

## EDITORIAL PREFACE

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The *International Journal of Embedded and Real-Time Communication Systems* (IJERTCS) ends its fourth volume with three research articles on the topics of conformance testing, simulation based reliability analysis and wireless sensor network hardware. The journal has an interdisciplinary scope, binding together research from different disciplines with focus on how the disciplines converge to embedded and real-time systems for the communication application domain. The subject coverage of the journal is broad, which enables a clear presentation of how the research results presented in the journal benefit the convergence of embedded systems, real-time systems and communication systems. The journal is aimed to benefit scientists, researchers, industry professionals, educators and junior researchers like PhD students in the embedded systems and communication systems sector. An important aim is to provide the target audience with a forum to disseminate and obtain information on the most recent advances in embedded and real-time communication systems research: to give the readers the opportunity to take advantage of the research presented in the journal in their scientific, industrial or educational purposes.

The development of modern embedded and real-time communication systems is becoming more and more demanding. Users expect more and more features and functionality from their systems, while manufacturers and design teams

try to come up with systems that meet the users' demands while still keeping the manufacturing costs and times-to-market reasonable. In the core of these efforts is the need to have a streamlined and comprehensive process for specification, design, simulation and validation framework. Such a process, or methodology, is expected to provide a well-defined path from the product idea based on the users' needs and desires to a ready-to-use device like a smart phone with reliable and appropriate functionality, good and even fashionable user appeal and an attractive price. From the user's perspective, the embedded communication system is expected to support a large variety of different applications, communication technologies and standards, often in a hand-held device running on battery power. From the manufacturer's point of view, the problem is not trivial: first of all, all relevant standards need to be supported by the system, which causes design challenges for device size, power consumption and manufacturing price. Intelligent hardware design is not enough, but the software running on the device must also be intelligent in its decisions of selecting appropriate actions in different use scenarios like in switching from one communication standard to another, and in switching on and off the different communication subsystems to conserve battery power and increase stand-by time. Constantly developing improved and more efficient specification, modeling, design

and verification flows and methodologies is thus in the focal point of research targeted to help manufacturers meet consumer requirements within a sustainable development and manufacturing time and cost.

The difficult design constraints for embedded and real-time communication systems place great demands on forthcoming research in embedded and real-time communication systems. Research needs to target the challenges in future complex converged wireless systems by adventurous development and technological exploration, and experimentation with novel technologies, systems and system design methodologies. Key research areas in this respect are embedded system design, communication system design, system-wide security and hardware/software co-design, producing results that converge into novel technologies usable in future secure embedded communication systems. In this issue, the first two articles deal with conformance testing and simulation based reliability analysis, which are very important research topics in the area of embedded and real-time communication system design methodologies. The third article has an engineering and prototyping focus, which also are very important areas in the final stages of an embedded communication system design process.

In the first article of this issue, *Noureddine Adjir* (University of Moulay Tahar, Algeria), *Pierre de Saqui-Sannes* (University of Toulouse, France) and *Kamel Mustapha Rahmouni* (University of Oran, Algeria) study algorithms for testing real-time systems and present an approach for model-based black-box conformance testing of pre-emptive real-time systems. The authors use Labeled Prioritized Time Petri Nets with Stopwatches (LPrSwTPN) for modeling. The expectation is that these models not only specify system and environment interactions and time constraints, but they also enable modeling of suspend/resume operations in real-time systems. The authors propose an online testing technique that makes it possible to handle non-determinism and partly observable systems,

and ensures thoroughness through volume and brute-force. The authors are planning to implement the proposed approach in the TINA model analyzer, and to address other types of testing, in particular, robustness testing, in the near future.

