira Zaliasi, Jiaji Mao, Sujin Park, Xiaofeng Yang, Xiaopeng Zhong, Seyedhamidreza Motaman, Dhruv Patel, Yi Luo, Bangan Liu, Siming Ma, and Chair Cormac O'Connell.**

Korea University; Denis Daly, Omni Design Technologies, Massachusetts; Shidhartha Das, ARM, United Kingdom; Andreas Demosthenous, University College London, United Kingdom; Chun-Huat Heng, National University of Singapore; Makoto Ikeda, University of Tokyo, Japan; Seulki Lee, IMEC-NL, The Netherlands; Yoonmyung Lee, SungKyunKwan University, Korea; Salvatore Levantino, Politecnico di Milano, Italy; Qiang Li, University of Electronic Science and Technology, China; Shih-Chii Liu, University of Zurich/ETH Zurich, Switzerland; Shahriar Mirabbasi, University of British Columbia, Canada; Tinoosh Mohsenin, University of Maryland; Cormac O'Connell, TSMC, Canada; Mondira Pant, Intel, Massachusetts; Shanthi



**Session 1 of the SRP (from left): Chair Yoonmyung Lee, Kai Xu, Xingqiang Peng, Younghyun Lim, Daniele Montanari, Praveen M.V., Jahoon Jin, Mao-Ling Chiu, Hyeonji Lee, and Chair Shahriar Mirabbasi.**



**Session 2 of the SRP (from left): Chair Tinoosh Mohsenin, Zhewei Jiang, Shuo-An Huang, Jianxu Yang, Huwan Peng, Pyungwoo Yeon, Yuting Hou, Zeliang Wu, Sanfeng Zhang, and Chair Jae-sun Seo.**



The recipients of the 2018 SSCS Pre-Doctoral Fellowship with SSCS Awards Chair John Corcoran. (From left) John Corcoran, Hui Jiang, Se-Un Shin, Chandrakanath Reddy Chappidi, Chul Kim, Taiyun Chi, Hans Reyserhove, Nicolas Butzen, Nai-Chung Kuo, Bert Moons, Komal Badami, Shanshan Dai, Ali Mostajeran, Rouzbeh Kananizadeh, Mahdi Assefzadeh, Wei-Han Yu, Shanolan Li, Korkut Kan Tokgoz, and Shiyu Su.



The recipients of the 2018 ISSCC/SSCS Student Travel Grant Award with SRP Chair Prof. SeongHwan Cho. First row (from left) Xiaofei Ma, Arunkumar Salimath, Chee Cheow Lim, Cheng Wong, Cheng-Ru Ho, Xiaofeng Yang, Jennifer Zaini-Desevedavy, Samira Shamsir, Sanfeng Zhang, Mao-Ling Chiu, Siming Ma, and Preethi Padmanabhan.

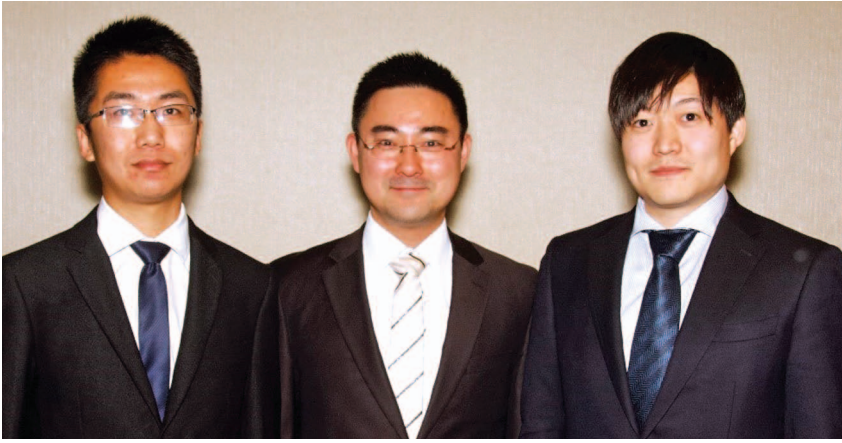


Prof. Tom Lee gave a talk, "Chance Favors the Prepared Mind—The Discovery and Invention of the Transistor."

