

# **2013 IEEE Workshop on Signal Processing Systems**

**(SiPS 2013)**

**Taipei City, Taiwan  
16 – 18 October 2013**



**IEEE Catalog Number: CFP13SIG-POD  
ISBN: 978-1-4673-6236-8**

# 2013 IEEE Workshop on Signal Processing Systems SiPS 2013 Table of Contents

Message from the Conference Chairs.....	i
Message from the Technical Program Chairs .....	iii
Organizing Committee .....	v
Technical Program Committee .....	vi
Reviewers .....	viii
Keynotes.....	x

## **Lecture Session I: Optimization of Wireless Communication Signal Processing Systems**

### **L1-1**

<b>Parameterized Core Functional Dataflow Graphs and Their Application to Design and Implementation of Wireless Communication Systems.....</b>	<b>1</b>
<i>Lai-Huei Wang, Chung-Ching Shen, Shuvra Bhattacharyya</i>	

### **L1-2**

<b>Wireless Fading Communication System Performance Evaluations via SIRP and SDP Methods .....</b>	<b>7</b>
<i>Cheng-An Yang, Kung Yao, Ezio Biglieri</i>	

### **L1-3**

<b>A Polar-Based Demapper of 8PSK Demodulation for DVB-S2 System.....</b>	<b>13</b>
<i>Anthony Barre, Emmanuel Boutillon, Neysser Blas, Daniel Diaz</i>	

### **L1-4**

<b>Cracking the Complexity of Fixed-Point Refinement in Complex Wireless Systems.....</b>	<b>18</b>
<i>David Novo, Irene Tzimi, Ubaid Ahmad, Paolo Ienne, Francky Catthoor</i>	

## **Lecture Session II: Signal Processing for Communications**

### **L2-1**

**High-Resolution and Low-Cost Direction-of-Arrival Estimation by 2q-Root-Music Method..... 24**

*Yuta Shikagawa, Koichi Ichige*

### **L2-2**

**A Soft-Output Parallel Sack Algorithm for MIMO Detection ..... 30**

*Zhi Yue, Guanghui He, Jiangpeng Li, Jun Ma, Zhigang Mao*

### **L2-3**

**High Speed Decoding of Non-Binary Irregular LDPC Codes Using GPUs ..... 36**

*Moritz Beermann, Enrique Monzó, Laurent Schmalen, Peter Vary*

### **L2-4**

**Efficient Decision Feedback Blind Equalizer with Multi-Level Modulus Algorithm and Two-Stage Feedback Scheme for High-Order QAM Cable Receivers ..... 42**

*Li Chen, Chih-Peng Fan*

## **Lecture Session III: Signal processing for biomedical and image applications**

### **L3-1**

**A Pitch Based VAD Adopting Quasi-ANSI 1/3 Octave Filter Bank with 11.3 ms Latency for Monosyllable Hearing Aids ..... 48**

*Yi-Cheng Huang, Yi Fanchiang, Shyh-Jye Jou*

### **L3-2**

**A Digital Microfluidic Processor for Biomedical Applications ..... 54**

*Kelvin Yi-Tse Lai, Yu-Tao Yang, Gary Wang, Yi-Wen Lu, Chen-Yi Lee*

### **L3-3**

**Multi-Scale Image Compressed Sensing with Optimized Transmission ..... 59**

*Saheed Olanigan, Lei Cao*

### **L3-4**

**Edge Curve Scaling and Smoothing with Cubic Spline Interpolation for Image Upscaling ..... 65**

*Wei-Chen Wu, Tsun-Hsien Wang, Ching-Te Chiu*

## **Poster Session I: Communication Signal Processing Systems & Applications**

### **P1-1**

**Efficient Self-Correction Scheme for Static Non-Idealities in Nano-Scale Quadrature Digital RF Transmitters..... 71**

*Chunshu Li, Min Li, Mark Ingels, Xiaoqiang Zhang, Marian Verhelst, Sofie Pollin, Joris Van Driessche, Andre Bourdoux, Liesbet Van der Perre*

### **P1-2**

**Cuboid Array: a Novel 3-D Array Configuration for High Resolution 2-D DOA Estimation..... 77**

*Hiroki Moriya, Yuki Doi, Koichi Ichige, Hiroyuki Arai, Takahiro Hayashi, Hiromi Matsuno, Masayuki Nakano*

### **P1-3**

**Low-Cost Antenna Array via Antenna Switching for High Resolution 2-D DOA Estimation ..... 83**

*Yuki Doi, Hiroki Moriya, Koichi Ichige, Hiroyuki Arai, Takahiro Hayashi, Hiromi Matsuno, Masayuki Nakano*

