Session 11 Overview: *Emerging Memory and Wireless Technology*

Technology Directions Subcommittee

Session Chair: *Fu-Lung Hsueh*
TSMC, Hsinchu, Taiwan

Session Co-Chair: *Shinichiro Mutoh*
NTT, Tokyo, Japan

With continuing technology scaling, enabling advances in computation, memory, and communication, energy-efficient memory and wireless communication will become even more important for ubiquitous mobility. This session introduces several emerging memory and wireless technologies enabling improved energy efficiency. Integration of non-volatile memory with logic for data retention, integration of a timing micro-system including crystal oscillators, and integration of NEMS resonators are some of the novelties that will be presented in this session. These technologies will impact computation, future short-distance communication for sensors, body area networks, mobile platforms, and industrial applications making mobile computing truly ubiquitous.

8:30 AM

11.1 A 3.4pJ FeRAM-Enabled D Flip-Flop in 0.13µm CMOS for Nonvolatile Processing in Digital Systems

M. Qazi, Massachusetts Institute of Technology, Cambridge, MA

In Paper 11.1, MIT and Texas Instruments presents a D-flip-flop with ferroelectric capacitor based non-volatile storage, enabling logic pipelines to be suspended and power-cycled without losing the state. The paper demonstrates a save-restore energy budget of just 3.4pJ/b.

9:00 AM

11.2 Nonvolatile Logic-in-Memory Array Processor in 90nm MTJ/MOS Achieving 75% Leakage Reduction Using Cycle-Based Power Gating

M. Natsui, Tohoku University, Sendai, Japan

In Paper 11.2, Tohoku University and NEC describes an MTJ-based logic-in-memory, parallel motion vector prediction accelerator implemented with cycle-based power gating, demonstrating 4× reduction in leakage power and 2× reduction in active power.

 978-1-4673-4516-3/13/$31.00

9:30 AM

11.3 A Versatile Timing Microsystem Based on Wafer-Level Packaged XTAL/BAW Resonators with Sub-µW RTC Mode and Programmable HF Clocks

D. Ruffieux, CSEM, Neuchatel, Switzerland

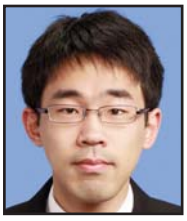
In Paper 11.3, CSEM, Micro Crystal, Fraunhofer IZM, VTT and STMicroelectronics illustrates a novel timing micro-system achieving sub-microwatt power consumption in real-time clock mode, consuming only 0.1mW when the RC PLL is activated, and 10mW with BAW DCO activation.

10:15 AM

11.4 Microwave Amplification with Nanomechanical Resonators

F. Massel, Aalto University, Espoo, Finland

In Paper 11.4, Aalto University and VTT introduces a low-noise microwave amplification scheme using a nano-mechanical resonator. Injection of microwaves induces a coherent stimulated emission and signal amplification.



10:45 AM

11.5 A 0.15mm-Thick Non-Contact Connector for MIPI Using Vertical Directional Coupler

W. Mizuhara, Keio University, Yokohama, Japan

In Paper 11.5, Keio University presents a 0.15mm-thick non-contact connector for Mobile Industry Processor Interface (MIPI) applications. A fully balanced pulse transmitter fabricated in 90nm CMOS technology consumes 1.5pJ/b and significantly suppresses EMI, allowing simultaneous two-channel communications.

11:15 AM

11.6 1.2Gb/s 3.9pJ/b Mono-Phase Pulse-Modulation Inductive-Coupling Transceiver for mm-Range Board-to-Board Communication

H. Cho, KAIST, Daejeon, Korea

In Paper 11.6, KAIST and Samsung Electronics presents a mono-phase pulse modulation inductive-coupling transceiver for mm-range board-to-board communication. Fabricated in 130nm CMOS, it demonstrates 1.2Gb/s data rate, and consumes 3.9pJ/b for the data transceiver and 0.73pJ/b for the clock transceiver at 1.2V.

11:45 AM

11.7 Retrodirective Transponder Array with Universal On-Sheet Reference for Wireless Mobile Sensor Networks Without Battery or Oscillator

H. Fukuda, Keio University, Yokohama, Japan

In Paper 11.7, Keio University describes an innovative application where a rotating shaft is equipped with sensors, wrapped in a 2D waveguide sheet with a retrodirective transponder array. The system beamforms the power to the wireless mobile sensors without battery or oscillator, and improves the power efficiency by 23×.

12:00 PM

11.8 A Scalable 2.9mW 1Mb/s eTextiles Body Area Network Transceiver with Remotely Powered Sensors and Bi-Directional Data Communication

N. V. Desai, Massachusetts Institute of Technology, Cambridge, MA

Paper 11.8 from MIT and Masdar Institute of Science and Technology presents a base station and a sensor node in 0.18µm CMOS, enabling a scalable fault-tolerant eTextiles body area network with inductive resonant power and asymmetric bi-directional data links. The base station consumes 2.9mW per sensor and is capable of 80kb/s downlink and 1Mb/s uplink speeds.