Pavan, Indian Institute of Technology, India; Jae-sun Seo, Arizona State University; Mingoo Seok, Columbia University, New York; Farhana Sheikh, Intel, Oregon; Bing Sheu, Chang Gung University, Taiwan; GuoXing Wang, Shanghai Jiao Tong University, China; Jeffrey Weldon, University of Hawaii; Chung-Yu Wu, National Chiao Tung University, Taiwan; Jerald Yoo, National University of Singapore; and Samira Zaliasl, Ferric, New York.

The Student Research Preview (SRP) at ISSCC 2018 was held on 11 February 2018 and brought 25 students

to ISSCC. The program highlighted selected student research projects in progress by graduate students from around the world. Selection is based on the work's technical quality and innovation. The session began with a welcome and introduction by SRP Chair SeongHwan Cho. Afterward, award recipients for SSCS Pre-Doctoral Fellowships and recipients of the 2018 ISSCC/SSCS Student-Travel Grant were acknowledged. In addition, the 2018 Silkroad Award and the ISSCC 2017 Student-Research Preview Award were given. The introduction and awards ceremony was followed



The 2018 Silkroad Award recipients (from left): Jingzhi Zhang, Sungdae Choi, and Kodai Ueyoshi.

by a talk by Prof. Tom Lee, Stanford University, “Chance Favors the Prepared Mind—The Discovery and Invention of the Transistor.”

Linearized histories of technology present a danger of falsely conveying that each development follows logically and inevitably from what precedes it. That misapprehension, in turn, often incorrectly informs policies designed to foster innovation, producing incrementalism instead.

The conspicuously nonlinear history of the transistor refutes claims in some recountings that the transistor is the first electronic device whose characteristics were predicted before having been fabricated. Ideas for FET-like devices first appeared in patents by Julius Lilienfeld soon after the accidental discovery of copper oxide-based semiconductors in the 1920s. Unaware of Lilienfeld’s earlier work, Shockley, Bardeen, and Brattain tried to realize copper oxide MOSFETs at Bell Labs in the late 1930s but met with repeated failure, even after switching to germanium in the 1940s. A diagnostic experiment designed to understand the frustrating failures turned out by accident to amplify, although the unwieldy structure cobbled together by Bardeen and Brattain was not the MOSFET that they had been trying to create. The point-contact transistor that they had stumbled upon worked by principles that have never been fully understood. Shockley, frustrated at having been largely a spectator to the epoch-shattering

discovery, then invented a simpler device, the junction transistor. In short, the transistor was discovered and then invented.

The true story of how semiconductors came to dominate electronics is therefore a tale of a series of accidents caused by, and in the presence of, Pasteur’s fabled “prepared minds.” Discontinuities in history are not predictable from linear extrapolations, so the best we can do is work in areas that are likely to create happy accidents and make sure that our minds are prepared to exploit them should they occur.

Following Lee’s talk, each student was given 1 min to present his/her research to the audience. The SRP focused on three sessions:

- 1: Communications and Power
- 2: Deep Learning and Biomedical Circuits
- 3: Memory, Sensors, and Mixed-Signal Circuits

After the student presentations, there was a poster session, where attendees could take a look at students research.

—Abira Sengupta  
—Tom Lee

### **Workshop on Circuits for Social Good**

- Chair: Vivienne Sze, Massachusetts Institute of Technology, Cambridge.
- Committee: Alison Burdett; Sonia Leon, Intel, Santa Clara, California; Rikky Muller, University of California, Berkeley; Farhana Sheikh, Intel,



At the Workshop on Circuits for Social Good evening session, Vivienne Sze welcomed the audience and talked about the benefits of joining the SSCS.



