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# CECS eNEWS



Center for Embedded Computer Systems, University of California, Irvine

## Highlights

- **WorldComp 2013**
- NSF Variability-Expeditions Mtg.
- Book Release
- **Student Profile:**  
Wael ElSharkasy
- **Project Profile:**  
Efficient Error-Aware  
Power Management  
for Memory  
Dominated OFDM  
Systems

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## WorldComp/EEE'13 – VIVA e-Learning!

- Quoc-Viet Dang



Between July 22-25, I attended WorldComp'13 in Las Vegas, NV. The "World Congress" covers 22 smaller conferences in the areas of Computer Science, Computer Engineering, and Applied Computing. They were all held simultaneously at the Tropicana Hotel.

The Keynote Speeches for the conferences covered "Accessing and Computing Meaning" by Prof. Raskin of Purdue University and "Visualization and Data Mining for High Dimensional Datasets" by Prof. Inselberg of Tel Aviv University, Israel. There were also numerous tutorials, covering everything from parallel and distributed computing to cyber security and new ways to share e-Learning content. During breaks, we were able to discuss current research with grad students from many different universities at their poster sessions. At the end of the first conference day, there was a nice buffet welcome dinner where I had the opportunity to meet researchers from some of the other conferences.

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## WorldComp 2013 (continued from page 1)...

Sponsors and vendors were also present to demonstrate some of their latest gadgets available for University research. One such gadget was NAO, the autonomous humanoid robot. It sang, it danced, and it knew how to brace itself when falling or tripping. It was programmable – much more than the basic Xilinx FPGA using for research; of a hefty price tag of unit.



to brace itself when falling – also completely more interesting than some of the boards we are currently using. Of course, it also comes at around \$16,000 per

Among the several tutorial sessions offered, I found Dr. Pratap Chintalapanti's tutorial on "How to use Android to Create Content, Publish, and Share" particularly interesting. He heads a company in

Lensoo Inc., which created a free Android application and web platform for educators (and anyone else) to create and share presentations quickly. The ability to import pdf's & images along with synced audio recording for each slide made it more useful than current equivalent offerings. It was very easy to make quick example slides demonstrating some concepts as well as upload and share them. The best part was that the application is free. The only disappointment was that it was only available for tablets and not smartphones. However, we were informed that smartphone and iPad support is coming soon.

San Jose, CA called

The specific conference I attended was The 2013 International Conference on e-Learning, e-Business, Enterprise Information Systems, and e-Government (EEE'13), where I presented some preliminary e-Learning research conducted under Dr. Gajski along with our grad researcher from the School of Education at UC Irvine, Wenliang He titled "An Online Methodology for Individualized Education."

