

2016 IEEE International Workshop on Signal Processing Systems (SiPS 2016)

**Dallas, Texas, USA
26 – 28 October 2016**



**IEEE Catalog Number: CFP16SIG-POD
ISBN: 978-1-5090-3362-1**

**Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

******This publication is a representation of what appears in the IEEE Digital Libraries. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP16SIG-POD
ISBN (Print-On-Demand):	978-1-5090-3362-1
ISBN (Online):	978-1-5090-3361-4
ISSN:	1520-6130

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

2016 IEEE International Workshop on Signal Processing Systems

SiPS 2016

Table of Contents

Message from the Conference Chairs.....	xi
Organizing Committee.....	xii
Additional Reviewers.....	xiv

Session 1: Vision and Sensing

Hardware-Efficient Neighbor-Guided SGM Optical Flow for Low Power Vision Applications	1
<i>Jiang Xiang, Ziyun Li, Hun Seok Kim, and Chaitali Chakrabarti</i>	
Compressed Power Spectral Density Estimation via Group-Based Total Variation Minimization	7
<i>Jun Zhou, Zhongfeng Wang, and Sebastian Hoyos</i>	
Architecture and Implementation of a Simplified Locality Sensitive Hashed Signatures Based Fast Motion Estimation Algorithm	11
<i>Pavel Arnaudov and Tokunbo Ogunfunmi</i>	
Variation-Tolerant Architectures for Convolutional Neural Networks in the Near Threshold Voltage Regime	17
<i>Yingyan Lin, Sai Zhang, and Naresh R. Shanbhag</i>	

Session 2: Signal Processing Algorithms and Image Processing

TouchSpeaker, a Multi-Sensor Context-Aware Application for Mobile Devices	23
<i>Jona Beysens, Alessandro Chiumento, Sofie Pollin, and Min Li</i>	
Synthesis of Probability Theory Based on Molecular Computation	27
<i>Ziyuan Shen, Chuan Zhang, Lulu Ge, Yuchen Zhuang, Bo Yuan, and Xiaohu You</i>	

Low Complexity 3D Ultrasound Imaging Using Synthetic Aperture Sequential Beamforming	33
<i>Jian Zhou, Siyuan Wei, Richard Sampson, Ming Yang, Rungroj Jintamethasawat, Oliver D. Kripfgans, J. Brian Fowlkes, Thomas F. Wenzsch, and Chaitali Chakrabarti</i>	

Low Complexity Single Channel ICA Architecture Design Methodology for Pervasive Healthcare Applications	39
<i>Swati Bhardwaj, Adapa Bhagyaraja, R. Shashank, Pranit Jadhav, Dwaipayan Biswas, Amit Acharyya, and Ganesh R. Naik</i>	

Session 3: Low Power and Energy Efficient Design

Distributed Memory Allocation Technique for Synchronous Dataflow Graphs	45
<i>Karol Desnos, Maxime Pelcat, Jean-François Nezan, and Slaheddine Aridhi</i>	
Energy-Efficient Simultaneous Localization and Mapping via Compounded Approximate Computing	51
<i>Jinwook Oh, Jungwook Choi, Guilherme C. Januario, and Kailash Gopalakrishnan</i>	
An ASIC for Energy-Scalable, Low-Power Digital Ultrasound Beamforming	57
<i>Bonnie Lam, Michael Price, and Anantha P. Chandrakasan</i>	
Xor-Masking: A Novel Statistical Method for Instruction Read Energy Reduction in Contemporary SRAM Technologies	63
<i>Joonas Multanen, Timo Viitanen, Pekka Jääskeläinen, and Jarmo Takala</i>	

Posters I - Signal Processing Algorithms and VLSI

Rich Representation Spaces: Benefits in Digital Auscultation Signal Analysis	69
<i>Dimitra Emmanouilidou and Mounya Elhilali</i>	
In-Air Ultrasonic 3D-Touchscreen with Gesture Recognition Using Existing Hardware for Smart Devices	74
<i>Bert Van Dam, Yuri Murillo, Min Li, and Sofie Pollin</i>	
Improving the Performance of the Carrier Tracking Loop for GPS Receivers in Presence of Transient Errors due to PVT Variations	80
<i>Mohamed Mourad Hafidhi and Emmanuel Boutillon</i>	
Estimating Parameters of Multiple Damped Complex Sinusoids with Model Order Estimation	86
<i>Donna L. Kocherry, Shanglin Ye, and Elias Aboutanios</i>	
Reliable Fixed-Point Implementation of Linear Data-Flows	92
<i>Thibault Hilaire, Anastasia Volkova, and Maminionja Ravoson</i>	
Executing Dynamic Data Rate Actor Networks on OpenCL Platforms	98
<i>J. Boutellier and I. Hautala</i>	

