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GUEST EDITORIAL

COST Action IC0803 RF/microwave communication subsystems for emerging wireless technologies (RFCSET)

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RF/Microwave Communication Subsystems for Emerging Wireless Technologies (RFCSET addresses important topics related to the design, optimization, and application of modern RF/microwave subsystems by bringing together researchers with different backgrounds from microwave engineering and signal processing communities. It came into force in June 2008 within the European Cooperation in Science and Technology (COST) framework. Presently, a total of more than 40 institutions from academia and industry participate in RFCSET, originating from 20 COST European countries and three non-COST countries.

The research focus of the action is divided into three working groups: (a) WG1: Ultralow power and power efficient RF technologies, (b) WG2: Smart and reconfigurable RF radio transceivers, and (c) WG3: Design and optimization methods toward highly integrated terminals and efficient communication systems. The research activity in the first working group targets energy efficient systems, both in terms of reducing their overall power dissipation as well as improving their efficiency. Correspondingly, one can identify efforts toward extremely low power sensors and Radio Frequency Identification (RFIDs), and system and circuit architectures aiming to maximize the transmitter efficiency as well as to mitigate distortion due to circuit imperfections. The second working group directs efforts toward subsystems with multiple and reconfigurable functionalities. A characteristic example of the activities in this group includes RF design and signal processing efforts for software-defined radio. One can identify topics such as ultra-wideband (UWB) RF front-ends, and novel algorithms for interference rejection and adaptive functionality. Finally, the activity in the third working group aims at developing innovative and efficient CAD techniques for the analysis, design, and optimization of passive and active microwave and millimeter-wave circuits. Novel optimization techniques combining global optimization and convex analysis with electromagnetic (EM) simulation are also part of this working group (WG). Research efforts in this working group provide the foundation for efficient CAD methodologies for the circuits and systems that are the design objective of WG1 and WG2.

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This issue brings eight papers that are representative of the research lines of the action. They illustrate the diverse activities undertaken by the researchers of the action from hardware design to system simulation, and serve as an example to demonstrate the multi-disciplinary efforts that are required in order to address these problems.

The first paper presents an RF self-identification system for road-to-car communication. L. Roselli *et al.* describe the overall system design and focus on the design of the transmitting and receiving antennas. The proposed system has been adopted by many top Formula 1 racing teams as a lap trigger system used to reset the on-board electronics when the car crosses either the finishing line or the specific path reference point.

The next paper by Jan Kracek and Milos Mazanek presents a review of the principles of wireless power supply methods. The various methods are described including historical developments and they are compared in terms of efficiency, operating frequency, received power, and distance.

The next paper by Collado *et al.* deals with nonlinear analysis and design of a wideband distributed voltage controlled oscillator. Oscillators are fundamental components of modern transceivers and wide operating bandwidth is essential in order to maximize flexibility and adaptability of software radio transceivers and comply with a multitude of existing communication standards. The authors present for the first time a nonlinear analysis of a distributed voltage-controlled oscillator (VCO) and investigate the various solutions that are present in such architectures.

The following paper deals with system related optimization. Ali al-Sherbaz *et al.* propose a particle swarm optimization technique in order to adaptively control the performance of a Worldwide Interoperability for Microwave Access (WiMAX) radio system. The optimizer uses information such as signal-to-noise ratio, error rate, channel state, and carrier frequency offset in order to adapt the transmitted channel power and modulation order in order to minimize the error rate and maximize data throughput.

The next three papers deal with analysis and mitigation of distortion due to various impairments. Lauri Antilla *et al.* address the effects of impairments in direct conversion transmitters and propose an adaptive digital pre-distorter that jointly compensates amplitude and phase imbalance effects in the up-converter and distortion due to the power amplifier nonlinearity. The authors propose a learning strategy that efficiently tracks the time-varying characteristics of the front-end, is amenable to field-programmable gate array (FPGA) implementation and jointly addresses the major impairments typically present in a modern transmitter. The proposed technique can find applications especially in cellular base stations, broadcast transmitters, and other high-performance RF signal generators. Furthermore, Markus Allen *et al.* describe the various nonidealities present in analog-to-digital (A/D) converters and introduce a mathematical model based on Fourier analysis to accurately model zero-symmetric hard clipping. The authors then proceed to propose a post-processing method based on adaptive interference cancellation to mitigate distortion introduced from A/D converter nonidealities. Finally, Ville Syrjala *et al.* present a mathematical analysis of the effects of phase noise and sampling jitter in OFDM receivers whose effects can be distinguished into a multiplicative factor rotating the received signal constellation and intercarrier interference (ICI). The authors then present a method to estimate and mitigate the ICI term.

Finally, the last paper deals with the non-ideal and frequency-dependent behavior of the components of the UWB transmitter RF-front end. Pancera *et al.* consider optimization of the spectrum use by investigating the interaction between elements within an entire system, while emphasis is placed on the realization of the shaping filters required to make optimal use of bandwidth.

We would like to thank the authors that have contributed to this special issue, and also acknowledge the valuable work of the reviewers and their effort to maintain the high quality of the papers.

Apostolos Georgiadis received the B.S. degree in physics and the M.S. degree in telecommunications from the Aristotle University of Thessaloniki, Greece, in 1993 and 1996, respectively. He received the Ph.D. degree in electrical engineering from the University of Massachusetts, Amherst, in 2002. In 2007 he joined Centre Tecnologic de Telecomunicacions de Catalunya (CTTC), Spain, as a Senior Research Associate in the Communication Subsystems area, where he leads a research line in nonlinear microwave circuit design. His research interests include active antenna arrays, oscillators and coupled oscillator arrays, and energy harvesting techniques. He is involved in a number of technical program committees and serves as a reviewer for several journals including IEEE Transactions on Antennas and Propagation, and IEEE Transactions on Microwave Theory and Techniques. He is the Chairman of COST Action IC0803, RF/Microwave communication subsystems for emerging wireless technologies (RFCSET), and the Coordinator of Marie Curie Industry-Academia Pathways and Partnerships project Symbiotic Wireless Autonomous Powered system (SWAP).

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Karoly Kazi received the B.S. degree in electrical engineering from the Technical University of Budapest, Hungary in 1980. In 1980 he worked for the Research Institute for Technical Physics in Hungary where he performed research and modeling of parasitic effects of microwave semiconductor packages. In 1990 he was with Yogogawa Electric Co. Japan working on microwave circuit development. Since 1993 he is with Bonn Hungary Ltd., where he is now co-owner and Managing Director. His expertise is in microwave CAD design, microwave DROs, LNAs, mixers, wideband passive circuits, microwave vector I/Q receivers, and other circuits. He is involved in project coordination and in system design. He has received the President Award of the Hungarian Academy of Sciences, the Gold Prize of Young Inventors, and he is an Honorary Associate Professor at the Budapest University of Technology. He has authored/co-authored approximately 50 papers and publications and he holds 10 patents.

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