



DESIGN, AUTOMATION & TEST IN EUROPE 2013

- Staff



Highlights

- DATE 2013
- Postdoc Profile: Steffen Peter
- Award: Rainer Doemer receives Faculty of the Year award
- Project Profile: Design Science for CPS
- ASP-DAC 2013
- Henkel Lecture
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This year's Design, Automation & Test in Europe Conference (DATE) was held in Grenoble, France at the Alpexpo Conference Center and spanned an entire week starting on Monday, March 18 with tutorials and ending on Friday, March 22 with workshops. As in previous years, CECS affiliated researchers and graduate students made substantial contributions at DATE 2013.

CECS Director, Prof. Fadi Kurdahi served as the chair for the technical session on *Reconfigurable Computing*. He was also co-chair for the technical session on *High Level Synthesis and Coarse-Grained Reconfigurable Architectures*.

Prof. Nikil Dutt was the co-organizer, general chair and technical program committee member for the *International Workshop on Neuromorphic and Brain-Based Computing Systems*. He also served as co-chair for the technical session on *Architectural and High-Level Synthesis*.

Prof. Jeff Krichmar served as co-chair of the technical program committee for the *International Workshop on Neuromorphic and Brain-*

Based Computing Systems and Prof. Tajana Simunic Rosing chaired the technical session on Green Computing Systems.

The following faculty affiliates and students were invited to give talks and make presentations at various workshops and tutorial sessions:

- Prof. Alex Nicolau, "Variability-Aware Memory Management in the Operating System," *the International Workshop on Software Approaches to Resilient System Design*.
- Professor Ian Harris, "Natural Language Processing," the tutorial session on *Design and Verification of Embedded Systems from Natural Language Descriptions*.
- Prof. Jeff Krichmar, "Brain: Principles & Modeling Abstractions," *the International Workshop on Neuromorphic and Brain-Based Computing Systems*.
- Prof. Rajesh Gupta, "Variability Induced Compiler Directed Strategies," *the International Workshop on Software Approaches to Resilient System Design*.

DATE & POSTDOC PROFILE

DATE 2013 (continued from page 1)...

- PhD Candidate Weiwei Chen, "Out-of-order Parallel Simulation for Electronic System-Level Design," the tutorial session on *Post-Silicon Validation: Old Challenges and New Solutions*, ACM SIGDA/EDAA PhD Forum.

The following technical papers were accepted and presented by CECS faculty affiliates and/or their graduate students:

- "Optimized Out-of-order Parallel Discrete Event Simulation Using Predictions," by Weiwei Chen and Rainer Dömer.

- "Profit Maximization through Process Variation Aware High Level Synthesis with Speed Binning." Mengying Chun Jason Xue, Alex Orailoglu.

- "Utility-Aware Deferred Load Balancing in the Cloud Driven by Dynamic Pricing of Electricity," Muhammad Adnan, Rajesh Gupta.

- "Variation-Tolerant OpenMP Tasking on Tightly-coupled Processor Clusters," Abbas Rahimi, Andrea Marongiu, Paolo Burgio, Rajesh Gupta and Luca Benini.

- "Hierarchically Focused Guardbanding: An Adaptive Approach to Mitigate PVT Variations and Aging," Luca Benini and Rajesh K. Gupta.



Postdoc Profile: Steffen Peter

- Staff



Steffen Peter is a Postdoctoral Researcher in the Information and Computer Science department at UC Irvine. Since August 2012, he has worked in Prof. Tony Givargis' Research Group for the Design Science for Cyber Physical Systems Project.

Steffen received his diploma in computer science (2006) and his PhD (Dr.-Ing) in Computer Engineering (2011) from the Brandenburg University of Technology at Cottbus (BTU) in Germany. From 2006 to 2012 he worked in the IHP Microelectronics research institute in Frankfurt (Oder), Germany, on several national and European research projects.

In the project Mobile Business Engine he de-

signed energy-efficient hardware accelerators for network (TCP/IP) and cryptographic (Elliptic Curve Cryptography) protocols. This work found application in a range of systems on chip for mobile communication that have been manufactured in the IHP 0.25um CMOS technology.

