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Editorial for selected papers from the 2023 IMEKO TC4 International Conference

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Dear Readers,

The 26th International Measurement Confederation IMEKO TC4 Conference was held on September 20-21, 2023, in the beautiful Italian city of Pordenone. It was organized together with the industry-driven World Magnetic Conference at the COILTECH Italy trade show and was traditionally focused on promoting new ideas and trends. The Conference connected researchers, experts, and industry professionals from all around the world to discuss these ideas and trends in metrology, measurement, instrumentation, and sensors.

The number of presentations covering mainly fields of measurement of electrical quantities was nearly sixty. From all these papers, the Board of the TC4 sessions selected the papers for an extension into full papers potentially published in an ACTA IMEKO special issue. The Authors of the selected papers were invited to extend their papers and submit them for refereeing. By the end of the review process, seven papers were accepted.

The IMEKO TC4 Conference 2023 in Pordenone selected papers emphasize the event's commitment to advancing electrical measurement through innovation and collaboration with industry. They present innovative technologies and highlight the significance of interdisciplinary efforts and progress. The insights shared at the Conference will play a crucial role in shaping the future of electrical metrology, addressing the evolving challenges in modern measurement science.

Dragana Popovic Renella et al. [1] introduce a novel CMOS magnetic field sensor capable of simultaneously measuring all three magnetic field components at a single location. The sensor integrates three sets of mutually orthogonal Hall-effect elements for high spatial resolution. CMOS technology ensures precise angular accuracy and orthogonality. The sensor also employs a spinning-current technique to mitigate offset, low-frequency noise, and planar Hall Effect. With a wide analog bandwidth from DC to 300 kHz, the sensor is versatile for applications such as 3D positioning, proximity, current sensing, and magnetometry.

Marcin Wojciechowski et al. [2] report the measurement setups for electrical noise in the frequency range from 10 kHz to 100 MHz, focusing on semiconductor structures made of new Dirac materials, specifically 2D-COF/MOF intended for the construction of quantum Hall resistance standard (QHRS). The setups included a spectrum analyzer and a preamplifier, achieving an input noise value of approximately 1 nV/√Hz at 100 kHz with a preamplifier gain of 400 V/V. The overall noise figure of the measurement system was reduced to below 0.4 dB at higher frequencies, compared to around 7 dB for the spectrum analyzer alone.

Marco Coïsson et al. [3] discuss the importance of magnetic measurements in supporting European challenges in areas such as electric vehicles, healthcare, and clean energy. However, very few European National Metrology Institutes (NMIs) have the capabilities to perform traceable measurements of key magnetic quantities, which limits the adoption of new technologies and materials due to a lack of local metrological expertise. The TRaMM project (21SCP02) aims to transfer INRIM's (Italy) expertise in magnetic calibration and measurements to CEM (Spain) and NSAI (Ireland), addressing the gap and enabling better innovation in these critical fields.

Jan Sobotka et al. [4] introduce a modified electric vehicle architecture designed to facilitate rapid prototyping of software-driven features. The system allows control of the vehicle, acquisition of custom data, and communication with the driver via a REST API. This solution is implemented through hardware modifications to a production car, incorporating an Advantech

industrial computer to run the prototyped software. The approach provides a flexible platform for developing new vehicle functionalities and collecting scientific data.

Federico Filippi et al. [5] evaluate three methods for estimating Pulse Transit Time (PTT), peak-to-peak, tangent-secant, and cross-correlation, to assess arterial stiffness via Pulse Wave Velocity (PWV). The methods were tested using a novel arterial simulator capable of adjusting the stiffness of an arterial surrogate by varying transmural pressure. Results confirm the cross-correlation method as the most robust. Additionally, the simulator's effectiveness was validated.

Gabriele Bocchetta et al. [6], in their study, introduce a novel method to estimate the grasping force of a microgripper (MG) prototype designed for microscopic-scale applications, particularly in biomedical tissue manipulation. The MG, equipped with electrostatic rotary comb drives and Conjugate Surface Flexure Hinges, is analyzed using a combined experimental and finite element approach. The torque exerted by the microactuators is evaluated through image analysis of microscope-acquired video and numerical simulations of hinge stiffness. Experimental tests on human hair demonstrate the device's maximum grasping force.

Daniel Belega et al. [7] examine the accuracy of power system frequency measurements using two electronic instruments: a universal counter and a bench-top digital multimeter. The analysis covers both steady-state and dynamic conditions for synthesized and real-life signals. Additionally, the accuracy of rate-of-change of frequency estimates derived from measurements is evaluated. A comparison of the results presented leads to key observations and insights.

We would like to express our heartfelt thanks to all the Authors, Reviewers, and Attendees who made the Conference a great success. Special thanks to the local organizing committee in Pordenone and to SENIS Swiss and Coiltech Italy for their significant support and exceptional efforts. We hope that the research presented in this special issue will inspire ongoing innovation and collaboration in the field of measurement science.

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