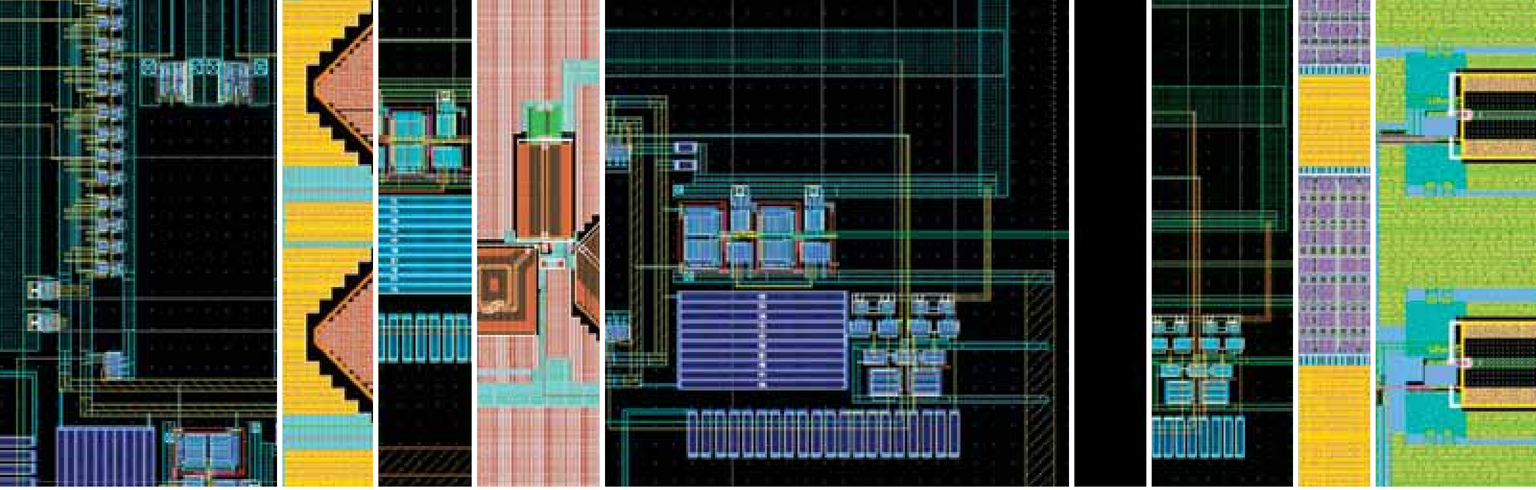
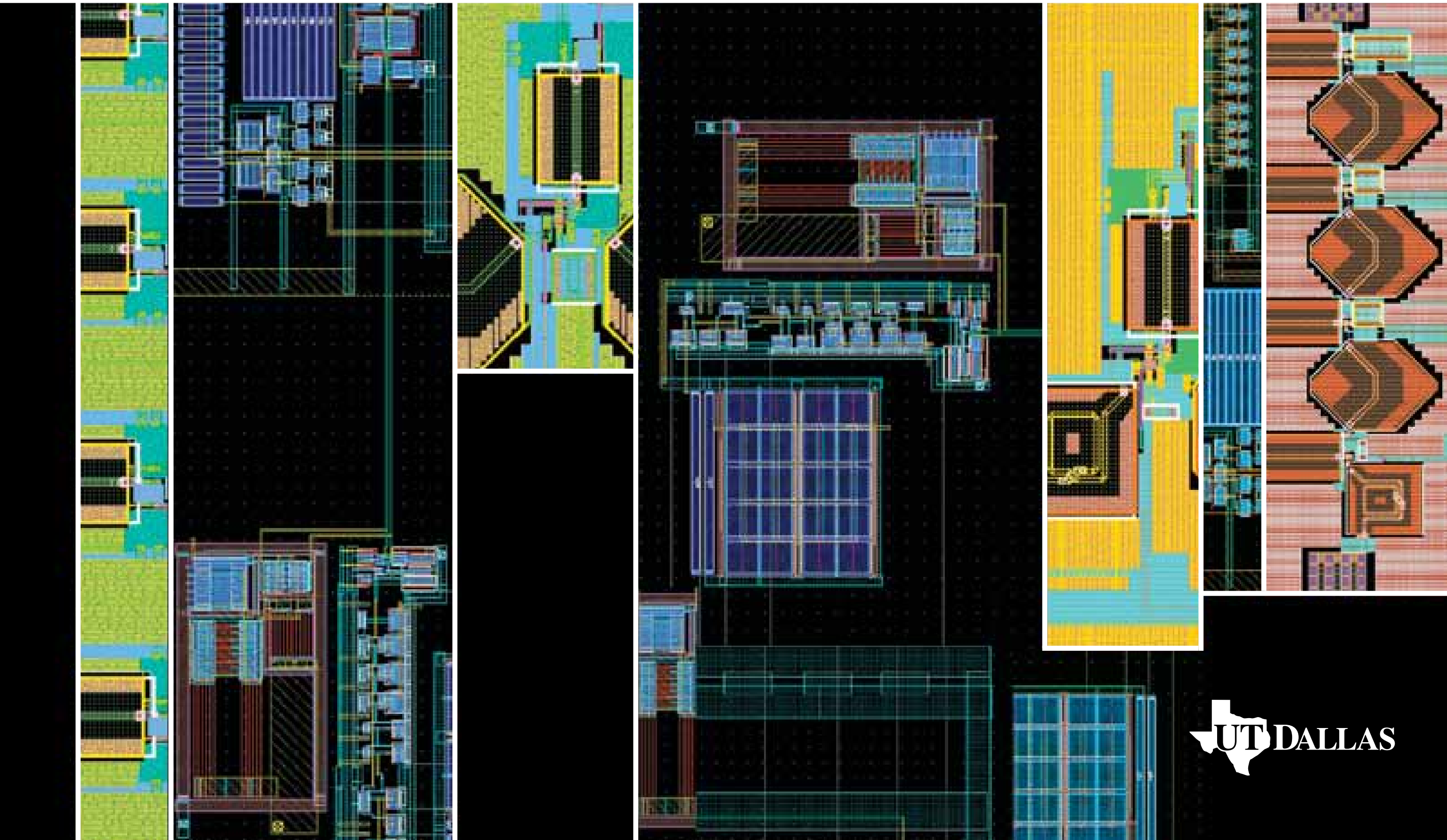


