SPECIAL SESSIONS
Session #1
Advancing the Frontiers of Solar Energy

Abstract:
Development of affordable solar energy has the potential to provide an inexhaustible, sustainable, import-independent source of energy that will reduce pollution, mitigate climate change, and eventually replace fossil fuels as our primary source of energy. Significant improvements in efficiency and reduction of cost for solar heating and electrical power generation have been made in the past ten years, but solar energy still remains expensive compared to fossil fuels (unless the environmental impact of fossil fuels is factored into the equation). Today we are on the verge of seeing solar energy production become competitive with fossil fuels both for large commercial power plants and for individual residential, business and mobile use. In this Special Session we present some of the current work in Solar-Thermal, Solar-Photovoltaic (PV), Concentrated Solar Power (CSP) and mobile solar electrical production both for individual use and for interconnection of large utility-scale plants to the electrical grid. We also look at a number of case studies of practical uses of Solar Energy in heating, electrical production for individuals and mobile solar for golf carts and Unmanned Aerial Vehicles (UAVs).

Organizer(s):
Michael A. Soderstrand,
Synapse International, L.L.C., Washington, DC, USA.
Session #2

Power Management and Energy Harvesting for Modern SoCs

Abstract:
Recent advances in integrated power management and energy harvesting systems are facilitating the possibility of seamless integration of sensors, harvesters, energy storage, digital processing, analog/RF communication, high efficiency regulators, and references on the same die. This special session will bring together a strong group of research teams from all over the world in the areas of power management and energy harvesting to introduce several new designs emerging in this rapidly developing field.

Organizer(s):
Paul M. Furth,
New Mexico State University, Las Cruces, New Mexico, USA.

Annajirao Garimella,
Intel Corporation, Hillsboro, Oregon, USA.
Session #3

High-Precision and High-Speed Data Converters

Abstract:
A wide variety of applications are demanding improvements in data converter speed and precision. The papers in this session demonstrate design and calibration techniques for improved data converter sample rates and resolution. Calibration techniques which improve the resolution of high-speed pipeline ADCs and DACs are presented. Continuous-time delta sigma (CT-ΔΣ) ADCs are gaining wider adoption in data conversion systems primarily aided by their robustness to mismatch and variations in nano-scale CMOS technologies and inherent anti-alias filtering. An interesting paper discusses system-level design of a proposed cascaded modulator and methods for synthesizing the digital noise cancellation filter (NCF) and exploration of circuit topologies to implement the concept. Also, several high performance high-speed ADC and DAC designs are presented. These improvements impact a wide range of applications, ranging from advanced imaging systems and sensors to high-speed transceivers.

Organizer(s):
Samuel Palermo,
Texas A&M University, College station, Texas, USA.
Session #4

CAS EARS: Circuits and Systems for Enhanced Access to Radio Spectrum

Abstract:
The electromagnetic spectrum is shared among military, civilian and public safety entities for a wide range of applications in RF sensing, intelligence, radar, and wireless communications. Traditionally, the spectrum is managed by the Federal Communications Commission (FCC) by licensing agreements between primary users of spectrum such as telecommunications companies and the Department of Defense. With continued growth in spectrum usage by both military and civilian users, the problem of spectral scarcity is now considered a major engineering grand challenge of our time. In fact, US based scientific agencies such as the National Science Foundation (NSF), Defense Advanced Research Project Agency (DARPA), Intelligence Advanced Research Projects Activity (IARPA) and the Office of Naval Research (ONR) are currently investing heavily in new science and technology towards the solution of the spectral scarcity challenge. As parts of this effort, there is tremendous scope for research and development towards algorithms, theory, and circuit realization of emerging wireless paradigms such as cognitive radios, reconfigurable radios and software defined radios towards achieving an enhanced access to the radio spectrum (EARS).

In this special session, we concentrate on recent findings in the circuits and systems arena, especially radio frequency CAS, that contribute towards the physical layer implementation of cognitive radio. The session will advance the current state of art in terms of RF circuits and microwave systems that are wideband, frequency agile, and reconfigurable, so that they are well suited for emerging cognitive radio transceivers.

Organizer(s):
Arjuna Madanayake,
University of Akron, Akron, Ohio, USA.
Session #5
Self-Healing and Self-Adaptive RF/Mixed Signal Circuits for Low-Cost, High-Yield and Robust Systems

Abstract:
During the past decade, Integrated Circuits (ICs) technology has progressed in accordance with Moore’s law. These advances in IC technology have enabled the integration of wireless front-ends with multiple analog and digital blocks on a single chip. For high speed operation, CMOS technology has evolved from 250-nm device feature size to 20-nm, and now utilizes complicated strain engineering approaches. In addition, silicon BJT technology has evolved into silicon-germanium (SiGe) Heterojunction Bipolar Transistors (HBTs). However, there are discouraging predictions regarding the effects of process variations on the yield in deep-submicron ICs processes. Also, there are predictions that the testing of integrated circuits for correct functionality will be necessary in the development of robust electronic systems. Thus, there is an urgent need to research and develop novel methodologies in the area of self-healing and self-adaptive RF/Mixed signal circuits for low-cost, high yield and robust systems. This special session will focus on the novel and outstanding achievements in the area of self-Healing and self-adaptive RF/Mixed signal circuits for low-cost, high yield and robust systems.