In the European projects UbiSec&Sens and WSN4CIP, Steffen was involved in the design and implementation of security solutions for wireless sensor networks. The main application area of these projects was the protection of critical infrastructures such as the electric grid and water mains with dependable wireless communication systems. To configure these systems automatically, in his PhD thesis, Steffen proposed a component-based approach that applies models to assess security and dependability in the context of application scenario and environment, in addition to properties such as performance, radio, and energy consumption.

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POST DOC cont. AND FACULTY AWARD

Postdoc (continued from page 2)...

From 2010 to 2012 Steffen was technical coordinator of the EU project TAMPRES, which investigated approaches to implement light-weight and tamper resistant sensor nodes for the Future Internet of Things. The work in TAMPRES resulted in a microcontroller, whose instruction set is compatible to the widely used TI MSP430, but which additionally contains a range of side-channel-resistant cryptographic protocols and protection mechanisms to enable trustworthiness for a wide range of distributed sensing and control applications.

Steffen's work in IHP was followed by more than 25 reviewed journal, conference and workshop papers, and six registered international patents.

His research interests include modeling of timing, network and dependability aspects in cyber physical systems and wireless sensor networks. He is also interested in the application of such models for system configuration processes that are applicable for users outside the design community.

Outside the lab Steffen is interested in a variety of outdoor activities including Running (proud member in the UCI running club), Mountain biking (proud owner of a nice bike), scuba diving (proud to be an AOWD), and hiking (proudly survived fighting a raccoon).

Professor Rainer Doemer Receives Faculty of the Year Award

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Professor Rainer Doemer was honored as Electrical Engineering and Computer Science Professor of the Year at the annual UCI ESC awards banquet. This award is presented annually to engineering faculty for excellence in teaching. The

dinner was held in the Doheny Beach room in the Student Center at UCI on Friday, February 22, at E-Week 2013.

E-Week is an annual event organized by the Engineering Student Council (ESC) at UC Irvine. The awards banquet is a chance to recognize faculty and students from the Henry

Samueli School of Engineering who have done an outstanding job.

Congratulations to Prof. Dömer for his hard work and dedication!



ASP-DAC 2013

The 18th Asia and South Pacific Design Automation Conference

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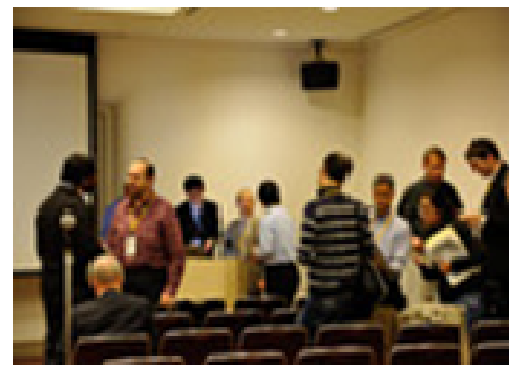


Research affiliates and graduate students from the Center for Embedded Computer Systems were well represented at the 18th Asia and South Pacific Design Automation Conference in Yokohama, Japan on January 22-25, 2013. ASP-DAC is the annual international conference on VLSI design automation in Asia and the South Pacific region, one of the most active regions for design and fabrication of silicon chips in the world. Here are some highlights:



- Professor Nikil Dutt presented the tutorial on *Temperature- and Process Variation-Aware Dependable Embedded Systems*. He also served on the technical program subcommittee for *Embedded and Real-Time Systems*.
- An invited paper titled “Variability-Aware Memory Management for Nanoscale Computing” was presented at the special session on *Dependability of on-Chip Systems*. Authors: Nikil Dutt, Puneet Gupta, Alex Nicolau, Luis A.D. Bathen, Mark Gottscho

- A paper titled “VISA Synthesis: Variation-Aware Instruction Set Architecture Synthesis” was presented at the technical session on *System-Level Synthesis and Optimization*. The authors include Yuko Hara-Azumi, Tkuya Azumi and Nikil Dutt.
- PhD candidate, Ting-Shuo Chou was the presenter for a paper titled “An Efficient Compression Scheme for Checkpointing of FPGA-Based Digital Mockups” at the technical session on *Emerging Technologies in Cyber Systems*. Authors include Ting-Shuo Chou, Chen Huang, Bailey Miller, Frank Vahid, Tony Givargis.
- Ting-Shou Chou presented another paper on behalf of Le-Ngyuen Tran at the technical session on *Revisiting Latency and Reliability in Memory Architectures*. The title of the paper is “Heterogeneous Memory Management for 3D-DRAM and External DRAM with QoS”. Authors Le-Ngyuen Tran, Houman Homayoun, Fadi J. Kurdahi, Ahmed M. El-tawil.