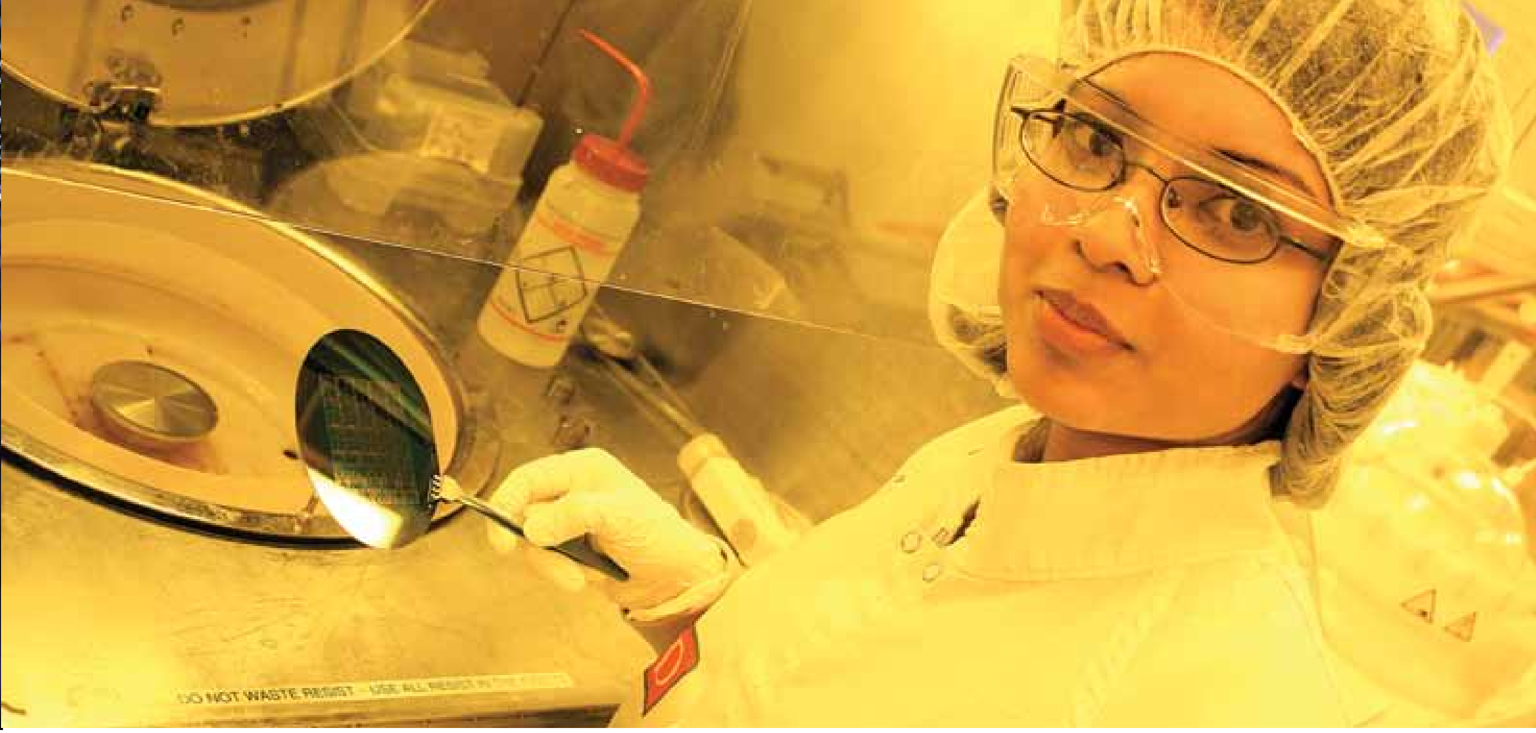
TEXAS ANALOG CENTER OF EXCELLENCE



TxACE OVERVIEW

TxACE is the first and largest international, university-based analog technology center.

BASED AT THE UNIVERSITY OF TEXAS AT DALLAS, the Texas Analog Center of Excellence is designed to create leading-edge analog technology for both traditional electronics and emerging applications. The center is a $16 million collaboration among Semiconductor Research Corp., the State of Texas through its Texas Emerging Technology Fund, Texas Instruments Inc., The University of Texas System and The University of Texas at Dallas.



Since its creation in 2008, TxACE has established itself as the largest international, university-based analog technology center. TxACE research seeks to create fundamental analog, mixed-signal and RF design innovations that improve energy efficiency, health care, and public safety and security.

TxACE is particularly active in working to lower the cost of millimeter-wave and sub-millimeter-wave analog electronics that could revolutionize health care and bolster security.

TxACE's 2010 budget tops $10 million. TxACE awards research funds on a competitive basis following requests for proposals. We invite you to peruse this brochure for more information and to see the back page for contact details, including information about receiving future requests for proposals and accessing our core facilities in Dallas.

WE NOW FUND RESEARCH BY 68 PRINCIPAL INVESTIGATORS AT 26 ACADEMIC INSTITUTIONS.

TxACE RESEARCH

TxACE research concerning analog circuits and technologies is organized under four thrusts

1 ENERGY EFFICIENCY