### **P1-4**

**A Semi-Analytical Bivariate Gaussian Model of The Approximation Error Impact on The Min-Sum Ldpc Decoding Algorithm ..... 89**

*Nikos Kanistras, Vassilis Paliouras*

### **P1-5**

**Iterative Source-Channel Decoding Design Using Distortion Based Index Assignment and Joint Redundant Information..... 95**

*Chun-Feng Wu, Wei-Ho Chung*

### **P1-6**

**A Method for Using Sub-Nyquist Sampling for Ultra Low-Power Positioning Systems ..... 100**

*Tuba Ayhan, Wim Dehaene, Marian Verhelst*

### **P1-7**

**Designing a Low-Power Wireless Sensor Node RASIP Architecture ..... 106**

*Jan Wagner, Rainer Buchty, Christian Schubert, Mladen Berekovic*

### **P1-8**

**An Area and Energy Efficient Half-Row-Paralleled Layer LDPC Decoder for the 802.11ad Standard ..... 112**

*Meng Li, Frederik Naessens, Peter Debacker, Praveen Raghavan, Claude Desset, Min Li, Antoine Dejonghe, Liesbet Vander Perre*

**P1-9**

**High-Speed Conflict-Free Layered LDPC Decoder for the DVB-S2, -T2 and -C2 Standards..... 118**

*Cédric Marchand, Laura Conde-Canencia, Emmanuel Boutillon*

**P1-10**

**Design and Implementation of a High Throughput Soft Output MIMO Detector ..... 124**

*Yin-Tsung Hwang, Yi-Yo Chen*

**P1-11**

**An Efficient Compressive Wideband Spectrum Sensing Architecture for Cognitive Radios..... 130**

*Mohamed Shaban, Dmitri Perkins, Magdy Bayoumi*

**Lecture Session IV: VLSI/FPGA Based Design and Implementation of Signal Processing Systems**

**L4-1**

**A New VLSI Architecture for 3D-DCT Video Compression System..... 135**

*Jeoong Sung Park, Tokunbo Ogunfunmi*

**L4-2**

**High Performance Architecture for the Encoder of JPEG-Ls on SOPC Platform ..... 141**

*Lih-Jen Kau, Shih-Wei Lin*

**L4-3**

**A 40-NM 54-MW 3x-Real-Time VLSI Processor for 60-KWORD Continuous Speech Recognition .. 147**

*Guangji He, Yuki Miyamoto, Kumpei Matsuda, Shintaro Izumi, Hiroshi Kawaguchi,  
Masahiko Yoshimoto*

**L4-4**

**A New Dimension of Parallelism in Ultra High Throughput LDPC Decoding ..... 153**

*Philipp Schläfer, Norbert Wehn, Matthias Alles, Timo Lehnigk-Emden*

**L4-5**

**Inexpensive Correctly Rounded Floating-Point Division and Square Root with Input Scaling ..... 159**

*Timo Viitanen, Pekka Jääskeläinen, Jarmo Takala*

## **Lecture Session V: Multimedia System Design Flow and Applications**

### **L5-1**

**A Comparison of CABAC Throughput for HEVC/H.265 Vs. AVC/H.264 ..... 165**

*Vivienne Sze, Madhukar Budagavi*

### **L5-2**

**Algorithmic Complexity Analysis on Data Transfer Rate and Data Storage for Multidimensional Signal Processing..... 171**

*Gwo Giun Lee, Chun-Fu Chen, He-Yuan Lin*

### **L5-3**

**Partitioning and Optimization of High Level Stream Applications for Multi Clock Domain Architectures ..... 177**

*Simone Casale Brunet, Endri Bezati, Claudio Alberti, Marco Mattavelli, Edoardo Amaldi, Jorn Janneck*

### **L5-4**

**A Low-Power Video Recording System with H.264/AVC and Light-Weight Compression ..... 183**

*Hyun Kim, Chae Eun Rhee, Hyuk-Jae Lee*

## **Lecture Session VI: Design Methodology and Tools for Signal Processing Systems**

### **L6-1**

**Systematic Method to Convert Analog Filters to Digital Filters ..... 189**

*Alexandru Lodin, Lacrimioara Grama, Corneliu Rusu, Jarmo Takala*

### **L6-2**

**A Parallel Stochastic Computing System with Improved Accuracy..... 195**

*Lifeng Miao, Chaitali Chakrabarti*

### **L6-3**

**A Conflict-Free Memory Mapping Approach to Design Parallel Hardware Interleaver Architectures with Optimized Network and Controller..... 201**