PROJECT PROFILE

Design Science for CPS

-Steffen Peter, Tony Givargis, Frank Vahid, Daniel Gajski, Ting-Shuo Chou, Volkan Gunes, Tom Springer

Cyber Physical Systems (CPSs) are systems that integrate the “cyber part” in which the system processes information and communicates with its distributed environment, the “interface part” in which components such as sensors, actuators, analog/digital converters, etc. convert information into physical quantities, and the “physical part” which performs the primary function of a CPS.

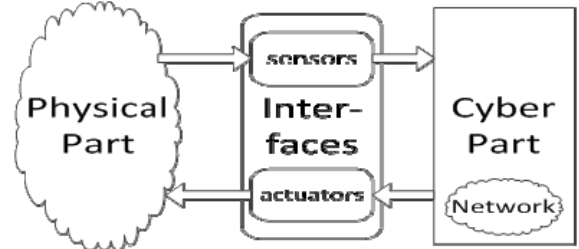


Figure 1: General CPS Architecture

CPSs have an extraordinary potential to change industry, the economy, and our lifestyles, but they also present an enormous design-science challenge, as CPSs require integration of different types of knowledge from many different disciplines.

Objective of DesignSciCPS:

The overall objective of DesignSciCPS is to create a general CPS design-science that makes design of every CPS simpler, faster and more dependable, while at the same time reducing the cost and the required expertise level.

We build on the well-understood methodology for embedded system design, represented in form of the Y-chart. It is our goal to extend the Y-chart methodology with a new level providing answers for the challenges in the CPS design. The new CPS design level is highlighted in Figure 2. Our research highlights the following two aspects of the new layer:

1. Definition of suitable models and languages for the specification of the behavior of the CPS on one side, and models representing the architecture and structure of the CPS on the other side.
2. To derive a suitable system architecture for a given behavioral specification, we investigate analytic approaches to explore the design alternatives including cyber and physical components.

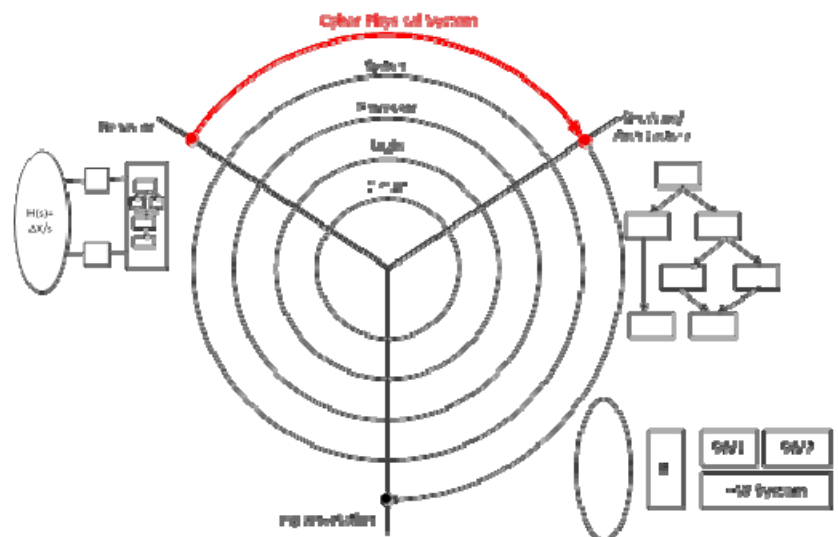


Figure 2: Y-chart extended with a CPS layer

PROJECT PROFILE cont.

