ACTA IMEKO
ISSN: 2221-870X
September 2015, Volume 4, Number 3, 2 - 3

Introduction to the Special Issue on the 20th IMEKO TC-4 International Symposium and the 18th TC-4 Workshop on ADC and DAC Modelling and Testing

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Section: EDITORIAL

Citation: Ján Šaliga, Sergio Rapuano, Introduction to the Special Issue on the 20th IMEKO TC-4 International Symposium and the 18th TC-4 Workshop on ADC and DAC Modelling and Testing, Acta IMEKO, vol. 4, no. 3, article 1, September 2015, identifier: IMEKO-ACTA-04 (2015)-03-01

Editor: Paolo Carbone, University of Perugia, Italy

Received June 25, 2015; **In final form** June 25, 2015; **Published** June 2015

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The IMEKO Technical Committee number 4 on "Measurement of Electric Quantities" comprises researchers from all over the world dealing with Electrical and Electronic Measurements. Such research community meets annually at the TC-4 Symposia or the IMEKO World Congresses where the most recent original proposals and research results are presented and discussed in several oral and poster sessions focused on specific topics. After having been organized in many countries, from Bulgaria in 1990 to Barcelona in 2013, the TC-4 Symposium came back to Italy for the third time in its history. The 2014 edition of the Symposium and the 18th TC-4 Workshop on ADC and DAC Modelling and Testing, in fact, were held in Benevento, a historical town amid the southern Italy known for the significant memories of its glorious past and the beauty of its UNESCO World Heritage sites. The theme of 2014 was "Research on Electrical and Electronic Measurement for the Economic Upturn". Benevento is the site of a small and young but very dynamic University that hosted the TC-4 Symposium 2014, which, gathering more than 200 papers presented by researchers of all over the world, was one of the most successful ones. Among this relevant number of contributions, the board of TC-4 selected a few papers to be extended and submitted for the peer review of Acta IMEKO journal. In this Special Issue you can find the 11 articles that, according to the reviewers, were considered worthy of publication in this journal. The double selection of the TC-4 board and the journal reviewers provided a distillate of the most advanced scientific activity in this field. The papers included in the special issue represent a sample of the state of the art of the research on several topics associated with the measurement of electric quantities.

More in detail, the traditional research field of analog-to-digital converter (ADC) metrology is represented in this issue by two papers. The paper Reliable, accurate and scalable ADC test methods for standard software platforms, by Vilmos Pálfi, Tamás Viroztek, and István Kollár, presents some algorithms to overcome some problems arising from the application of the sinewave histogram test, a commonly used method to characterize nonlinear behaviour of ADCs. The paper Digital reconstruction stage for the FBD ΣΔ–based ADC in multistandard receiver: theoretical analysis and design, by Rihab Lahouli, Manel Ben-Romdhane, Chiheb Rebai and Dominique Dallet, presents the design of a digital reconstruction stage for a frequency band decomposition (FBD)-based ADC architecture for digitizing multistandard receiver signals.

Another research topic the TC-4 researchers are focused on is the time synchronization among instruments, always needed when a consistent result is requested from a distributed group of instruments or sensors. The paper Time coordination of standalone measurement instruments by synchronized triggering, by Francesco Lamonaca, Domenico Luca Carnì and Domenico Grimaldi, proposes a new architecture of hardware interface for the synchronous triggering of the measurement instruments in a distributed measurement system with the aim to avoid the effects of concurrent software processes, and to reduce the causes of delay in detecting the trigger condition. The paper Hybrid time synchronization for underwater sensor networks, by Oriol Pallares Valls, Pierre-Jean Bouvet and

Joaquin del Río, is focused on a particular but significant case of distributed measurement system. It presents a study of time synchronization problems over underwater sensor networks, taking into account the main communication challenges of the water channel and observing its behaviour in simulation and real tests.

The current measurement methods and instruments are a core business for TC-4 researchers. In the paper Setting up of a floating gate test bench in a low noise environment to measure very low tunneling currents, the authors Jérémy Postel-Pellerin, Gilles Micolau, Philippe Chiquet, Jeanne Melkonian, Guillaume Just, Daniel Boyer and Cyril Ginoux, propose a solution to measure very low tunneling currents in Non-Volatile Memories, based on the Floating-Gate technique. The proposed key factor is to carry out the measurements in an extremely low-noise environment that allows the authors to reach current levels lower than the ones obtained by direct measurements.

The nondestructive testing is a main research field in many areas, including telecommunications, electronics and manufacturing. The research results presented in the two following papers aim at easing the metrological characterization of conductive or superconductive elements by means of microwaves. In particular the paper Surface conductance and microwave scattering in semicontinuous gold films, by Jan Obrzut, presents techniques to study mechanisms of electromagnetic response of randomly structured metallic networks. The paper Broadband Corbino spectroscopy and stripline resonators to study the microwave properties of superconductors, by Marc Scheffler, Maximilian Felger, Markus Thiemann, Daniel Hafner, Katrin Schlegel, Martin Dressel, Konstantin Ilin, Michael Siegel, Silvia Seiro, Christoph Geibel and Frank Steglich, describes two different techniques to study superconductors at microwave frequencies: the broadband Corbino approach can be used on a very wide range of frequencies almost continuously but is limited to thin-film samples whereas the stripline resonators are sensitive enough to study low-loss single crystals but can provide results only at a set of discrete resonant frequencies.

The design and characterization of measurement transducers is another core activity of TC-4 researchers. Several papers were presented in this field during the Symposium. This issue includes two papers on this topic. The paper Estimation of stepping motor current from long distances through cable-length-adaptive piecewise affine virtual sensor, by Alberto Oliveri, Mark Butcher, Alessandro Masi and Marco Storace, proposes a piecewise affine virtual sensor, a function of past inputs and measured outputs of a system, for the estimation of the motor-side current of hybrid stepper motors, which actuate the LHC (Large Hadron Collider) collimators at CERN. The paper New generation of cage-type current shunts developed using model analysis, by Věra Nováková Zachovalová, Martin Šíra, Pavel Bednář and Stanislav Mašláň, presents a new type of ac/dc current shunt ranging from 30 mA to 10 A developed using a lumped circuit element model.

During the TC-4 Symposium 2014, several special sessions on interdisciplinary topics were organized gathering researchers from the more traditional TC-4 fields and quite diverse ones that are based on metrology or that are the base for a correct measurement. Legal metrology and software quality are two examples of such fields where metrology merges with and supports or is supported by different disciplines. The paper Painting authentication by means of a Biometric-Like approach, by Giuseppe Schirripa Spagnolo, Lorenzo Cozzella, Maurizio Caciotta, Roberto Colasanti and Gianluca Ferrari, for example, an innovative system based on smartphone acquisition and mobile application is proposed to verify artwork authenticity based on random intrinsic object characteristics. Software is an essential component of many measurement systems, while metrology concepts are the base of any method for evaluating the quality of software. The paper Some thoughts on quality models: evolution and perspectives, by Luigi Buglione, discusses from an evolutionary perspective what software quality has been, is and could be perceived and defined during next years, by a measurement perspective.

The Editors of this issue and the authors are grateful to all the colleagues and institutions that have made these contributions possible. A particular acknowledgement is due to all the TC-4 board members and the reviewers that with their efforts allowed the production of this Special Issue.

We sincerely hope that you will enjoy the reading of this Issue.