MEMS Inertial Motion Sensing Watch for Measuring Walking and Running Activities	104
<i>F. Bardyn, M. Savary, S. Grassi, P.-A. Farine, B. Fasel, and K. Aminian</i>	
A Non-EEG Biosignals Dataset for Assessment and Visualization of Neurological Status	110
<i>Javad Birjandtalab, Diana Cogan, Mazyar Baran Pouyan, and Mehrdad Nourani</i>	

Session 4: Special Session - System Level Modeling and Design Methodologies

Energy Efficient Hybrid Precoding for Multi-User Massive MIMO Systems Using Low-Resolution ADCs	115
<i>Li-Feng Lin, Wei-Ho Chung, Hsin-Jung Chen, and Ta-Sung Lee</i>	
Models of Architecture: Reproducible Efficiency Evaluation for Signal Processing Systems	121
<i>Maxime Pelcat, Karol Desnos, Luca Maggiani, Yanzhou Liu, Julien Heulot, Jean-Francois Nezan, and Shuvra S. Bhattacharyya</i>	
Dataflow-Based Design of Coarse-Grained Reconfigurable Platforms	127
<i>Francesca Palumbo, Carlo Sau, Tiziana Fanni, Paolo Meloni, and Luigi Raffo</i>	
Deep Convolutional Neural Network on iOS Mobile Devices	130
<i>Chun-Fu (Richard) Chen, Gwo Giun (Chris) Lee, Vincent Sritapan, and Ching-Yung Lin</i>	
Power and Thermal Modeling for Communication Systems	136
<i>Marilyn Wolf, Shuvra Bhattacharyya, Jacques Florence, and Adrian E. Sapio</i>	

Session 5: Source and Channel Coding Systems

Pre-Sorted Forward-Backward NB-LDPC Check Node Architecture	142
<i>Hassan Harb, Cédric Marchand, Ali Al Ghouwayel, Laura Conde-Canencia, and Emmanuel Boutillon</i>	
An FPGA Emulation Platform for Polar Codes	148
<i>Chenrong Xiong, Yi Zhong, Chun Zhang, and Zhiyuan Yan</i>	
Beyond 100Gbps Encoder Design for Staircase Codes	154
<i>Guanghui Hu, Jin Sha, and Zhongfeng Wang</i>	
An Efficient Hardware Architecture for Lossless Data Compression in Data Center	159
<i>Zhisheng Wang, Jun Lin, and Zhongfeng Wang</i>	

Session 6: Communication Systems

Improving Sound Localization for Hearing Aid Devices Using Smartphone Assisted Technology	165
<i>Anshuman Ganguly, Chandan Reddy, Yiya Hao, and Issa Panahi</i>	
A Reconfigurable Memory PUF Based on Tristate Inverter Arrays	171
<i>Yijun Cui, Chenghua Wang, Weiqiang Liu, and Maire O'Neill</i>	
Sparse-Clustered Network with Selective Decoding for Internet Traffic Classification	177
<i>Scott Dickson Dagondon, Warren J. Gross, and Brett H. Meyer</i>	
Complexity Reduced Carrier Recovery Using Spread Spectrum for Low CNR Environment	183
<i>Tomohiro Arakawa and Nobukazu Doi</i>	

Session 7: DSP Architectures

Data-Canonic Real FFT Flow-Graphs for Composite Lengths	189
<i>Yingjie Lao and Keshab K. Parhi</i>	
New Identical Radix-2 ^k Fast Fourier Transform Algorithms	195
<i>Fahad Qureshi and Jarmo Takala</i>	
Hardware-Efficient Twiddle Factor Generator for Mixed Radix-2/3/4/5 FFTs	201
<i>Tomasz Patyk, Fahad Qureshi, and Jarmo Takala</i>	
Efficient Hardware Architecture for Compressed Sensing with DFT Sensing Matrix	207
<i>Junmei Yang, Chuan Zhang, Shi Jin, Chao-Kai Wen, and Xiaohu You</i>	