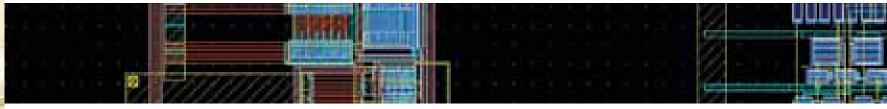
(Thrust leader: Dongsheng Brian Ma, UT Dallas)

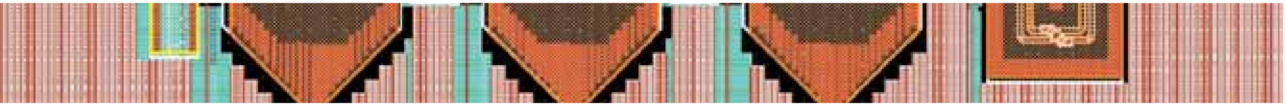
TxACE is committed to helping alleviate global energy problems by significantly improving the energy efficiency of electronics systems as well as developing analog technologies that can increase energy-generation efficiency. We are also working to energize and power a variety of long-lasting in-situ microscale devices such as wireless microsensors, biomedical implants and portable microelectronics.

2 HEALTH CARE

(Thrust leader: Ramesh Harjani, University of Minnesota)

Analog and RF integrated circuit technology is the essential interface enabling the power, speed and miniaturization of modern digital microelectronics to be brought to bear on an array of medical applications, including medical imaging, patient monitoring, laboratory analyses, bio-sensing and new therapeutic devices. TxACE is working to identify and support analog circuit research challenges that have the potential to enable important health-related technology.





3 PUBLIC SAFETY AND SECURITY

(Thrust leader: Brian Floyd, North Carolina State University)

TxACE has awarded nearly $1.5 million to researchers to develop analog technology that enhances public safety and security. The projects are intended to: 1) Enable a new generation of devices that can scan for harmful substances by researching 200-300-GHz silicon ICs for use in spectrometers, and 2) Significantly reduce the cost of in-vehicle radar technology to improve automotive safety by researching circuit techniques that can improve manufacturing and lower test and packaging costs.