Design Science for CPS (cont. from page 5)

In the current phase of the project, we work with small examples for CPSs to test and understand models and design methods.

One example developed, modeled and implemented in our group is the Falling Ball Example (see Figure 3). The Falling Ball example has the objective to take a picture exactly at the moment a falling ball passes a camera. The approaching time is predicted based on information from motion sensors mounted above the camera.

This simple example has some interesting properties of CPSs. The example needs exact timing and it requires modeling of physical phenomena. In spite of the example's simplicity, a designer has to cope with deviations between model and real physical world as well as with timing uncertainties on the cyber part.

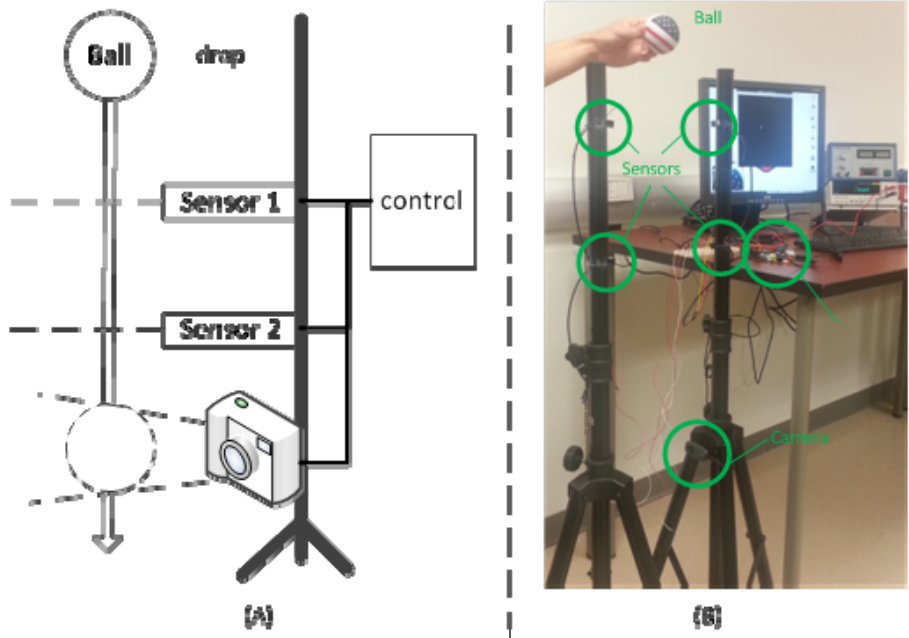


Figure 3: Setup of the Falling Ball example: (A) as schematics, (B) in practice

Henkel Delivers CECS Distinguished Lecture

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On February, 2013, Professor Jörg Henkel delivered a CECS distinguished Lecture titled, "A Thermal Perspective of Dependability in Systems on Chip". In the first part of the lecture, he introduced some basics of on-chip reliability from a thermal point of view (i.e., how heat/temperature

is related to reliability). He then explained the concepts of NBTI and Electromigration, and showed that many reliability-related mechanisms are accelerated by temperature. He also discussed challenges posed by, and solutions for, how to estimate and measure temperature. In the second part of the talk he introduced some concepts on how to control on-chip temperature through mechanisms such as load balancing etc. Professor Jörg Henkel is currently with Karlsruhe Institute of Technology (KIT) in Germany, where he is directing the Chair for Embedded Systems CES. His current research is focused on design and architectures for embedded systems with focus on low power and reliability.

European Colleagues Visit CECS

A group of CECS collaborators and colleagues from various Universities in The Netherlands and Germany visited CECS on February 22, 2013. The visitors included Prof. Dirk Jansen and his two graduate students, from TU Delft, Prof. Giehl and his assistant, University of Mannheim; Prof. Scheible, Reutlingen University; Prof. Johanssen and Dr. Vettermann, University of Pforzheim; Prof. Siggelkow, University of Ravensburg-Weingarten, and Mr. Dusch and Mr. Schmidt, University of Ofenbourg. They met with Prof. Gajski, Prof. Dömer and Prof. Al Faruque to discuss current research programs at CECS and to explore the possibility of research collaboration.