Posters II - DSP Architectures and Low Power Design

A Dual-Stage, Ultra-Low-Power Acoustic Event Detection System	213
<i>Yu Chen, Minchang Cho, Seokhyeon Jeong, David Blaauw, Dennis Sylvester, and Hun-Seok Kim</i>	
Design Kernel Exploration Using QBF-Based Boolean Matching	219
<i>Thomas B. Preußner and Fredo Erxleben</i>	
On the Narrowband Interference Cancellation Scheme in OFDM Communication Systems in Frequency Selective Fading Channels	224
<i>Il Han Kim, Tarkesh Pande, and Xiaolin Lu</i>	
FPGA-Based Low-Power Speech Recognition with Recurrent Neural Networks	230
<i>Minjae Lee, Kyuyeon Hwang, Jinhwan Park, Sungwook Choi, Sungho Shin, and Wonyong Sung</i>	

Efficient Hardware Architecture for Large Disparity Range Stereo Matching Based on Belief Propagation	236
<i>Sih-Sian Wu, Chen-Han Tsai, and Liang-Gee Chen</i>	
Gearbox Fault Diagnosis Using Power Spectral Analysis	242
<i>Mehrdad Heydarzadeh, Negin Madani, and Mehrdad Nourani</i>	
Improved Multiplierless Architecture for Header Detection in DVB-S2 Standard	248
<i>Héctor Miyashiro, Emmanuel Boutillon, Christian Roland, Joel Vilca, and Daniel Díaz</i>	
Efficient Emulation of Floating-Point Arithmetic on Fixed-Point SIMD Processors	254
<i>Lukas Gerlach, Guillermo Payá-Vayá, and Holger Blume</i>	

Session 8: Special Session - Design and Implementation of Massive MIMO Systems for 5G

Implementation of Low-Latency Signal Processing and Data Shuffling for TDD Massive MIMO Systems	260
<i>Steffen Malkowsky, Joao Vieira, Karl Nieman, Nikhil Kundargi, Ian Wong, Viktor Öwall, Ove Edfors, Fredrik Tufvesson, and Liang Liu</i>	
Serving 22 Users in Real-Time with a 128-Antenna Massive MIMO Testbed	266
<i>Paul Harris, Wael Boukley Hasan, Steffen Malkowsky, Joao Vieira, Siming Zhang, Mark Beach, Liang Liu, Evangelos Mellios, Andrew Nix, Simon Armour, Angela Doufexi, Karl Nieman, and Nikhil Kundargi</i>	
Steepest Descent Method Based Soft-Output Detection for Massive MIMO Uplink	273
<i>Ye Xue, Chuan Zhang, Shunqing Zhang, Zhizhen Wu, and Xiaohu You</i>	
Full Dimension MIMO (FD-MIMO) - Reduced Complexity System Design and Real-Time Implementation	279
<i>Gary Xu, Yang Li, Sridhar Rajagopal, Robert Monroe, Jin Yuan, Sudhir Ramakrishna, Young Han Nam, and Jianzhong (Charlie) Zhang</i>	

Session 9: Efficient Hardware Design

Efficient Rate Conversion Filtering on GPUs with Shared Memory Access Pattern Scrambling	285
<i>Mrugesh Gajjar and Ismayil Guracar</i>	
Resource-Aware Optimization of Modular, Cascade Detection Systems	291
<i>Long N. Le and Douglas L. Jones</i>	
Energy Efficient Ultrasonic Communication on Steel Pipes	297
<i>Sijung Yang and Andrew C. Singer</i>	

Low-Complexity, Sub-Band DPD with Sequential Learning: Novel Algorithms and WARPLab Implementation	303
<i>Chance Tarver, Mahmoud Abdelaziz, Lauri Anttila, Mikko Valkama, and Joseph R. Cavallaro</i>	

Session 10: Special Session - Stochastic Computing for Information Processing

Stochastic Computing Can Improve Upon Digital Spiking Neural Networks	309
<i>Sean C. Smithson, Kaushik Boga, Arash Ardakani, Brett H. Meyer, and Warren J. Gross</i>	
Stochastic BP Polar Decoding and Architecture with Efficient Re-Randomization and Directive Register	315
<i>Menghui Xu, Xiao Liang, Chuan Zhang, Zhizhen Wu, and Xiaohu You</i>	
Design Space Exploration for K-Nearest Neighbors Classification Using Stochastic Computing	321
<i>Dylan Cannisi and Bo Yuan</i>	
Computing RBF Kernel for SVM Classification Using Stochastic Logic	327
<i>Yin Liu and Keshab K. Parhi</i>	
Author Index	333