

ULPESH

Workshop on
Ultra-Low Power
Environmental
monitoring, Security,
and Health

July 24th 2015
Rome, Italy
Co-located with ISLPED 2015



Nano-Tera Workshop on Ultra-Low Power Environmental monitoring, Security, and Health (ULPESH)

We are pleased to invite you to participate in the Nano-Tera Workshop on Ultra-Low Power Environmental monitoring, Security, and Health, to be held in Rome, Italy on Friday July 24th 2015, following right after the last session of the ISLPED 2015 conference.

Nano-Tera is a Swiss research initiative that supports interdisciplinary research projects that use engineering and information technology to improve health and security, and to broaden our management of energy and the environment. Many of these projects rely heavily on low-power electronics and design and include a significant amount of research in this area. They are therefore well aligned with the focus of the ISLPED conference.

The workshop addresses senior researchers, PhD students, and industry professionals. For the program, we have organized there invited keynote presentations aligned with the objectives of the Nano-Tera program to discuss different areas and applications of low-power design. These keynote presentations are then followed by an in-depth tutorial addressing various aspects and design guidelines for near-threshold VLSI circuits and systems.

Friday, July 24th 2015, 12:15 – 17:00	
12:15 – 13:00	Lunch
13:00 – 13:05	Opening and Welcome Prof. Luca Benini, ETH Zurich
13:05 – 13:50	E-Health: Devices, Circuits and Systems Prof. Giovanni De Michelli, EPFL
13:50 – 14:35	Keynote: “Predictable low power systems for environmental applications” Prof. Lothar Thiele, ETH Zurich
14:35 – 15:20	Keynote: “Big Data and Dark Silicon: Taming Two IT Inflection Points on a Collision Course” Prof. Babak Falsafi, EPFL
15:20 – 15:30	Break
15:30 – 17:00	Tutorial on low-power design Prof. Massimo Alioto, National University of Singapore

Registration: The workshop (including lunch) is free of charge for attendees of the ISLPED conference and will be managed on-site at the ISLPED registration desk. Since the number of participants is limited, you can also pre-register by sending e-mail to andreas.burg@epfl.ch with subject “ULPESH Registration”.

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KEYNOTE by Prof. Giovanni De Michelli, EPFL

E-Health: devices, circuits and systems

Electronic-health or E-health is a broad area of engineering that leverages transducer, circuit and systems technologies for applications to health management and lifestyle. Scientific challenges relate to the acquisition of accurate medical information from various forms of sensing inside/outside the body and to the processing of this information to support or actuate medical decisions. E-health systems must satisfy safety, security and dependability criteria and their deployment is critical because of the low-power and low-noise requirements of components interacting with human bodies. E-health is motivated by the social and economic goals of achieving better health care at lower costs and will revolutionize medical practice in the years to come.

Speakers Biography

Giovanni De Micheli is Professor and Director of the Institute of Electrical Engineering and of the Integrated Systems Centre at EPF Lausanne, Switzerland. He is program leader of the Nano-Tera.ch program. Previously, he was Professor of Electrical Engineering at Stanford University. He holds a Nuclear Engineer degree (Politecnico di Milano, 1979), a M.S. and a Ph.D. degree in Electrical Engineering and Computer Science (University of California at Berkeley, 1980 and 1983).

Prof. De Micheli is a Fellow of ACM and IEEE and a member of the Academia Europaea. His research interests include several aspects of design technologies for integrated circuits and systems, such as synthesis for emerging technologies, networks on chips and 3D integration. He is also interested in heterogeneous platform design including electrical components and biosensors, as well as in data processing of biomedical information. He is author of: *Synthesis and Optimization of Digital Circuits*, McGraw-Hill, 1994, co-author and/or co-editor of eight other books and of over 600 technical articles. His citation h-index is 84 according to Google Scholar. He is member of the Scientific Advisory Board of IMEC (Leuven, B), CfaED (Dresden, D) and STMicroelectronics.

Prof. De Micheli is the recipient of the 2012 IEEE/CAS Mac Van Valkenburg award for contributions to theory, practice and experimentation in design methods and tools and of the 2003 IEEE Emanuel Piore Award for contributions to computer-aided synthesis of digital systems. He received also the Golden Jubilee Medal for outstanding contributions to the IEEE CAS Society in 2000, the D. Pederson Award for the best paper on the IEEE Transactions on CAD/ICAS in 1987, and several Best Paper Awards, including DAC (1983 and 1993), DATE (2005) and Nanoarch (2010 and 2012).

He has been serving IEEE in several capacities, namely: Division 1 Director (2008-9), co-founder and President Elect of the IEEE Council on EDA (2005-7), President of the IEEE CAS Society (2003), Editor in Chief of the IEEE Transactions on CAD/ICAS (1997-2001). He has been Chair of several conferences, including Memocode (2014) DATE (2010), pHealth (2006), VLSI SOC (2006), DAC (2000) and ICCD (1989).

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KEYNOTE by Prof. Lothar Thiele, ETH Zurich

Predictable low power systems for environmental applications

The field of cyber-physical systems is now in a stage where serious applications of societal and economic importance are in reach such as internet of things, industrial process monitoring and control, environment monitoring, logistics, healthcare applications, home automation, and traffic control. Spatially distributed nodes are used as a new kind of measurement instrument to collect physical or environmental data. In many of these applications, measurements are precious, data must not be lost and should arrive under real-time constraints. In order to significantly advance this class of application domains by using wireless sensor networks as a novel means of observation and interaction, it is inevitable that low power wireless communication is available with known and predictable properties.

The talk will introduce new models and methods that lead to predictable and power efficient networked embedded systems such as optimized and predictable use of harvested solar energy, data cleaning methods, network tomography, sensor calibration, and new classes of dependable synchronization and communication protocols. We will demonstrate their use in extensive, long-term installations of sensor networks in hostile environments for safety-critical applications (mobile air quality measurements in cities and environmental sensing in permafrost regions).