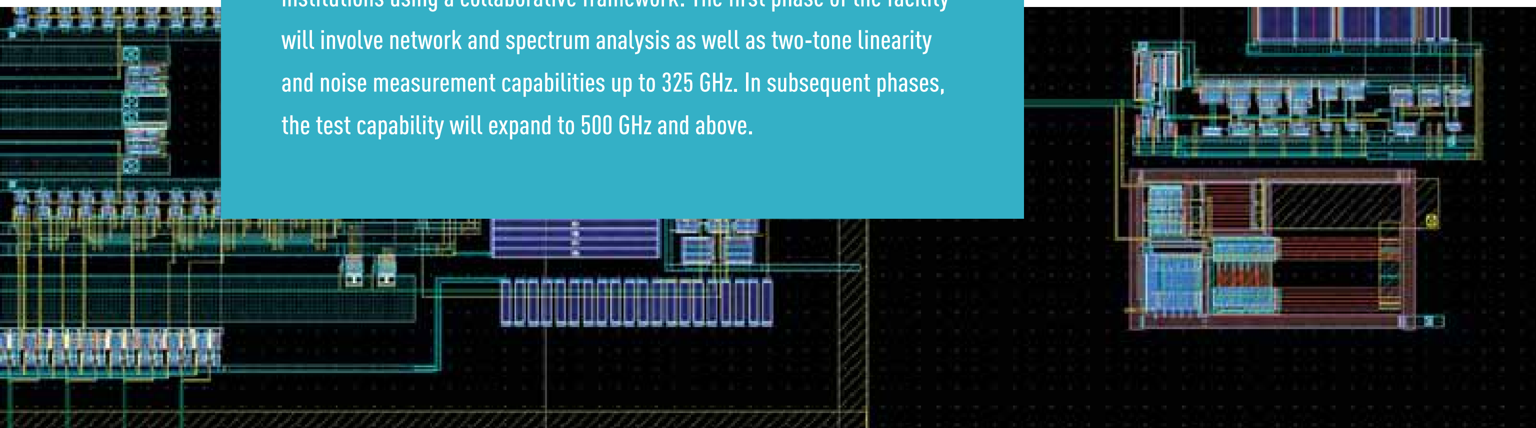
4 FUNDAMENTAL ANALOG CIRCUITS RESEARCH

(Thrust leader: David Allstot, University of Washington)

Research in this thrust focuses on cross-cutting areas in analog circuits that have an impact on all of the application areas represented by the other TxACE thrusts. Fundamental analog circuits research is crucial for the design of analog-to-digital converters and communication links, the development of CAD tools and testing of high-speed circuits.