Prof. Esther Rodriguez-Villegas presented “Pioneering Ultra-Low Technologies to Empower Personal Healthcare.”

Hillsboro, Oregon; Yildiz Sinangil, Apple, Cupertino, California; Trudy Stetzler, Halliburton, Houston, Texas; Ingrid Verbauwhede, KU Leuven, Belgium; Alice Wang, MediaTek, San Jose, California; and Rabia Tugce Yazicigil, Massachusetts Institute of Technology, Cambridge.

The first workshop cosponsored by the ISSCC and the SSCS Women in Circuits Committee was held Sunday 11 February. The event, “Workshop for Social Good,” was open to the public and had both ISSCC conference attendees and local engineers and students joining. The purpose of the workshop was to have leading women at all stages of life talk about topics relevant to their careers. Two senior women were invited to give keynotes, two junior women gave invited talks, and at the end of the workshop, there was a series of round tables of topics ranging from careers





The Workshop on Circuits for Social Good speakers and the Women in Circuits Committee.



Workshop on Circuits for Social Good Keynote Speaker Nevine Nassif, gave the talk “Low-Power Design: How Can We Help Become Green?”



The room was filled to capacity for the Workshop on Circuits for Social Good evening session.

in industry, academia, entrepreneur, to specific topics, such as machine learning and biomedical applications. The inaugural event was a big success with 300 participants.

Prof. Teresa Meng opened the night with a heartfelt and highly personal account of her experience as the first female professor in electrical engineering at Stanford University and as the cofounder of Atheros Communications (later acquired by Qualcomm). In her speech “Winning the Game in a Male-Dominated Industry,” she detailed various experiences over the past 30 years, many of which she had never spoken about before. She shared some tough battles that she chose to fight—such as gender wage disparity—and also some battles she decided not to fight—such as a case of sexual harassment early on in her career. Choosing your battles wisely was her advice to the audience.

The second keynote of the workshop was given by Nevine Nassif, fellow at Intel, about the technical challenges of power efficiency in Xeon servers in the data center. She shared that the amount of power the IT sector uses will triple by three times and consume 20% of global electricity by 2030 mainly driven by big data, cloud computing, and artificial intelligence needs. After discussing the power/performance landscape, she delved into a few techniques, which have contributed to the 300X power efficiency in Xeon over the last decade. This includes increasing on-die integration to reduce chip-to-chip power, integrated regulators for overall power reduction, and per core power states. Finally, she shared her realization that squeezing out each milliwatt in the server would lead to enough energy savings that was equivalent to powering her house!

Prof. Esther Rodriguez-Villegas from Imperial College London and Dr. Christine Ho from Imprint Energy gave invited talks about their recent work. Rodriguez-Villegas first described her passion for the FG MOS transistor; but then a visit to a home for epilepsy patients in Chalfont inspired her toward wearable, noninvasive biomedical electroencephalography (EEG) when she saw all of the patients wired up to the EEG machine. She cautioned the audience not to jump into the circuit solution but to consider the end user and first model and then test it before concluding on the final circuit. Ho spoke about her experience as cofounder and CEO of Imprint Energy, a startup company which makes ultrathin flexible printed batteries. She shared how she made the emotional transition from a researcher freshly out of graduate school to entrepreneur who wants to transform her innovative concept into



At the end of the workshop, attendees broke out into round tables and were given the opportunity to discuss a series of topics with experts.

a startup. With many fun examples, she encouraged the audience to make the emotional leap themselves!

At the end of the workshop, the audience met with experts in the following topics:

- next-generation communications (Prof. Alyssa Apsel, Cornell University, and Prof. Azita Emami, California Institute of Technology)
- machine learning and multimedia (Prof. Vivienne Sze and Prof. Marian Verhelst, KU Leuven)
- medical devices (Prof. Rikky Muller, University of California, Berkeley, and Prof. Esther Rodriguez-Villegas, Imperial College London)
- security and the Internet of Things (Edith Beigne, CEA-LETI, and Prof. Ingrid Verbauwhede, KU Leuven)
- careers in industry (Andrea Cathelin, STmicroelectronics; Yildiz Sinangil, Apple; Trudy Stetzler, Halliburton; Bich-Yen Nguyen, Soitec; and Sonia Leon, Intel)
- careers in academia (Prof. Terri Fiez, University of Colorado-Boulder, and Prof. Milin Zhang, Tsinghua University)
- entrepreneurship (Christine Ho, Imprint Energy, and Teresa Meng, Atheros Communications).