Organizer(s):
Abhilash Goyal,
Oracle (Sun Microsystems), Santa Clara, California, USA.
Reversible Computing

Abstract:
Reversible computing has been proposed as a solution for non-dissipative ultra-low-power green computing. It is based on logic circuits that can generate unique output vector from each input vector, and vice versa, that is, there is a one-to-one mapping between the input and the output vectors. Landauer has shown that during irreversible computation 1-bit of information results in KT*ln2 Joules of energy dissipation. However, Bennett proved that this KT*ln2 joules of energy dissipation will not occur if computation is performed in a reversible manner. Thus, reversible logic can be useful to design non-dissipative circuits if the implementation platform is also physically reversible. Reversible computing can find promising applications in emerging nanotechnologies such as Quantum Dot Cellular Automata (QCA) computing, Optical Computing, and Superconductor Flux Logic (SFL) family, where the energy dissipated due to information destruction will be a significant factor of the overall heat dissipation of the system. A quantum computer performs an elementary unitary operation on one, two or more two-state quantum systems called qubits. Any unitary operation is reversible and hence quantum networks must be built from reversible logic gates. Thus, the feasibility of reversible logic gates could critically impact the realization of quantum computing. While reversible logic has been seen as a purely academic issue for a long time, recent accomplishments such as validation of Landauer’s Principle also triggered the interest of industry. Further, first physical realizations of reversible circuits based on CMOS, adiabatic, the superconductor flux logic family, and photonic technologies have recently been presented. The special session will provide a comprehensive review on fundamentals as well as the current state-of-the-art of reversible circuit design. An introductory paper will discuss basics of reversible computing, its promising applications and recent accomplishments on low-power design, adiabatic circuits, and fault testing. Several papers will focus on important concepts of logical and physical reversibility, ultra-low power non-dissipative green circuits, and irreversibility of floating point arithmetic. Other papers will focus on applying reversible logic in quantum computing, design flow, automatic design methods as well as hardware description languages and building blocks.

Organizer(s):
Himanshu Thapliyal & Nagarajan Ranganathan,
University of South Florida, Tampa, FL, USA.
Session #7
VLSI Scaling and Trusted Mixed Signal Electronics Development

Abstract:
The continued evolution of VLSI scaling toward 22-nm and smaller nodes has created difficult issues for designers that have relatively low volume prototype and supply needs, yet specify electronics for systems that have decades long supply times. Volume in mixed signal electronics is dominated by the telecommunications industry, i.e. mobile computing and smart phones. However, the reliability and supply chain management of electronics of the telecommunications industry is dramatically different from the energy and related industries, such as transportation. The latter systems have very stringent safety requirements and can have long life electronics designs, as opposed to telecommunications which accepts dropped calls and relies on short life cycle electronics designs for market development. A related issue is the ever increasing prototyping expense for ASICs as scaling progresses toward and past the 22-nm node, where it is becoming increasingly difficult for non-telecommunications industries as well as universities to manage IC design costs in this upcoming era. This special session will bring together designers from government, industry, and universities that have these similar issues, along with developers that offer solutions to these issues.

Organizer(s):
Steve Bibyk & Greg Creech,
The Ohio State University, Columbus, Ohio, USA.
Session #8

Fabrication and Characterization of nano-Materials, Molecular Structures, and nano-Interfaces

Abstract:
There is increasing interest in scaling down electronic devices to achieve minimum energy consumption and optimum switching speed, which requires minimizing the basic components of electronic devices. Nano devices based on nano-materials, like nano-wires, nano-crystals, and molecular structures are potential candidates to replace the conventional components of electronic devices. However, thorough investigation is still needed to understand the electrical properties of such components as well as understanding the nano-interfaces between nano-materials and semiconductor substrates. This session will focus on recent developments in the characterization of the electrical properties of nano-materials, nano-wires, molecular structures and molecular electronics, and nano-metal-metal and nano-metal-semiconductor interfaces, from experimental and theoretical points of view.

Organizer(s):
Moh’d Rezeq & Mohamed Ismail,
Khalifa University of Science, Technology and Research, Abu Dhabi, UAE.
Session #9

Ultra-Short-range Wireless Communication for Systems & Networks on Chip Applications

Abstract:
Both end-of-Moore and more-of-Moore scenarios for silicon integration predict that the heterogeneous integration of Complementary-Metal-Oxide-Semiconductor (CMOS) based System-on-Chip (SoC) and massively-scaled multi core computing platforms interconnected via Network-on-Chip (NoC) architectures will vastly benefit from ultra-short range (<100cm) wireless communication links that can lower power consumption or reduce system complexity while also providing unique flexibilities in design and integration. This special session will be dedicated to understand, evaluate, and analyze the design and integration of novel, low-power and compact wireless communication systems and enabling technologies. The session will bring a broad spectrum of system and circuit engineering experts around a set of themes that include challenges in THz CMOS integration, antenna design, medium access, and network design and optimization.

Organizer(s):
Avinash Kodi & Savas Kaya,
Ohio University, Athens, Ohio, USA.
David Matolak,
University of South Carolina, Columbia, South Carolina, USA.
Abstract:
In the last 5 years there has been a major increase in the industry development of products for the teaching of circuits and electronics. Traditional circuits labs have not kept pace with the analog innovations being used in industry for mixed signal design. In particular, industry analog amplifier circuits have steadily developed to be more compatible with digital systems, requiring techniques of single supply design and low voltage supply design (3v and dropping). This special session will bring together industry and university developers for electronics education that is enabled by relatively low cost systems, such as a lab bench (scope, generator, meter) in a box that is combined with a laptop. In addition, lab kits such as the Analog System Lab Kit Pro allow for a more significant exploration of the Art of Electronics. In addition to presentations, the represented industries will set up exhibit booths and sponsor student electronics contests.

Organizer(s):
Steve Bibyk & Greg Creech,
The Ohio State University, Columbus, Ohio, USA.