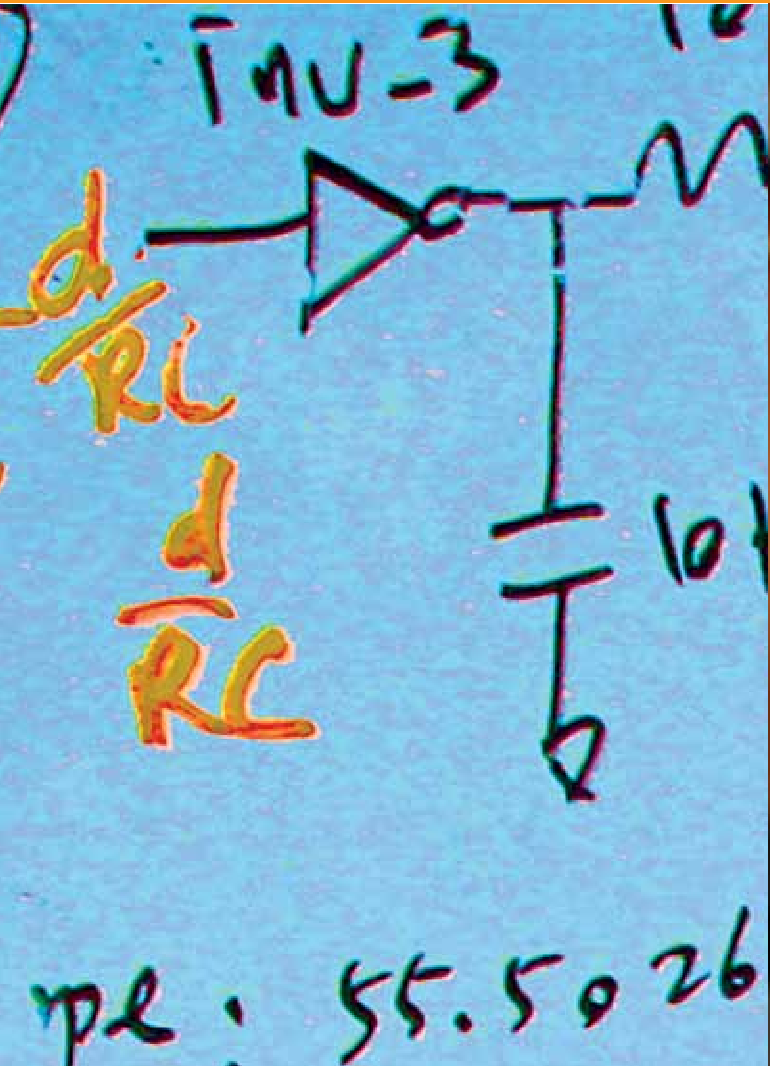
RESEARCH INFRASTRUCTURE

One highlight of TxACE's new 8,000-square-foot laboratory is an electronics characterization facility focusing on millimeter- and submillimeter-wave semiconductor technology. Created in partnership with Agilent Technologies Inc., it will be available to academic, industrial and government institutions using a collaborative framework. The first phase of the facility will involve network and spectrum analysis as well as two-tone linearity and noise measurement capabilities up to 325 GHz. In subsequent phases, the test capability will expand to 500 GHz and above.



TxACE RESEARCH

Work is under way in several areas within TxACE's four primary research thrusts



CAD FOR MIXED-SIGNAL AND RF/MILLIMETER-WAVE SIMULATIONS

- Parallel simulations
- Fast PVT-tolerant design and simulation techniques
- Fast PLL simulations and design verification
- Behavioral model generation algorithms

MILLIMETER- AND SUB-MILLIMETER-WAVE CIRCUITS

- 77-81-GHz radar circuits with built-in self test
- 180-300-GHz spectrometer
- Antennas for radars and spectrometers
- Beam-forming arrays
- Techniques to reduce the number of pixels in "Superman" imagers
- Frequency-channelized ADC sub-THz transmitter components

INTEGRATED POWER ELECTRONICS

- Single-inductor multiple-output power converters
- Software-defined DC-DC converter for thermal management
- LED driver
- Transistor sizing for energy efficiency
- System-level models and design of power-delivery networks with on-chip voltage regulators
- Power-efficient power-line communications for enabling smart-grid applications
- Energy-harvesting circuits (thermal, light, multiple-source and DC-DC converter)

BASEBAND ANALOG ELECTRONICS

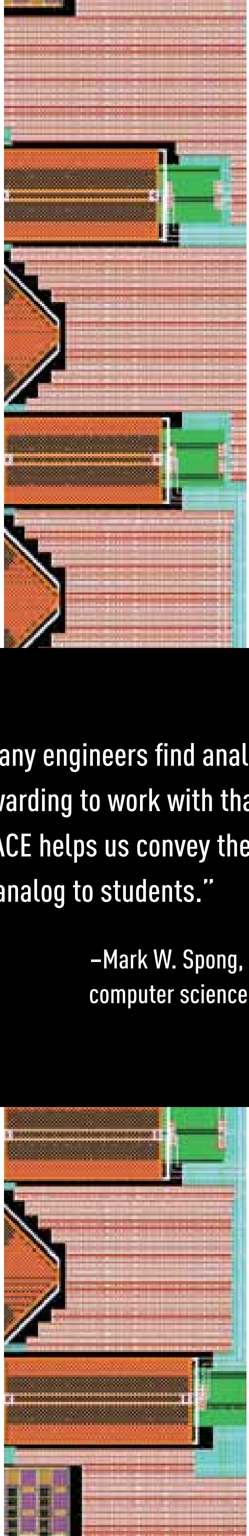
- High sampling rate ADCs: Energy-efficient 10-20-GS/s ADC; comparator; frequency channelized ADC
- Other ADCs: ADCs for broadband applications; low complexity ADC
- High-speed I/O: MIMO for wireline communications; digitally enhanced I/O; sub-1-mW/Gbps serial I/O transceiver
- Sub-0.5-V high-accuracy CMOS temperature sensor
- Mixed-signal architecture for low-power physical uncloneable functions

TEST

- Low-cost testing for >50-GHz circuits
- Adaptive test for test-cost reduction
- Fault models for analog circuits
- Analyses for parametric measurements

RF AND WIRELESS

- Reconfigurable antenna interface for low-power wireless sensor nodes
- Wideband receiver



TxACE RECENT RESEARCH ACCOMPLISHMENTS

(September 2009 - August 2010)