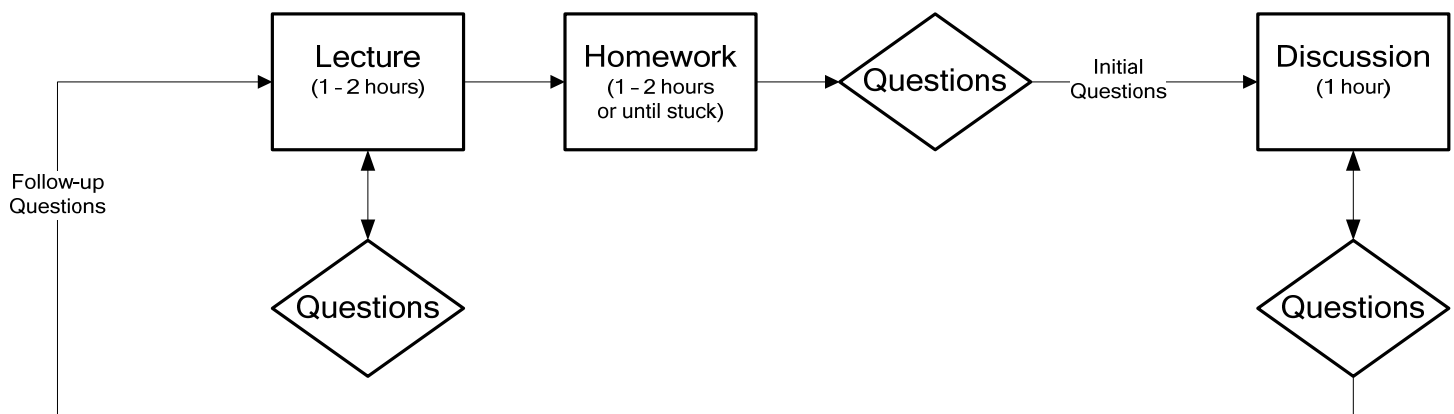


Figure 1: A Typical In-Class Methodology Work Flow

# WORLDCOMP cont.

## WorldComp 2013 (continued from page 2)...

In our research, we focus on improving student performance by utilizing online tools and making basic changes in teaching methodology to help ensure a better use of available resources by students. A secondary goal is to keep overhead costs down, which is the main goal of many proponents of online education. We compared 2 groups of students in Dr. Gajski's Digital Design Logic course over 2 different quarters. The first group was used as a control group, where we followed a typical in-class teaching methodology. The typical in-class method works fine, but has a long turn-around time. We believe we can help create a quicker and more comprehensive learning experience by utilizing online tools and adjusting student learning behaviors where necessary.

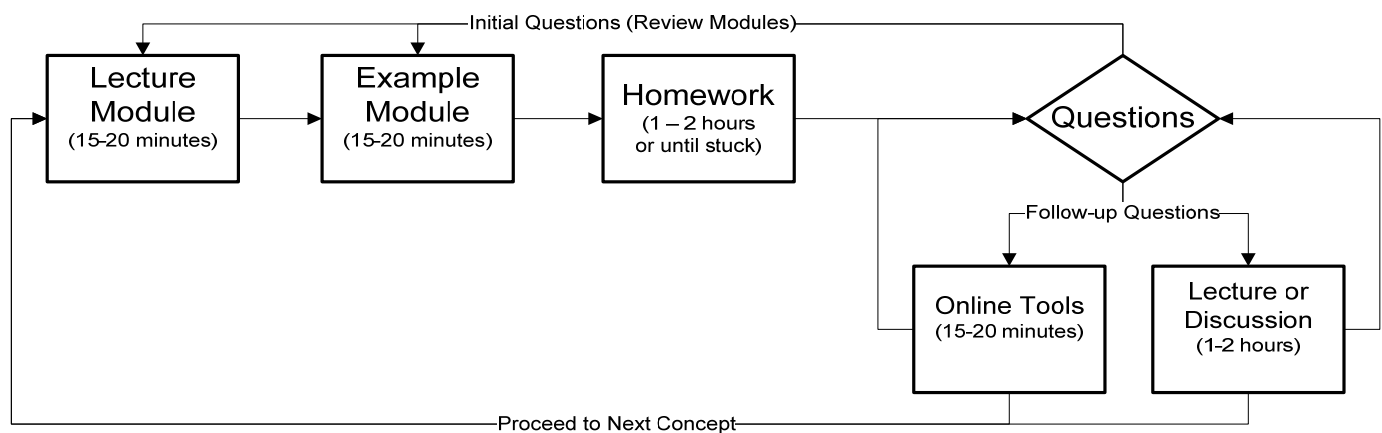
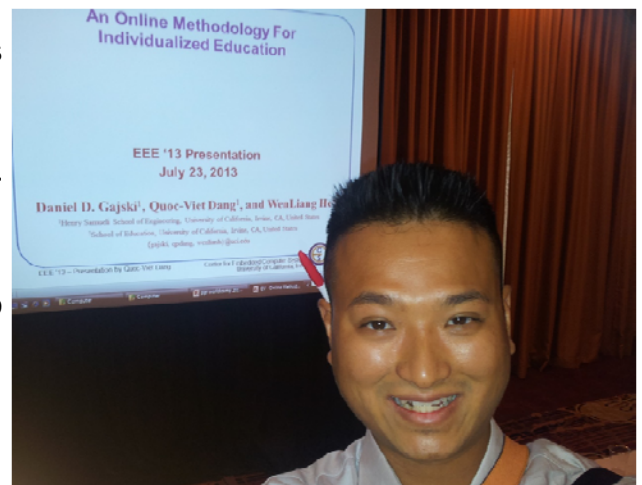


Figure 2: A Typical Online Methodology Work Flow

The second group received 3 different instruction methodologies: an in-class teaching style, an online course simulation style, and a hybrid methodology that combined certain parts of both in-class and online methods. By further splitting each group into 3 different subgroups based on ability (above average, average, below average), we were able to compare the different effects that each teaching style had on each group of students.