*Aroua Briki, Cyrille Chavet, Philippe Coussy*

### **L6-4**

**Separable Beamforming for 3-D Synthetic Aperture Ultrasound Imaging..... 207**

*Ming Yang, Richard Sampson, Thomas Wenisch, Chaitali Chakrabarti*

## **Lecture Session VII: Software Based Design and Implementation of Signal Processing Systems**

### **L7-1**

**Soft-Core Stream Processor for Sliding Window Applications ..... 213**

*Peng Wang, John McAllister*

### **L7-2**

**Architecting an LTE Base Station with Graphics Processing Units ..... 219**

*Qi Zheng, Yajing Chen, Ronald Dreslinski, Chaitali Chakrabarti, Achilleas Anastasopoulos, Scott Mahlke, Trevor Mudge*

### **L7-3**

**Accelerating Motion Compensated Adaptive Color Doppler Engine on Cuda-Based GPU Platform ..... 225**

*I-Hsuan Lee, Yu-Hao Chen, Nai-Shan Huang, An-Yeu Wu*

### **L7-4**

**Programmable Implementation of Zero-Crossing Demodulator on an Application Specific Processor ..... 231**

*Amanullah Ghazi, Jani Boutellier, Jari Hannuksela, Shahriar Shahabuddin, Olli Silvén*

## **Poster Session II: Multimedia/Biomedical Signal Processing Application Systems**

### **P2-1**

**A Real-Time Processing Flow for ICA Based EEG Acquisition System with Eye Blink Artifact Elimination ..... 237**

*Kuan-Ju Huang, Jui-Chieh Liao, Wei-Yeh Shih, Chih-Wei Feng, Jui-Chung Chang, Chia-Ching Chou, Wai-Chi Fang*

### **P2-2**

**Fisblim: a Five-Step Blind Metric for Quality Assessment of Multiply Distorted Images..... 241**

*Ke Gu, Guangtao Zhai, Min Liu, Xiaokang Yang, Wenjun Zhang, Xianghui Sun, Wanhong Chen, Ying Zuo*

### **P2-3**

**Fast Prediction Unit Selection for HEVC Fractional Pel Motion Estimation Design ..... 469**

*Shiau-Yu Jou, Tian-Sheuan Chang*

### **P2-4**

**An Efficient Two Phase Image Interpolation Algorithm Based Upon Error Feedback Mechanism ..... 251**

*Sunil Jaiswal, Oscar Au, Juhi Bhadviya, Vinit Jakhethiya, Yuan Yuan, Anil Tiwari*

<b>P2-5</b>	
<b>Dynamic Programming Based Disparity Estimation Circuit Design for 3D Image System.....</b>	<b>256</b>
<i>Yu-Cheng Fan, Yan-Hong Jiang, Hung-Kuan Liu, Chieh-Lin Chen</i>	
<b>P2-6</b>	
<b>Evaluation of Different Audio Features for Musical Genre Classification .....</b>	<b>260</b>
<i>Babu Baniya, Deepak Ghimire, Joonwhoan Lee</i>	
<b>P2-7</b>	
<b>A New Image Quality Metric Based on Mix-Scale Transform .....</b>	<b>266</b>
<i>Min Liu, Guangtao Zhai, Ke Gu, Qi Xu, Xiaokang Yang, Xianghui Sun, Wanhong Chen, Ying Zuo</i>	
<b>P2-8</b>	
<b>A Gradient Intensity-Adapted Algorithm for the Fast Decision of H.264/AVC Intra-Prediction Modes .....</b>	<b>272</b>
<i>Lih-Jen Kau, Jia-Wei Leng</i>	
<b>P2-9</b>	
<b>Spatial-Cue-Based Multi-Band Binaural Noise Reduction for Hearing Aids.....</b>	<b>278</b>
<i>Cheng-Yen Yang, Wen-Sheng Chou, Kuo-Chiang Chang, Chih-Wei Liu, Tai-Shih Chi, Shyh-Jye Jou,</i>	
<b>P2-10</b>	
<b>A High Performance Foreground Detection Algorithm for Night Scenes.....</b>	<b>284</b>
<i>Tsung-Han Tsai, Chih-Chi Huang, Chen-Shuo Fan</i>	
<b>P2-11</b>	
<b>A New Method for Vehicle Detection Using MEXICANHAT Wavelet and Moment Invariants .....</b>	<b>289</b>
<i>Qian Tian, Tengfei Zhong, Hong Li</i>	
<b>P2-12</b>	
<b>Reversible Data Hiding Scheme with High Embedding Capacity Using Semi-Indicator- Free Strategy .....</b>	<b>295</b>
<i>Jiann-Der Lee, Yaw-Hwang Chiou, Jing-Ming Guo</i>	
<b>P2-13</b>	
<b>Enhancement of Speech Over Wireless Network Using Sinusoidal Modeling and Synthesis .....</b>	<b>301</b>
<i>Dhany Arifianto</i>	