> "Many engineers find analog more rewarding to work with than digital. TxACE helps us convey the excitement of analog to students."
>
> –Mark W. Spong, engineering and computer science dean, UT Dallas

BASEBAND ANALOG ELECTRONICS

Demonstrated a tool that lowers dynamic power of digital integrated circuits by more than 35% and lowers leakage power by more than 70% compared to that generated using state-of-the-art EDA tools. PI: C. Sechen, The University of Texas at Dallas

Demonstrated a supply-regulated PLL architecture that eliminates the tradeoff between supply noise rejection and oscillator phase noise suppression. The PLL is the first to employ bandwidth tracking and achieves the highest supply noise immunity, best power efficiency and low jitter. PI: P. Hanumolu, Oregon State University

By exploring energy-delay tradeoffs in algorithm, recurrence, wiring and circuit topology, developed the most energy-efficient 64-bit adder (EZO-S2). PI: P.V. Oklobdjiza, The University of Texas at Dallas

Developed a BER-aware 3-b ADC architecture with shaping gain >30 dB that has 106x lower BER than a conventional 4-b ADC and 50% savings in power consumption for flash converters. PIs: N. Shanbhag and E. Rosenbaum, The University of Illinois at Urbana-Champaign

Demonstrated a ΔΣ ADC that uses an auxiliary quantizer to significantly raise the maximum input stable range. Demonstrated a low-complexity synthesizable all-digital domino-logic-based ADC. PI: U. Moon, Oregon State University

Developed a MIMO architecture for reducing far-end crosstalk with reduced power and area. Achieved reliable signal integrity with narrow channel spacing, increasing data throughput. PI: R. Harjani, The University of Minnesota

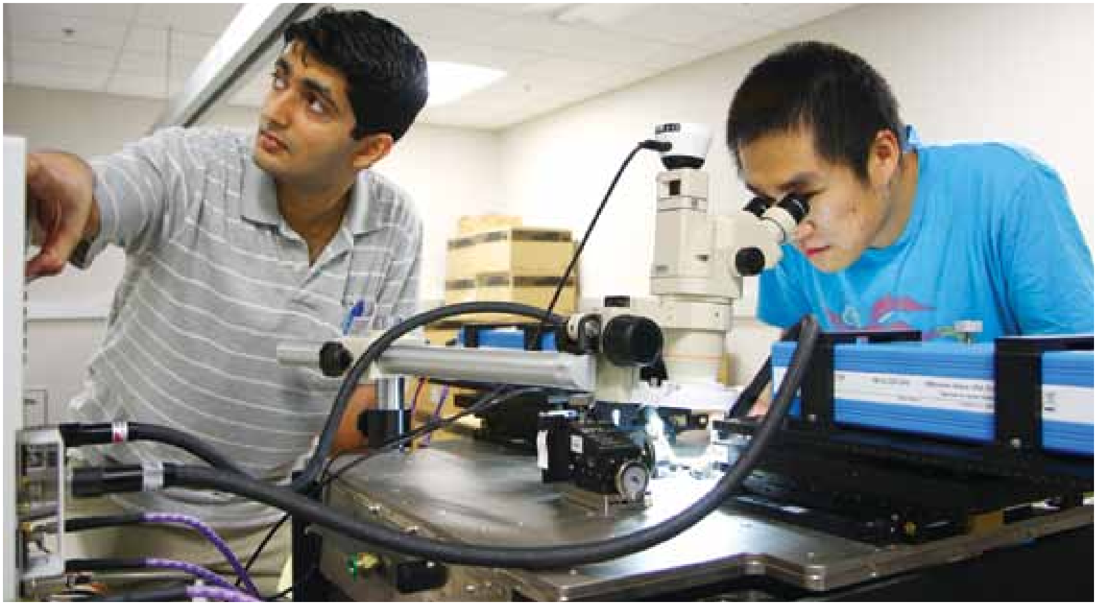
Demonstrated an adaptive data-prediction-based ultrasound receiver with ~27-30 dB higher output dynamic range while using a lower resolution ADC (10-bit instead of 12-bit). PI: D. Ma, The University of Texas at Dallas (formerly of The University of Arizona)