Initial results are very promising. Above average students responded well to a simulated online course; however, the rest of the students did not fare so well. However, with our hybrid methodology, which guides students with introductory lectures in-class while allowing them to review the details of various concepts online at home, showed improvement for students overall. Below average students responded particularly well to this teaching method. More specific comparisons and more research must be done, but the potential for improving student performance and saving money in the long run is definitely feasible. Being able to discuss various e-Learning methods formally in discussion panels and informally during breaks and poster sessions has given me a whole new set of research ideas to brainstorm over the rest of Summer.



# NSF MTG. and BOOK RELEASE

## CECS hosts NSF Variability Expedition Meeting

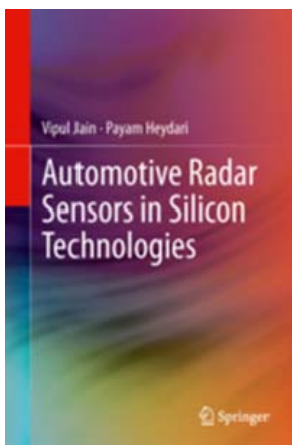
Staff



Professors Nikil Dutt and Alex Nicolau hosted the NSF Variability Expedition PI/Student Meeting on Friday, June 14, from 9:00am – 4:00pm in Donald Bren Hall. Variability Expedition lead PI, Rajesh Gupta, gave the opening speech with an overview and summary of VarExp Experimental Platforms and provided the goals for the meeting. The attendees included UCLA Professors Puneet Gupta and Mani Srivastava, and graduate students, Yasmine Badr, Mark

Gottscho, Liangzhen Lai and Lucas Wanner; UCSD Professors Rajesh Gupta and Steve Swanson, and graduate student, Omid Assare; Stanford University Professor Subhasish Mitra; UCI Professors Nikil Dutt and Alex Nicolau, and graduate students, Abbas BanaiyanMofrad, Hossein Tajik, Majid Namaki, Santanu Sarma and Jurngyu Park. For more information about the NSF Variability Expedition Project, please go to: <http://www.variability.org/>

## Book Release: Automotive Radar Sensors in Silicon Technologies



Professor Payam Heydari and Dr. Vipul Jain are the authors of a new book titled *Automotive Radar Sensors in Silicon Technologies*, published by Springer. This book presents architectures and design techniques for mm-wave automotive radar transceivers. Several fully-integrated transceivers and

receivers operating at 22-29 GHz and 77-81 GHz are demonstrated in both CMOS and SiGe BiCMOS technologies. Excellent performance is achieved indicating the suitability of silicon technologies for automotive radar sensors. This book bridges an existing gap between information available on dependable system/architecture design and circuit design. It provides the background of the field and detailed

descriptions of recent research and development of silicon-based radar sensors. System-level requirements and circuit topologies for radar transceivers are described in detail. Holistic approaches towards designing radar sensors are validated with several examples of highly-integrated radar ICs in silicon technologies. Circuit techniques to design millimeter-wave circuits in silicon technologies are discussed in depth. Describes concepts and fundamentals of automotive radar sensors; Bridges the current gap between publications on system/architecture design and circuit design for automotive radar sensors; Describes in detail system-level requirements and circuit topologies for radar transceivers; Validates holistic approaches towards designing radar sensors with several examples of highly-integrated radar ICs in silicon technologies; Describes various techniques to design millimeter-wave circuits in silicon technologies.