Speakers Biography

Lothar Thiele received his Diplom-Ingenieur and Dr.-Ing. Degrees in Electrical Engineering from the Technical University of Munich in 1981 and 1985 respectively. After completing his Habilitation thesis from the Institute of Network Theory and Circuit Design of the Technical University Munich, he joined the Information Systems Laboratory at Stanford University in 1987.

In 1988, he took up the chair of microelectronics at the Faculty of Engineering, University of Saarland, Saarbrücken, Germany. He joined ETH Zurich, Switzerland, as a full Professor of Computer Engineering, in 1994. His research interests include models, methods and software tools for the design of embedded systems, embedded software and bioinspired optimization techniques.

Lothar Thiele is associate editor of IEEE Transaction on Industrial Informatics, IEEE Transactions on Evolutionary Computation, Journal of Real-Time Systems, Journal of Signal Processing Systems, Journal of Systems Architecture, and INTEGRATION, the VLSI Journal.

In 1986 he received the "Dissertation Award" of the Technical University of Munich, in 1987, the "Outstanding Young Author Award" of the IEEE Circuits and Systems Society, in 1988, the Browder J. Thompson Memorial Award of the IEEE, and in 2000-2001, the "IBM Faculty Partnership Award". In 2004, he joined the German Academy of Sciences Leopoldina. In 2005, he was the recipient of the Honorary Blaise Pascal Chair of University Leiden, The Netherlands. Since 2009 he is a member of the Foundation Board of Hasler Foundation, Switzerland. Since 2010, he is a member of the Academia Europaea. In 2013, he joined the National Research Council of the Swiss National Science Foundation. Lothar Thiele received the "EDAA Lifetime Achievement Award" in 2015.

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KEYNOTE by Prof. Babak Falsafi, EPFL

Big Data and Dark Silicon: Taming Two IT Inflection Points on a Collision Course

Information technology is now an indispensable pillar of a modern-day society, thanks to the proliferation of digital platforms in the past several decades. We are now witnessing two inflection points, however, that are about to change IT as we know it. First, we are entering the Big Data era where demand on robust and economical data processing, communication and storage is growing faster than technology can sustain. Second, while forecasts indicate that chip density scaling will continue for another decade, the diminishing returns in digital platform energy efficiency and the impending "energy wall", is leading server designers towards energy-centric solutions and eventually Dark Silicon. In this talk, I will motivate these two IT trends and present promising research avenues for IT platform and infrastructure designers and operators to help mitigate these technological challenges.

Speakers Biography

Babak Falsafi is Professor in the School of Computer and Communication Sciences and the founding director of the EcoCloud research center pioneering future energy-efficient and environmentally-friendly cloud technologies at EPFL. He has made numerous contributions to computer system design and evaluation including a scalable multiprocessor architecture which was prototyped by Sun Microsystems (now Oracle), snoop filters and temporal stream prefetchers that are incorporated into IBM BlueGene/P and BlueGene/Q, and computer system design evaluation methodologies that have been in use by AMD and HP for research and product development. He is a recipient of an NSF CAREER award, IBM Faculty Partnership Awards, and an Alfred P. Sloan Research Fellowship. He is a fellow of IEEE.

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TUTORIAL by Prof. Massimo Alioto, *National University of Singapore*

Near-Threshold VLSI Circuits and Systems: Aiming at (Nearly) Minimum-Energy Computation

Near-threshold circuits promise a sustainable performance growth over the next CMOS technology generation for constant power envelope, as well as increased functionality on mobile and IoT devices at constant energy availability. At the same time, near-threshold operation poses various design challenges that have not been fully addressed yet.

This tutorial provides a design-centric treatment of near-threshold logic circuits for operation at nearly minimum energy. Circuit models are introduced to develop a deep understanding of the critical design issues and the benefits of near-threshold operation. Quantitative tools are introduced to make quick estimates and design decisions at circuit level, and evaluate the impact at adjacent levels of abstraction. Design considerations on critical sub-systems are also discussed in the context of sub-32nm technologies, exemplifying the key design tradeoffs by recent industrial and academic prototypes.

Emphasizing the uniqueness of the performance/energy/resiliency/leakage design tradeoff at near-threshold voltages, this tutorial aims to debunk several wrong assumptions and myths stemming from traditional above-threshold low-power common wisdom.

Speakers Biography

Massimo Alioto received the M.Sc. and the Ph.D. degree in Electrical Engineering from the University of Catania (Italy) in 1997 and 2001. He is currently an Associate Professor at the Electrical and Computer Engineering Department of the National University of Singapore, where he leads the Integrated Circuits and Embedded Systems area (80+ people). He previously held positions at University of Siena, Visiting Scientist at Intel Labs – CRL (2013), Visiting Professor at University of Michigan - Ann Arbor (2011-2012), BWRC – University of California, Berkeley (2009-2011), EPFL (2007).

He co-authored 200+ journal/conference publications (75 journals) and two books. His research interests include ultra-low voltage VLSI circuits, green computing, self-powered sub- μ W systems, error-aware and widely energy-scalable VLSI circuits, emerging technologies.

He was IEEE Distinguished Lecturer (2010-2012) and Chair of the “VLSI Systems and Applications” Technical Committee (2011-2012). He is Associate Editor in Chief of IEEE Transactions on VLSI Systems, and served as Guest Editor of various journal special issues. He has served as Associate Editor for several journals, Technical Program Chair (ICECS, NEWCAS, VARI, ICM) and Track Chair in a number of conferences (ICCD, ISCAS, ICECS, VLSI-SoC, APCCAS, ICM).