COMPUTER-AIDED DESIGN

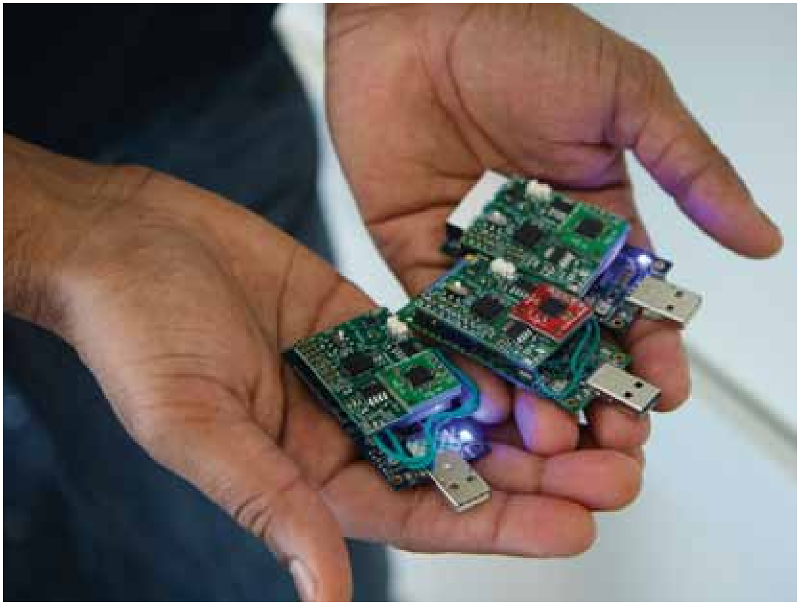
Created equivalent circuit model and understood impact of back-gate bias on silicon-on-insulator-based nanowire sensor operation. PI: E. Vogel, The University of Texas at Dallas

Developed multi-algorithm parallel circuit simulation techniques using 8 threads that speed up run time by more than 10x over serial single algorithms. PI: Peng Li, Texas A&M University

Developed variability-enabled nonlinear phase models for PLLs that enable accurate simulation of PLL dynamics orders of magnitude faster than comparable alternatives. PI: J. Roychowdhury, The University of California, Berkeley



TxACE RECENT RESEARCH ACCOMPLISHMENTS



Developed the hierarchical differential algebraic equation (HDAE) formulation core for enabling multilevel algorithms that reduces memory usage and speeds up simulation. The HDAE core has been used to enable multilevel DC, AC, transient and harmonic balance analyses. PI: J. Roychowdhury, The University of California, Berkeley

Developed a unified statistical analysis engine for SRAM performance, yield, reliability and testability that uses a novel Gibbs sampling algorithm to improve the accuracy and speed of analysis. Demonstrated 3~10x runtime speedup over other state-of-the-art CAD techniques without any accuracy loss. PI: X. Li, Carnegie Mellon University

INTEGRATED POWER ELECTRONICS

Demonstrated a DC-DC power conversion system with software-defined control schemes. The system utilizes an all-digital temperature sensor with high resolution and low static power consumption. PI: D. Ma, The University of Texas at Dallas (formerly of The University of Arizona)

Demonstrated a digital SIMO step-up/down power converter for DVS-enabled multicore systems. An adaptive freewheel switching control mechanism is demonstrated for cross regulation suppression. PI: D. Ma, The University of Texas at Dallas (formerly of The University of Arizona)

A single inductor dual-input dual-output (SIDIDO) boost converter is developed for energy-harvesting applications. A switching-time-aware pulse-frequency modulation control scheme is proposed to enable the converter to achieve the peak power efficiency of 89% over the load current range from 0.1 mW to 16 mW. PI: H. Lee, The University of Texas at Dallas

Using current mode control in a buck regulator, reduced (2-5x) off-chip inductor size to 1 µH and reduced chip size by ~5-10x. The regulator incorporates dynamically biased shunt feedback in both peak and valley current sensors for improving the sensing speed to 2.5 MHz. PI: H. Lee, The University of Texas at Dallas

MILLIMETER-WAVE INTEGRATED CIRCUITS

Demonstrated a tunable 60-GHz tuned amplifier using variable inductors in 45-nm CMOS. PIs: K. O, The University of Texas at Dallas; J. Brewer, The University of Florida

A broadband planar bowtie antenna with 55% bandwidth has been achieved. PIs: R. Henderson and A. Blanchard, The University of Texas at Dallas