# STUDENT & PROJECT PROFILES

## Student Profile: Wael ElSharkasy

-Staff

Wael ElSharkasy is a first year PhD student in the EECS department at UC Irvine. He received his Bachelor's and Master's degrees in Communications and Electronics Engineering from Alexandria University, Egypt in 2007 and 2011 respectively. From 2007 to 2012, he was a teacher assistant at the Electrical Engineering Department in Alexandria University, where he assisted in preparing materials and labs for different courses such as digital integrated circuits, digital VLSI, microprocessor system design and analog integrated circuit design.

His previous research experience includes FPGA implementations of digital multimedia and communications systems, design of microcontroller based embedded systems, and design of CMOS image sensor circuits.

In summer 2012, he was a visiting researcher at the Egypt-Japan University of Science and Technology (EJUST), where he worked in a project for developing a multiprocessor Network-on-Chip platform. He was also an active IEEE member since 2003 in Alexandria University student branch, where he was the student branch chairman in 2006 and the branch men-



tor from 2008 to 2011. He was also one of the organizing team of the IEEE Egyptian Engineering Day (EED) conference from 2005 to 2009.

In September 2012, he joined Prof. Fadi Kurdahi and Prof. Ahmed Eltawil's research group at UCI. His current research interests include digital VLSI design, studying variability in memory elements and design of resilient circuits.

## Efficient Error-Aware Power Management for Memory Dominated OFDM Systems

-Muhammad S. Khairy, Ahmed M. Eltawil and Fadi J. Kurdahi

With the growing share of embedded memories in terms of both area and power metrics in emerging wireless communication systems such as LTE and advanced WIFI, managing their power consumption will have a significant impact on system efficiency. While maintaining perfectly functional memories under all anticipated operating conditions, was both acceptable and achievable in older technologies, it is now becoming excessively difficult due to process variations which lead to excessive design margining. Recently, aggressive Voltage over-Scaling (VoS) has been proposed as an effective technique to significantly reduce power consumption. Reducing the supply voltage of the buffering memory through VoS results in controlled spatially uniform random errors. When the receiver experiences a high Signal to Noise Ratio (SNR), a power manager can utilize this SNR slack to reduce the power consumption via VoS on memories as long as an overall quality of service

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# PROJECT PROFILE cont.

## Efficient Error-Aware Power Management for Memory Dominated OFDM Systems (cont. from page 5)

(QoS) metric is achieved. However, to achieve this goal, a mathematical model that links the VoS induced errors and the system performance in terms of Packet Error Rate (PER) is necessary.

Fig. 1 shows a generic block diagram of an OFDM-based wireless communication system in which a smart power manager modulates the supply voltage of embedded buffering memory according to the wireless channel conditions. The main contributions of the projects are

- 1) With the existence of the VoS memories, the statistical model of the data distribution after each block in the OFDM system is derived.

