GUEST EDITORIAL

Introduction to the special issue on software defined radio: selected papers from the Wireless Innovations Forum's SDR'13-WinnComm

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This special issue contains extended articles of the selected papers from the research and development (R&D) track of the wireless innovation Forum's SDR'13-WinnComm conference on wireless communications technologies and software defined radio.

Established in 1996, the Wireless Innovation Forum™ is an non-profit "mutual benefit corporation" dedicated to advocating for the innovative use of spectrum, and advancing radio technologies that support essential or critical communications worldwide. Forum members bring a broad base of experience in software defined radio (SDR), cognitive radio (CR) and dynamic spectrum access (DSA) technologies in diverse markets and at all levels of the wireless value chain to address emerging wireless communications requirements through enhanced value, reduced total life cost of ownership, and accelerated deployment of standardized families of products, technologies, and services. The Forum acts as the premier venue for its members to collaborate to achieve these objectives, providing opportunities to network with customers, partners and competitors, educate decision makers, develop and expand markets and advance relevant technologies.

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The Technical Conference was first established in 2002 after a highly successful workshop held in 2001. Now attracting a broad range of delegates from over 20 different countries, the conference is the only event devoted to the advancement of reconfigurable radio technologies from research through deployment.

A unique feature of this conference is in providing opportunities to network from a broad mix of participants from all levels of the wireless value chain including investors, commercial network operators, radio manufacturers, system integrators, government procurement officials, regulators, technology providers, engineering service providers, and consultants. The academically focused papers are submitted to the R&D track of the conference. This year's paper topics included software defined radio implementations and architectures, communications signal processing, physical layer techniques, chip implementations, GPUs, FPGAs, processors, RF technologies, security, software systems, software communication architecture, spectrum sharing, cognitive radio, system implementation, and testing.

This special issue specifically highlights the selected R&D papers from the 2013 SDR'13-WinnComm conference. The extended papers were evaluated by world experts in software defined radio, cognitive radio, dynamic spectrum access, and communications system design.

This special issue contains 18 articles. A network simulation model framework for SDR is discussed by Sapello, Serban, Sethi, Chiang, and Moeltner. The framework takes into account time delays in the SDR processes and supports reconfiguration. The accuracy and scalability are evaluated in the paper. A hardware-accelerated design space exploration framework for communication systems is proposed by Kock, Hasselbarth, Pfitzner, and Blume. The framework combines high-level tools with system-on-chip template

mapped on an FPGA-based emulation system. The proposed framework is illustrated and verified with two case studies. Ozgul, Langer, Noguera, and Vissers present a design flow supporting partitioning on hardware and software components and compare different techniques for integrating such components. The authors use digital pre-distortion as an example and compare area/latency cost trade-offs and discuss energy savings on FPGA fabric.

DVB-T2 constellation demapping on GPUs is considered by Grönroos, Nybom, and Björkqvist as they investigate simplifications for demapping process for rotated QAM constellations. The experiments show that simplified demapper and LDPC decoder can share be same GPU. Bang, Ahn, Jin, Choi, Glossner, and Ahn describe an implementation of LTE system on an SDR Platform containing a GPU. The parallel resources of GPU are exploited in particular on turbo decoding. Experiments show that the implementation fulfills real-time requirements. Design of a vector processor for turbo decoding is discussed by Shahabuddin, Janhunen, Juntti, Ghazi, and Silvén. The authors have used the transport triggered architecture as a processor template and report the performance of a processor customized for max-log-MAP algorithm and synthesized on 90 nm IC technology.

A comparison of LTE channelizers is provided by Harris, Dick, Venosa, and Chen who analyze channelizers and show that recursive filters provide lower arithmetic complexity and group delay than FIR filters. Harris, Venosa, Chen, and Dick present a novel application of perfect reconstruction filter banks in 3GPP LTE and UMTS Radios. The analysis-synthesis chains have been optimized to maximize the performance with low arithmetic complexity in given applications. Detector implementations for 3G LTE downlink and uplink are discussed by Hänninen, Janhunen, and Juntti. They study programmable and configurable detector and QR decomposition implementations where the downlink transmission uses OFDM and the implementation is based on transport triggered architecture while uplink uses single-carrier FDMA and is implemented on FPGA.

Xie and Bose present an improvement for partial update Euclidean direction search algorithm for adaptive filtering. The proposed method provides significant reduction in computational complexity compared to full update methods. The steady-state performance has been verified with simulations and theoretical studies. Sinha, Balamuralidhar, and Bhujade propose a data communication on conventional audio interface of mobile devices by exploiting the frequency range of 16–20 kHz. The authors have built a prototype to show the potential of the proposed method.

Ankaralı, Şahin, and Arslan propose improving spectral efficiency of multicarrier schemes by allowing controlled overlapping of neighboring symbols in time and frequency. The method exploits user-specific filters, which have different tie-frequency characteristics. Coding-based ultra-wideband digital beamformer is discussed by Alwan, Balasubramanian, Atallah, LaRue, Sertel, Khalil, and Volakis. They propose a novel transceiver architecture for cognitive sensing, which uses onsite coding. The proposed solution reduces significantly the number of AD converters and I/O pins. Imana, Reed, and Yang propose a mechanism to control local oscillator and sampling frequencies in a receiver RF front-end to relax pre-selector filter selectivity requirements. The method allows improved reliability for receivers and it is suitable for agile applications such as dynamic spectrum access.

Secondary devices operating on TV white spaces are discussed by Almeida, Chaves, Vieira, and Iida. They propose the power level of secondary devices to be defined based on device location obtained from geo-location databases. The paper proposes three different strategies, which all ensure required protection without significant implementation costs. Adrat, Osten, Leduc, Antweiler, and Elders-Boll suggest hierarchical modulation to be used to add enhanced waveforms on top of legacy waveforms. The proposed approach allows additional bit budget for increased data rate and/or robustness. Amorim, Vieira, and Carvalho propose a coordinated power control mechanism, which allows resource sharing under interference constraints. The paper shows two approaches to improve the spectrum efficiency with a cost of interference margin. Waveform reconstruction from ontological descriptions is considered by Lechowicz and Kokar. They propose a novel method, which allows radios with different hardware and software architectures, different software APIs or non-uniform waveform descriptions, to interoperate. The authors have built a proof-of-concept system, which confirms the feasibility of the method.

As guest editors of this special issue, we sincerely thank the authors for their valuable contributions and all the anonymous reviewers for their feedback and help in ensuring a high level of quality. We also extend our appreciation to S. Shenbagam for his help on setting up this issue. We hope that you enjoy the special issue and find the articles informative and useful.

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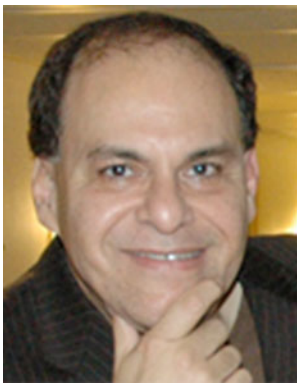
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