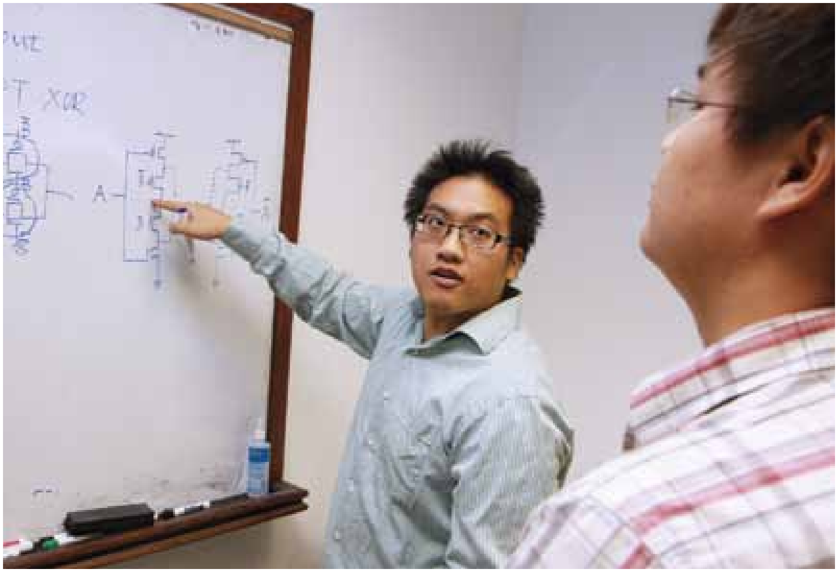
RF AND WIRELESS

Showed uncoordinated interference in MIMO communication proposed for the latest cellular standard causes the goodput gain to decay doubly exponentially with feedback delay. Proposed rate backoff at the transmitter maximizes the achievable ergodic goodput. PI: R. Heath, The University of Texas at Austin

TEST

Demonstrated a new automatic match circuit tuner using square split ring resonators that is 2.5x smaller in size. PI: K. Melde, The University of Arizona

Showed that by employing the NSGA-II genetic algorithm as a heuristic basis for feature selection, latent correlations between kerf/inline parameters and module final test parameters can be uncovered. PI: Y. Makris, Yale University



CONTACT TxACE

To become a TxACE partner, please contact:

Kenneth K. O, Director
972-883-5556

To discuss our core facilities in Dallas and how to obtain access to them, please contact:

Eric Vogel, Associate Director
972-883-5556

To receive future TxACE requests for proposals, please contact:

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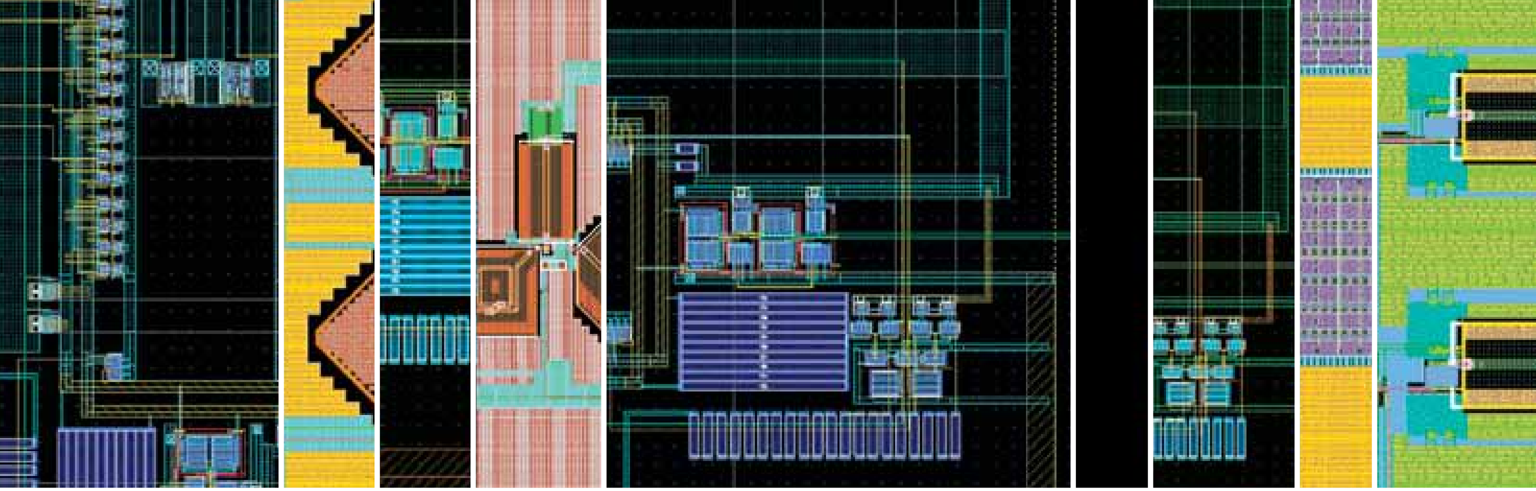

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