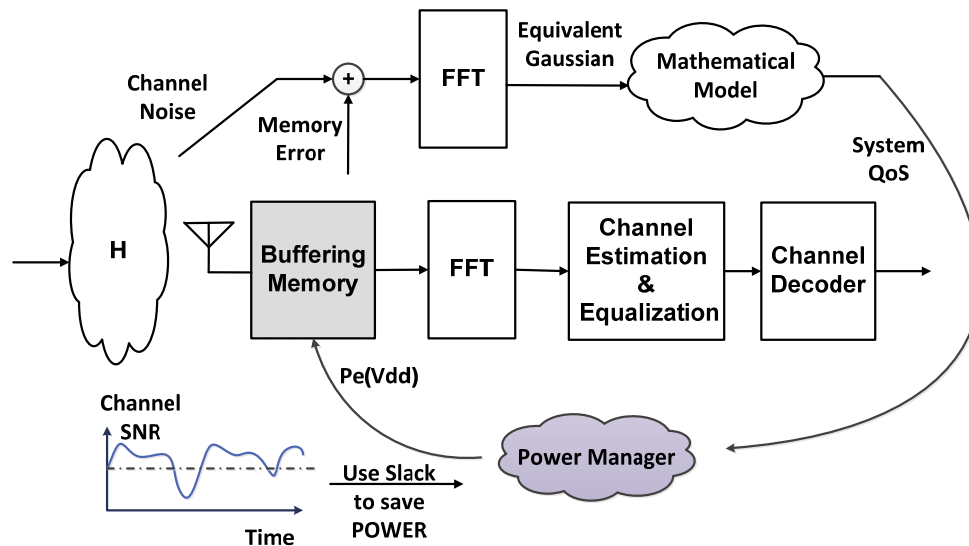


Figure 1: System block diagram

- 2) A framework that combines the channel noise and the buffering memory errors into an equivalent Gaussian is proposed.
- 3) Deriving a mathematical model of the Bit Error Rate (BER) and the Packet Error Rate (PER) based on that equivalent model.
- 4) Developing different power management techniques that controls the supply voltage of the buffering memory based on the proposed framework.

The problem of buffering memory power management is modeled as Markov Decision Process (MDP) with the goal of minimizing the power consumption under certain PER constraint  $P_o$ . Depending on the knowledge of system dynamics, two classes of memory power management techniques are employed. The Dynamic programming approach is leveraged when the wireless channel statistics are known while reinforcement learning techniques are used when the system dynamics are unknown or rapidly changing. Simulations results show that at high SNR 50% power savings in buffering memories is achieved with very small degradation in the system throughput.

# PUBLICATIONS

## Publications

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

### Author, Title, Publication

### Conference Proceedings

E. Hennigan, Ch. Kerschbaumer, P. Larsen, S. Brunthaler, and M. Franz; **"First-Class Labels: Using Information Flow to Debug Security Holes,"** in M. Huth, N. Asokan, S. Capkun, I. Flechais, and L. Coles-Kemp (Eds.), *The 6th International Conference on Trust & Trustworthy Computing (TRUST 2013)*, London, United Kingdom, June 17-19, 2013

Ch. Kerschbaumer, E. Hennigan, P. Larsen, S. Brunthaler, and M. Franz; **"Towards Precise and Efficient Information Flow Control in Web Browsers,"** in M. Huth, N. Asokan, S. Capkun, I. Flechais, and L. Coles-Kemp (Eds.), *The 6th International Conference on Trust & Trustworthy Computing (TRUST 2013)*, London, United Kingdom, June 17-19, 2013

Peyman Nazari, Byung-Kwan Chun, Vipul Kumar, Eric Middleton, Zheng Wang, Payam Heydari, **"A 130 nm CMOS Polar Quantizer for Cellular Applications,"** IEEE RFIC Symposium, Seattle, WA, USA, June 2-4, 2013

Jörg Henkel, Lar Bauer, Nikil Dutt, Puneet Gupta, Sani R. Nassif, Muhammad Shafique, Mehdi Baradaran Tahoori, Norbert Wehn, **"Reliable on-chip Systems in the Nano-era: Lessons Learnt and Future Trends,"** The 50<sup>th</sup> Annual Design Automation Conference (DAC), Austin, TX, USA, May 29-June 7, 2013, DAC 2013: 99

Abbas Rahimi, Luca Benini, Rajesh K. Gupta, **"Aging-Aware Compiler-Directed VLIW Assignment for GPU Architectures,"** The 50<sup>th</sup> Annual Design Automation Conference (DAC), Austin, TX, USA, May 29-June 7, 2013, DAC 2103: 16 (Best Paper Candidate)

Bailey Miller, Frank Vahid, Tony Givargis, **"Exploration with Upgradeable Models Using Statistical Methods for Physical Model Emulation,"** The 50<sup>th</sup> Annual Design Automation Conference (DAC), Austin, TX, USA, May 29-June 7, 2013, DAC 2013: 154

Hosseini Tajik, Houman Homaoun, Nikil Dutt, **"VAWOM: Temperature and Process Variation Aware Wearout Management in 3D Multicore Architecture,"** The 50<sup>th</sup> Annual Design Automation Conference (DAC), Austin, TX USA, May 29- June 7, 2013, DAC 2013: 178