The crowd stayed well past the scheduled ending time, and a lot of learning was done by all.

—Alice Wang

### Industry Showcase

- Session organizers: Alison Burdett, Eugenio Cantatore, Eindhoven University of Technology, The Ne-



Christine Ho gave a talk, “Driving a Ground-Breaking Ultrathin Flexible Printed Battery to Market—My Journey from Technologist to Entrepreneur.”



SSCS Women in Circuits Chair Edith Beigne.

therlands; Kush Gulati, Omni Design Tech., Milpitas, California; and Yan Li, Western Digital, Milpitas, California.

- Committee members: Shuichi Nagai, Panasonic, Osaka, Japan; Long Yan, Samsung, Hwaesong-si, Korea; Abbas Komijani, Apple, Cupertino, California; Roberto Nonis, Infineon, Villach, Austria; Alan Wong, EnSilica,

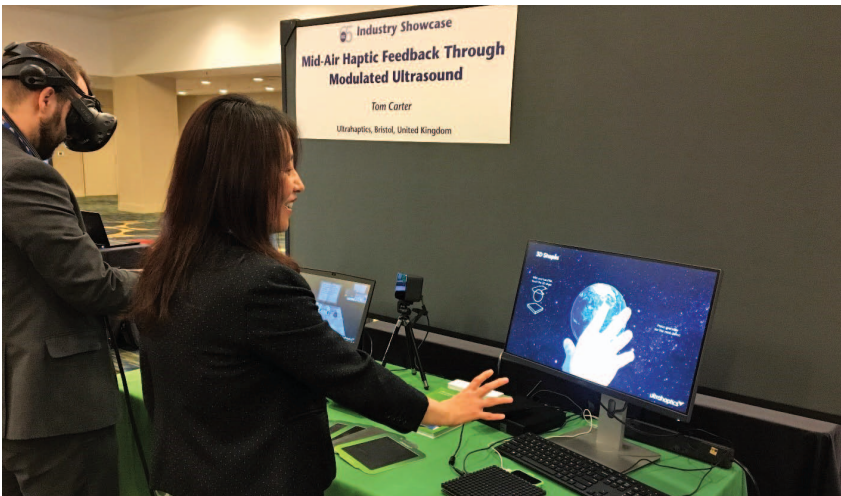
Abingdon, United Kingdom; David McLaurin, Analog Devices, Raleigh, North Carolina; John Maneatis, TrueCircuits, Los Altos, California; Calvin Chao, TSMC, Hsinchu City, Taiwan; Tim Piessens, icSense, Leuven, Belgium; Vadim Ivanov, Texas Instruments, Tuscon, Arizona; Jan Westra, Broadcom, Bunnik, The Netherlands; Yung-Shiang Shu,



The Industry Showcase evening session at ISSCC 2018 was packed with attendees.



The Industry Showcase session presenters with organizers Alison Burdett and Kush Gulati, who was also the host. (From left) Kazumasa Kaneda, Sony Electronics; Frans Sijstermans, NVIDIA; Guenael Strutt, Elliptic Labs; Amir Salek, Google; Biay-Cheng Hseih, Qualcomm; Alison Burdett; Kush Gulati, Omni Design Technologies, Inc.; Geoff Burns, Chronocam; Dag T. Wisland, Novelda AS; Alex Driskill-Smith, Ultrahaptics; and Jagjit Bal Singh, Infineon Technologies.