After the meeting, the group visited Prof. Givargis's Cyber Physical Systems Design lab, and CECS postdoctoral researcher, Dr. Steffen Peter presented their latest research paper entitled "*A Ball Goes to School – Our Experiences from a CPS Design Experiment*". This paper has been accepted for the First Workshop on Cyber-Physical Systems Education (CPS-Ed 2013), to be held on Monday, April 8, 2013 in Philadelphia, Pennsylvania. After the presentation, Dr. Peter kindly gave the group a campus tour culminating in lunch with CECS faculty at the University Town Center.



Publications

The following papers were published by CECS affiliates between January 2013 to March 2013 (and unreported papers from previous eNews).

Author, Title, Publication

Conference Proceedings

Weiwei Chen, Rainer Dömer, "**Optimized Out-of-order Parallel Discrete Event Simulation Using Predictions,**" Design, Automation & Test in Europe (DATE), Grenoble, France, March 18-22, 2013

Mengying Chun, Jason Xue, Alex Orailoglu, "**Profit Maximization through Process Variation Aware High Level Synthesis with Speed Binning,**" Design, Automation & Test in Europe (DATE), Grenoble, France, March 18-22, 2013

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PUBLICATIONS

The following papers were published by CECS affiliates between January 2013 to March 2013 (and unreported papers from previous eNews) - continued from page 7...

Muhammad Adnan, Rajesh Gupta, **“Utility-aware Deferred Load Balancing in the Cloud Driven by Dynamic Pricing of Electricity,”** Design, Automation & Test in Europe (DATE), Grenoble, France, March 18-22, 2013

Abbas Rahimi, Andrea Marongiu, Paolo Burgio, Rajesh Gupta, Luca Benini, **“Variation-tolerant OpenMP Tasking on Tightly-coupled Processor Clusters,”** Design, Automation & Test in Europe (DATE), Grenoble, France, March 18, 22, 2013

Abbas Rahimi, Luca Benini, Rajesh K. Gupta, **“Hierarchically Focused Guardbanding: An Adaptive Approach to Mitigate PVT Variations and Aging,”** Design, Automation & Test in Europe (DATE), Grenoble, France, March 18, 22, 2013

Rosario Cammarota, Alexandru Nicolau, Alexander V. Veidenbaum, Arun Kejariwal, Debora Donato, Mukund Madhugiri, **“On the Determination of Inlining Vectors for Program Optimization,”** 22nd International Conference on Compiler Construction (CC), Rome, Italy, March 16-24, 2013

Dali Zhao, Houman Homayoun, Alex Veidenbaum, **“Temperature Aware Thread Migration in 3D Architecture with Stacked DRAM,”** The International Symposium on Quality of Electronic Design (ISQED), San Jose, CA, March 4-6, 2013

Jordan Bisasky, Tinoosh Mohsenin, Houman Homayoun, **“A Many-core Platform for Biomedical Signal and Image Processing,”** The International Symposium on Quality of Electronic Design (ISQED), San Jose, CA, March 4-6, 2013

N. Kapadia, S. Pasricha, **“A Co-Synthesis Methodology for Power Delivery and Data Interconnection Networks in 3D ICs,”** The International Symposium on Quality Electronic Design (ISQED), San Jose, CA, March 4-6, 2013

N. Kapadia, S. Pasricha, **“VERVE: A Framework for Variation-Aware Energy Efficient Synthesis of NoC-based MPSoCs with Voltage Islands,”** The International Symposium on Quality Electronic Design (ISQED), March 4-6, 2013

Y. Zou, S. Pasricha, **“Reliability-Aware and Energy-Efficient Synthesis of NoC based MPSoCs,”** The International Symposium on Quality Electronic Design (ISQED), Santa Clara, CA, March 4-6, 2013

Y. Xiang, S. Pasricha, **“Thermal-Aware Semi-Dynamic Power Management for Multicore Systems with Energy Harvesting,”** The International Symposium on Quality Electronic Design (ISQED), Santa Clara, March 4-6, 2013

A. Homescu, S. Neisius, P. Larsen, S. Brunthaler, Michael Franz, **“Profile-guided Automated Software Diversity,”** The International Symposium on Code Generation and Optimization (CGO), Shenzhen, China, February 23-27, 2013

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PUBLICATIONS

The following papers were published by CECS affiliates between January 2013 to March 2013 (and unreported papers from previous eNews) - continued from page 8...