Pietro Mercati, Andrea Bartolini, Francesco Paterna, Tajana Simunic Rosing, Luca Benini, **"Workload and User Experience-aware Dynamic Reliability Management in Multicore Processor,"** The 50<sup>th</sup> Annual Design Automation Conference (DAC), Austin, TX USA, May 29-June 7, 2013, DAC 2013:2

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# PUBLICATIONS

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

Rajib Nath, Raid Zuhair Ayoub, Tajana Simunic Rosing, **“Temperature Aware Thread Block Scheduling in GPGPUs,”** The 50<sup>th</sup> Annual Design Automation Conference (DAC), Austin, TX USA, May 29-June 7, 2013, DAC 2013: 177

Ian G. Harris, **“Capturing Assertions from Natural Language Descriptions,”** 1<sup>st</sup> International Workshop on Natural Language Analysis in Software Engineering (NaturaliSE), San Francisco, USA, May 25, 2013

Krzysztof Piotrowski and Steffen Peter, **“Sens4U: Wireless Sensor Network Applications for Environment Monitoring Made Easy,”** the 4<sup>th</sup> International Workshop on Software Engineering for Sensor Network Applications (SENSENA), May 21, 2013

Lichen Weng, Chen Liu, Jean-Luc Gaudiot, **“Scheduling Optimization in Multicore Multithreaded Microprocessors through Dynamic Modeling,”** Conference on Computing Frontier (CF), Ischia, Italy, May 14-16, 2013

Jed Kao-Tung Chang, Chen Liu, Jean-Luc Gaudiot, **“Hardware Acceleration for Cryptography Algorithms by Hotspot Detection,”** The 8<sup>th</sup> International Conference on Grid and Pervasive Computing (GPC), Seoul Korea, May 9-11, 2013

Yi Xiang, Sudeep Pasrich, **“Harvesting-aware Energy Management for Multicore Platforms with Hybrid Energy Storage,”** ACM Great Lakes Symposium on VLSI (GLSVLSI), Paris, France, May 2-4, 2013, GLSVLSI 2013:25-30

Arup De, Maya Gokhale, Rajesh Gupta, Steven Swanson, **“Minerva: Accelerating Data Analysis in Next-Generation SSDs,”** The 21<sup>st</sup> IEEE Annual International Symposium on Field-Programmable Custom Computing Machines (FCCM), Seattle, WA, USA, April 28-30, 2013, FCCM 2013: 9-16

A. Canedo, E. Schwarzenbach, M.A. Al Faruque, **“Context-sensitive Synthesis of Executable Functional Models of Cyber-Physical Systems,”** ACM/IEEE 4<sup>th</sup> International Conference on Cyber-Physical Systems (ICCPS’13), Philadelphia, USA, April 8-11, 2013

Steffen Peter, Frank Vahid, Daniel D. Gajski, Tony Givargis, **“A Ball Goes to School – Our Experiences from a CPS Design Experiment,”** The 1<sup>st</sup> Workshop on Cyber-Physical Systems Education (CPS-ED 2013), Philadelphia, USA, April 4, 2013

Jun Yong Shin, Nikil Dutt, Fadi J. Kurdahi, **“Vision-inspired Global Routing for Enhanced Performance and Reliability,”** International Symposium on Quality Electronic Design (ISQED), Santa Clara, CA, USA, March 4-6, 2013, ISQED 2013: 239-244

Ayhan Demiriz, Nader Bagherzadeh, Abdulaziz Alhussien, **“CPNoC: On Using Constraint Programming in Design of Network-on-Chip Architecture,”** The 21<sup>st</sup> Euromicro International Conference on Parallel, Distributed, and Network-Based Processing (PDP), Belfast, United Kingdom, February 27-March 1, 2013, PDP 2013: 486-493

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

Azadeh Eskanadri, Ahmad Khademzadeh, Nader Bagherzadeh, Majid Janidarmian, **"Quality of Service Optimization for Network-on-Chip Using Bandwidth-Constraint Mapping Algorithm,"** The 21<sup>st</sup> Euromicro International Conference on Parallel, Distributed, and Network-Based Processing (PDP), Belfast, United Kingdom, February 27-March 1, 2013, PDP 2013: 504-508