## **Lecture Session VIII: Signal Processing to Rescue Moore's Law (I)**

### **L8-1**

**The SGC: a Simple Architecture for Gathering Statistics in Communication Links ..... 306**

*Andrew Bean, Andrew Singer*

### **L8-2**

**Error-Resilient Systems via Statistical Signal Processing ..... 312**

*Rami Abdallah, Naresh Shanbhag*

### **L8-3**

**Signal Processing Techniques for Reliability Improvement of Sub-20nm NAND Flash Memory .... 318**

*Dong-Hwan Lee, Jonghong Kim, Wonyong Sung*

### **L8-4**

**Signal Processing Challenges for Emerging Digital Intensive and Digitally Assisted Transceivers with Deeply Scaled Technology ..... 324**

*Min Li, Khaled Khalaf, Chunshu Li, Vidojkovi Vojkan, Mark Ingels, Andre Bourdoux, Piet Wambacq, Jan Craninckx, Liesbet Van Der Perre*

## **Lecture Session IX: Signal Processing to Rescue Moore's Law (II)**

### **L9-1**

**Hardware Specialization of Machine-Learning Kernels: Possibilities for Applications and Possibilities for the Platform Design Space ..... 330**

*Kyong Ho Lee, Zhuo Wang, Naveen Verma*

### **L9-2**

**Constructing Spare Sharing Networks for Reliability Enhancement of Scalable Systems ..... 336**

*Soroush Khaleghi, Wenjing Rao*

### **L9-3**

**ACO-Based Fault-Aware Routing Algorithm for Network-on-Chip Systems ..... 342**

*Chia-An Lin, Hsien-Kai Hsin, En-Jui Chang, An-Yeu Wu*

### **L9-4**

**Error Resilient MRF Message Passing Architecture for Stereo Matching ..... 348**

*Jungwook Choi, Eric P. Kim, Rob A. Rutenbar, Naresh Shanbhag*

## **Poster Session III: Optimization of Signal Processing Algorithms and Architectures**

### **P3-1**

**Application of Multi-COMPARATIONAL Algorithms to Classification of Acoustic Emission Signals Generated by Partial Discharges..... 354**  
*Tomasz Boczar, Dariusz Zmarzly, Sebastian Borucki, Andrzej Cichoń, Paweł Frączyk, Paweł Kurtasz*

### **P3-2**

**High-Performance Programs by Source-Level Merging of RVC-CAL Dataflow Actors..... 360**  
*Jani Boutellier, Amanullah Ghazi, Olli Silvén, Johan Ersfolk*

### **P3-3**

**Real Polynomial Form of Music for Uniform Linear Array ..... 366**  
*Xiang Cao, Jingmin Xin, Yoshifumi Nishio*

### **P3-4**

**A New Fast Satellite Selection Algorithm for BDS-GPS Receivers ..... 371**  
*Fanchen Meng, Bocheng Zhu, Shan Wang*

### **P3-5**

**Optimal Fixed-Point Fast Fourier Transform ..... 377**  
*Chun-Jen Wei, Shu-Min Liu, Sao-Jie Chen, Yu-Hen Hu*

### **P3-6**

**Optimal Data Allocation Algorithm for Loop-Centric Applications on Scratch-Pad Memories ..... 383**  
*Yibo Guo, Qingfeng Zhuge, Jun Zhang, Jingtong Hu, Edwin Sha*

### **P3-7**

**Bit Matrix Transpose with Tensor Product and Perfect Shuffling..... 389**  
*Jui-Chieh Lin, Yu Hen Hu*

### **P3-8**

**Memory Capacity Aware Non-Blocking Data Transfer on GPGPU..... 395**  
*Hao-Wei Liu, Hsien-Kai Kuo, Kuan-Ting Chen, Bo-Cheng Lai*

### **P3-9**

**Reliable Implementation of Linear Filters with Fixed-Point Arithmetic ..... 401**  
*Thibault Hilaire, Benoit Lopez*

### **P3-10**

**Partial Sums Generation Architecture for Successive Cancellation Decoding of Polar Codes..... 407**  
*Guillaume Berhault, Camille Leroux, Christophe Jégo, Dominique Dallet*

**P3-11**  
**Automated GATEWARE Discovery Using Open Firmware..... 413**  
*Shanly Rajan, Michael Inggs, Marc Welz*

**P3-12**  
**Closed-Form Design of Maximally Flat FIR Fractional Delay Filters Using Interlaced Sampling**  
**Method..... 419**  
*Peng-Hua Wang*

**Author Index..... 425**