The second article is written by *Afifa Gh-enai* and *Mohamed Benmohammed* from the LIRE Laboratory, Constantine II University, Algeria. The authors present an approach for embedded systems reliability analysis based on hybrid simulation. The authors indicate that the advantage of the proposed method comes from coupling of object-oriented stopwatch Petri nets (representing discrete dynamics and taking into account the suspension and resumption of tasks) and Java code (representing continuous dynamics) increases the level of detail for evaluating interactions between different objects of the system and also increases the number of feared scenarios that can be generated for evaluation. The authors illustrate their approach with an example in the embedded system domain, and conclude that the obtained results show that their hybrid approach that takes into account both the discrete and the continuous dynamics in the same formalism provides a realistic representation of the interactions between system components.

The third and last article of this issue is written by *Manivannan Doraipandian* and *Periasamy Neelamegam* from SASTRA University, India. In their engineering and case study oriented article, the authors discuss the important issue of processor selection for Wireless Sensor Network (WSN) nodes. Their objective is to increase the efficiency and provision of sensor nodes by identifying the relevant characteristics of their processing and transceiver units that would benefit from improvement. Based on the evaluations and a review of existing approaches, the authors present the development of sensor nodes based on LPC 2148 and LPC 2378 ARM processors and XBee series 2 units. The Arm processors are used as processing units and the Xbee unit is used for communication. The authors conclude

that although typically high flexibility is in conflict with low cost and small size, the node they propose is able to resolve these constraints.

As a journal in the focal point of computer science, computer engineering, telecommunication and communication engineering, the International Journal of Embedded and Real-Time Communication Systems (IJERTCS) is positioned well to provide its readership with interesting and well-focused articles based on recent high-quality research. The journal's coverage in topics from embedded systems, real-time systems, and communication system engineering, and especially how these disciplines interact in the field of embedded and real-time systems for communication, offers its readership both theoretical and practical research facilitating the convergence of embedded systems, real-time computing, and communication system technologies and paradigms. IJERTCS is aimed to benefit scientists, researchers, industry professionals, educators and junior researchers like PhD students in the embedded systems and communication systems sector. The journal aims to provide its target audience with a forum to disseminate and obtain information on the most recent advances in embedded and real-time communication systems research: to give the readers the opportunity to take advantage of the research presented in the journal in their scientific, industrial or educational purposes. IJERTCS publishes high-quality articles based

on recent important advancements in its research area, and aims for a fast turn-around time for submitted manuscripts.

This is the last editorial preface I will be writing as the Editor-in-Chief of IJERTCS. After five years as Editor-in-Chief (January 2009 - December 2013) I have decided that it is now time for me to move on towards other endeavors and challenges. I feel confident in leaving the responsible duty of running the journal into the hands of the next Editor-in-Chief. As the outgoing Editor-in-Chief, I wish to extend my sincerest thanks to all individuals who have contributed to the scientific content of the *International Journal of Embedded and Real-Time Communication Systems* (IJERTCS) during my five years as Editor-in-Chief: all contributing authors, all current and past members of IJERTCS editorial review board and all guest reviewers. It has been a pleasure and privilege to work with you in launching and establishing this journal. I also wish great success to the next Editor-in-Chief in the demanding duties of running the journal. Finally, I wish to thank all the contributors of this issue of IJERTCS, and I wish all readers an enjoyable and enlightening reading experience with the peer-reviewed research articles published in this issue.

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*Seppo Virtanen received his BSc in applied physics, MSc in electronics and information technology (1998), and DSc (Tech.) in communication systems (2004) from the University of Turku (Finland). Since 2009, he has been Adjunct Professor of Embedded Communication Systems at University of Turku. He was the first Editor-in-Chief of the International Journal of Embedded and Real-time Communication Systems (IGI Global), serving from 2009 to 2013. He is a senior member of the IEEE. His published academic research has been in the areas of hardware acceleration for protocol processing, protocol processor architectures, and hardware/software codesign methodologies for embedded communication systems. He has supervised more than 50 Master's theses to completion. In the past few years, his research interests have been focused on platforms capable of handling the processing of communication protocols, DSP routines, and software defined radio algorithms and applications in parallel on a parameterizable hardware platform, as well as information security and network security related topics especially in the embedded systems domain.*