## Author, Title, Publication

## Journal Articles

Sehwan Kim and Pai Chou, **"Power Distribution in Locally Daisy-Chained Sensing Systems,"** ACM Transactions on Design Automation of Electronic Systems, 2013

Sehwan Kim, Marco Torbol, Pai Chou, **"Remote Structural Health Monitoring Systems for Next Generation SCADA,"** Smart Structures and System (11): 5, May 2013

Sehwan Kim and Pai Chou, **"Size and Topology Considerations for Supercapacitor-Based Micro-Solar Harvesters,"** IEEE Transactions on Power Electronics (TPEL) 28 (4): 2068-2080, April 2013

Chifeng Wang, Wen-Hsiang Hu, Nader Bagherzadeh, **"Scalable Load Balancing Congestion-aware Network-on-Chip Router Architecture,"** Journal of Computer and System Sciences 79(4): 421-439(2013)

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

Zi-Shun Huang, Ian G. Harris, **"Return-oriented Vulnerabilities in ARM Executables,"** IEEE Homeland Security Affairs Journal (HSAJ), 2013

Sen Zhou, Kwei-Jay Lin, **"Real-time Service Process Admission Control with Schedule Reorganization,"** Service Oriented Computing and Application 7(1): 3-14 (2013)

Shiji Pan, Leland Gilreath, Payam Heydari, Filippo Capolino, **"Investigation of a Wideband BiCMOS Fully On-chip W-Band Bowtie Slot Antenna,"** IEEE Antennas and Wireless Propagation Letters, May 2013

Chen Huang, Bailey Miller, Frank Vahid, Tony Givargis, **"Synthesis of Networks of Custom Processing Elements for Real-Time Physical System Emulation,"** ACM Transactions on Design Automation of Electronic Systems (TODAES) 18(2): 22-42, March 2013

Alberto Compagno, Mauro Conti, Paolo Gasti, Gene Tsudik, **"Poseidon: Mitigating Interest Flooding DDoS Attacks in Named Data Networking,"** The Computer Research Repository(CoRR) abs/1303.4823(2013)

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

Elsayed Ahmed, Ahmed Eltawil, Ashutosh Sabharwal, “**Rate Gain Region and Design Tradeoffs for Full-Duplex Wireless Communications**,” The Computer Research Repository (CoRR) abs/1303.1795, March 2013

Luis Angel D. Bathen, Yongjin Ahn, Sudeep Pasricha, Nikil D. Dutt, “**MultiMaKe: Chip-multiprocessor Driven Memory-aware Kernel Pipelining**,” ACM Transactions on Embedded Computer Systems (TECS) 12(1): 59, March 2013

Shervin Sharifi, Dilip Krishnaswamy, Tajana Simunic Rosing, “**PROMETHEUS: A Proactive Method for Thermal Management of Heterogeneous MPSoCs**,” IEEE Transactions on CAD of Integrated Circuits and Systems 32(7): 1110-1123 (2013)

Shaoshan Liu, Richard Neil Pittman, Alessandro Forin, Jean-Luc Gaudiot, “**Achieving Energy Efficiency through Runtime Partial Reconfiguration on Reconfigurable Systems**,” ACM Transactions on Embedded Computer Systems 12(3): 72(2013)

Abbas Banaiyanmofrad, Housman Homayoun, Vasileios Kontorinis, Dean Tullsen, Nikil Dutt, “**REMEDiate: A Scalable Fault-Tolerant Architecture for Low-Power NUCA Cache in Tiled CMPS**,” The International Green Computing Conference, Arlington, VA, USA, June 27-29, 2013

Muhammad Abdullah Adnan, Ryo Sugihara, Yan Ma, Rajesh Gupta, “**Energy-Optimized Dynamic Deferral of Workload for Capacity Provisioning in Data Centers**,” The International Green Computing Conference, Arlington, VA, USA, June 27-29, 2013

Baris Aksanli, Eddie Pettis, Tajana Simunic Rosing, “**Distributed Battery Control for Peak Power Shaving in Datacenter**,” The International Green Computing Conference, Arlington, VA, USA, June 27-29, 2013

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