At the Industry Showcase evening session at ISSCC 2018, attendees were given the opportunity to get hands-on experience with the technologies featured in the showcase.



SSCS Women in Circuits Cochair Alice Wang.

MediaTek, Hsinchu City, Taiwan; Stéphane LeTual, STmicroelectronics, Crolles, France; and Yogesh Ramadass, TI, San Jose, California.

ISSCC has long been recognized as the foremost global forum for presentations of advances in solid-state circuits and systems-on-a-chip (SoCs). These technical advances propel new generations of products and services that drive the progress of our society and power our economies. This year at ISSCC, on the 65th anniversary of the conference, an evening event titled Industry Showcase was held to highlight how advances in silicon circuits, SoCs, and systems are fueling the most innovative industrial applications and products of the future.

The nine industry participants were chosen through a nomination and voting process by members of the Industry Showcase Committee and represented an exciting introduction to the next generation of applications and products enabled by the sustained evolution of solid-state integrated circuits.

The evening began with a brief “elevator pitch,” in which participants gave an overview of their product and the technology advances underlying its development. Each participant was presented with an ISSCC Industry Showcase Technology Innovation Award. The pitches were then followed by an interactive demonstration session enabling the attendees to get

hands-on experience with the featured technologies.

Participants in this lively and packed event, which we hope will be the first of many such Showcase Sessions at ISSCC, were:

- Infineon Technologies, Germany, introducing a 60-GHz antenna-in-package radar for sensing applications
- Google, Mountain View, California, presenting its tensor processing units
- Qualcomm Technologies, Inc., San Diego, California, introducing its power-efficient structured-light three-dimensional depth-sensing camera technologies for mobile devices
- Sony Corporation, Tokyo, Japan demonstrating the projection and sensing technology of Xperia Touch



The poster session at the SRP.



Poster Session Chairs (from left) Mondira Pant and Farhana Sheikh.



Denis Daly (far left) and SeongHwan Cho (far right) with ISSCC SRP Award winners Francesco Mattioli Della Rocca and Heein Yoon.

- Chronocam, Paris, France, introducing its frame-free vision system for high-speed low-power real-time machine vision.

—Alison Burdett

### Figures-of-Merit on Trial

#### Monday Evening Panel Featured Courtroom Drama!

- Organizers: Kostas Doris, NXP, Eindhoven, The Netherlands; Stefano Stanzione, imec-NL, Eindhoven, The Netherlands; and Paul Ferguson, Analog Devices, Wilmington, Massachusetts.
- Moderator: Gabriel Manganaro, Analog Devices, Wilmington, Massachusetts.
- Panelists: Filip Tavernier, KU Leuven, Belgium; Bob Dobkin, Analog Devices, Milpitas, California; Anton de Graauw, NXP Semiconductors, Eindhoven, The Netherlands; Jason T. Stauth, Thayer School of Engineering at Dartmouth, Hanover, New Hampshire; Lawrence Loh, MediaTek; and Pietro Andreani, Lund University, Lund, Sweden.

On Monday evening at ISSCC 2018, a panel was held featuring industry and academic notables. Two panelists at a time squared off in a riveting courtroom drama defending, prosecuting, and rebutting preselected popular figures of merit (FoMs) to determine their usefulness, after which, the over 200 member audience (as jury) deliberated and ultimately determined the fate of that FoM (and the attorneys). Each winning attorney received a gavel to proudly display, forever commemorating



The panelists of the Figures-of-Merit on Trial evening session.

- Elliptic Labs, San Francisco, California, presenting its ultrasound virtual sensors for mobile, virtual reality, and the Internet of Things
- NVIDIA, Santa Clara, California, introducing NVDLA, an open-source IP for AI inferencing
- Ultrahaptics, Bristol, United Kingdom, demonstrating mid-air haptic feedback through modulated ultrasound
- Novelda AS, Oslo, Norway, describing its pulse-based radar for presence detection



Moderator Tom Lee and the panelists of the Lessons Learned evening session.

his victory. The evening concluded with a vigorous discussion on the overall value of FoMs led by Bob Dobkin, and a good and educational time was had by all.