Zheng Wang, Pei-Yuan Chiang, Peyman Nazari, Chun-Cheng Wang, Zhiming Chen, Payam Heydari, **"A 210 GHz Fully Integrated Differential Transceiver with Fundamental Frequency VCO in 32 nm SOI CMOS,"** IEEE International Solid-State Circuits Conference (ISSCC), San Francisco, CA, February 17-21, 2013

Francis Caster, Leland Gilreath, Shiji Pan, Zheng Wang, Filippo Capolino, Payam Heydari, **"A 93-113GHz BiCMOS 9-Element Imaging Array Receiver Utilizing Spatial-Overlapping Pixels with Wideband Phase and Amplitude Control,"** IEEE International Solid-State Circuits Conference, San Francisco, CA, February 17-21, 2013

Baily Miller, Frank Vahid, Tony Givargis, **"Embedding-based Placement of Processing Element Networks on FPGAs for Physical Model Simulation,"** The 2013 ACM/SIGDA International Symposium on Field Programmable Gate Arrays (FPGA), Monterey, CA, February 11-13, 2013

Le-Nguyen Tran, Houman Homayoun, Fadi Kurdahi, Ahmed M. Eltawil, **"Heterogeneous Memory Management for 3D-DRAM and External DRAM with QoS,"** The 18th Asia and South Pacific Design Automation Conference (ASP-DAC), Yokohama, Japan, January 22-25, 2013, ASP-DAC 2013: 663-668

Ting-Shuo Chou, Chen Huang, Bailey Miller, Tony Givargis, Frank Vahid, **"An Efficient Compression Scheme for Checkpointing of FPGA-Based Digital Mockups,"** The 18th Asia and South Pacific Design Automation Conference (ASP-DAC), Yokohama, Japan, January 22-25, 2013, ASP-DAC 2013: 632-637

Yuko Hara-Azumi, Takuya Azumi, Nikil Dutt, **"VISA Synthesis: Variation-Aware Instruction Set Architecture Synthesis,"** The 18th Asia and South Pacific Design Automation Conference (ASP-DAC), Yokohama, Japan, January 22-25, 2013, ASP-DAC 2013: 243-248

Nikil Dutt, Puneet Gupta, Alex Nicolau, Luis Angel D. Bathen, Mark Gottscho, **"Variability-Aware Memory Management for Nanoscale Computing,"** The 18th Asia and South Pacific Design Automation Conference (ASP-DAC), Yokohama, Japan, January 22-25, 2013, ASP-DAC 2013: 125-132

Hyeoungho Bae, Charless C. Fowlkes, and Pai H. Chou, **"Accurate Motion Deblurring using Camera Motion Tracking and Scene Depth,"** IEE Workshop on the Application of Computer Vision (WACV), Clear Beach, Florida, USA, January 17-18, 2013

Author, Title, Publication

Journal Articles

Puneet Gupta, Yuvraj Agarwal, Lara Dolecek, Nikil D. Dutt, Rajesh K. Gupta, Rakesh Kumar, Subhasish Mitra, Alex Nicolau, Tajana Simunic Rosing, Mani B. Srivastava, Steven Swanson, Dennis Sylvester, **"Underdesigned and Opportunistic Computing in Presence of Hardware Variability,"** IEEE Transactions on CAD of Integrated Circuits and Systems 32(1): 8-23 (2013)

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PUBLICATIONS

The following papers were published by CECS affiliates between January 2013 to March 2013 (and unreported papers from previous eNews) - continued from page 9...