—Paul Ferguson

### **Lessons Learned—Great Circuits that Didn't Work—(Oops, If Only I Had Known)**

Mistakes Admitted at Tuesday Evening ISSCC panel!

- Organizers: Phillip Restle, IBM, T.J. Watson Research Center, Yorktown Heights, New York; Kostas Doris, NXP, Eindhoven, The Netherlands; Vivek De, Intel, Hillsboro, Oregon; and Paul Ferguson, Analog Devices, Wilmington, Massachusetts.
- Moderator: Tom Lee, Stanford University, California.
- Panelists: Bram Nauta, University of Twente, Enschede, The Netherlands; Nicky Lu, Etron Technology, Hsinchu, Taiwan; Shanthy Pavan, Institute of Technology, Madras, Chennai, India; David J. Allstot, University of California, Berkeley; Chris Mangelsdorf, Analog Devices, California; Barrie Gilbert, Analog Devices NW Labs, Beaverton, Oregon; and Jon Strange, MediaTek Wireless, West Malling, United Kingdom.

Brave engineers showcased some of their most vulnerable moments to an audience of over 500 people at “Lessons Learned—Great Circuits that Didn't Work—(Oops, If Only I Had Known)” evening panel at ISSCC 2018. Panelists exposed their (or their colleague's)

error-prone circuits, teasing the spectators by challenging them to catch the errors before the panelists exposed them. In one case, the audience voted on the correct arrangement of connections in a circuit only to be told that the answer was “it depends.” In the end, the audience was shown how the brave panelists (and their students and colleagues) learned from and, in some cases, picked up the pieces of their mistakes to create great circuits and franchise businesses.

—Phillip Restle  
—Paul Ferguson

### **Can Artificial Intelligence Replace My Job? The Dawn of a New IC Industry with AI**

- Organizers: Jaeha Kim, Seoul National University, Seoul, Korea, and Ki-Tae Park, Samsung Electronics, Gyeonggi-do, Korea.
- Moderator: Paul D. Franzon, North Carolina State University, Raleigh.
- Panelists: Bill Dally, NVIDIA, Santa Clara, California; Georges Gielen, KU Leuven, Belgium; Dario Gil, IBM Research, Yorktown Heights, New York; Antun Domic, Synopsys, Mountain View, California; Seung Hoon Tong, Samsung Electronics, Gyeonggi-do, Korea; and Hsien-Hsin Sean Lee, TSMC, Hsinchu, Taiwan.

An evening session held on 13 February 2018 addressed the dreaded question: “Can artificial intelligence (AI) replace IC designers?” The panel was moderated by Prof. Paul Franzon and consisted of renowned AI experts from industry and academia. The session was attended by nearly 300 people with strong interests and

opinions on how AI will shape the IC industry.

At the beginning of the discussion, it seemed inevitable that AI will take over our jobs. Although it was a made-up demonstration, Siri answering a question “Siri, how do you design a current mirror?” certainly made that impression. IC design does consist of many routine tasks, e.g., beating models and simulations, that can be easily automated. Furthermore, AI empowered by GPUs, neuromorphic ICs, and quantum computing is expected to surpass human's abilities even in nonroutine, cognitive tasks.

However, the panel reached a near consensus toward the end of the evening that AI won't “replace” IC designers. Instead, it will solve many narrow-scoped, well-defined problems to “assist” IC designers. While AI can be very powerful at solving problems with big data of well-defined inputs and outputs, it won't be able to act on its own to design a complex system like an IC. A practical constraint is that the number of designs being done today is rather small (10,000 per year), not enough to train AI or to justify its cost of development. Most importantly, any AI technology is not sustainable unless it serves a human's need or purpose.

The panel was quite successful in defending its position against intense questions from the audience. The survey conducted at the end showed that the majority of the attendees were convinced that AI would not replace our jobs.

—Jaeha Kim  