Bobby Dalton Young, Jonathan Apodaca, Luis Diego Briceno, Jay Smith, Suddep Pasricha, Anthony A. Maciejewski, Howard Jay Siegel, Bhavesh Khemka, Shirish Bahirat, Adrian Ramirez, Yong Zhou, **“Deadline and Energy Constrained Dynamic Resource Allocation in a Heterogeneous Computing Environment,”** The Journal of Supercomputing 63(2): 326-347 (2013)

Arup Chakraborty, Houman Homayoun, Amin Khejaf, Nikil Dutt, Ahmed Eltawil, Fadi Kurdahi, **“Multi-Copy Cache: A Highly Energy Efficient Cache Architecture”** ACM Transactions on Embedded Computing Systems (TECS). (Accepted, to be appear in 2013)

Jie Tang, Pollawat Thanarungroj, Chen Liu, Shaoshan Liu, Zhimin Gu, Jean-Luc Gaudiot, **“Pinned OS/Services: A Case Study of XML Parsing on Intel SCC,”** Journal of Computer Science and Technology (JCST) 28(1): 3-13 (2013)

Kyueun Y, Won Woo Ro, Jean-Luc Gaudiot, **“Importance of Coherence Protocols with Network Applications on Multicore Processors,”** IEEE Transactions on Computers 2(1): 6-15 (2013)

Chifeng Wang, Wen-Hsiang Hu, Nader Bagherzadeh, **“Scalable Load Balancing Congestion-aware Network-on-Chip Router Architecture,”** Journal of Computer and System Science (JCSS) 79(49): 421-439 (2013)

H. Sarbazi-Azad, Nader Bagherzadeh, **“Multicore Computing Systems: Architecture, Programming Tools, and Applications,”** Journal of Computer and System Sciences (JCSS) 79(4): 403-405 (2013)

Emiliano De Cristofaro, Claudio Soriente, Gene Tsudik, Andrew Williams, **“Tweeting with Hummingbird: Privacy in Large-Scale Micro-Blogging OSNs,”** IEEE Data Engineering Bulletin 35(4): 93-100 (2012)

Mishari Al Mishari, Emiliano De Cristofaro, Karim M. El Defrawy, Gene Tsudik, **“Harvesting SSL Certificate Data to Identify Web-Fraud,”** International Journal of Network Security (IJNS) 14(6): 324-338 (2012)

Chun Jason Xu, Nikil D. Dutt, **“Guest Editorial Special Section on Memory Architectures and Organization,”** Embedded Systems Letters 4(4): 81 (2012)

Masaya Yoshida, Tomoya Kitani, Masaki Bandai, Takashi Watanabe, Pai H. Chou, Winston Khoon Guan Seah, **“Probabilistic Data Collection Protocols for Energy Harvesting Wireless Sensor Networks,”** International Journal of Ad Hoc and Ubiquitous Computing (IJAHUC) 11(2/3): 82-96 (2012)

Ann Gordon-Ross, Frank Vahid, Nikil Dutt, **“Combining Code Reordering and Cache Configuration,”** ACM Transactions on Embedded Computing Systems (TECS) 11(4):88 (2012)

Robert P. Dick, Li Shang, Nikil Dutt, **“Introduction to Special Section SCPS’09,”** ACM Transactions on Embedded Computing Systems (TECS) 11(4): 74 (2012)

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CECS—promoting creativity and pursuing discovery!

Center for Embedded Computer Systems, University of California, Irvine



CECS Mission Statement:

To conduct leading-edge interdisciplinary research in embedded systems emphasizing automotive, communications, and medical applications, and to promote technology and knowledge transfer for the benefit of the individual and society.

CECS eNews

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Synopsys Inc., Fremont,
CA

Publications (cont. from previous page)

Mingyoung Kim, Mark-Oliver Stehr, Carolyn L. Talcott, Nikil Dutt, Nalini Venkatasubramanian, “**xTune: A Formal Methodology for Cross-layer Tuning of Mobile Embedded Systems,**” ACM Transactions on Embedded Computing Systems (TECS) 11(4): 73(2012)

Amin Khajeh, Minyoung Kim, Nikil Dutt, Ahmed M. Eltawil, Fadi J. Kurdahi, “**Error-Aware Algorithm/Architecture Coexploration for Video Over Wireless Applications,**” ACM Transactions on Embedded Computing Systems (TECS) 11(S1): 15 (2012)

