



Introduction to the Acta IMEKO special issue on the 16th IMEKO TC10 conference “Testing, Diagnostics & Inspection as a comprehensive value chain for Quality & Safety”, 2019

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Distinguished Readers, the here presented issue of Acta IMEKO makes public in open access form the selected highlights of the 16th IMEKO TC10 Conference on “Testing, Diagnostics & Inspection as a comprehensive value chain for Quality & Safety” held in Berlin, Germany, on September 3-4, 2019. Publication authors from 14 countries contributed to the scientific excellence of the conference. As a result of the review process with highly committed referees, the best 7 papers were accepted for this issue as introduced in the next paragraphs.

Ciani et al. presented a Wireless Mesh Network to implement a widely distributed condition monitoring system for a wind farm. The aim of the presented work is to propose an architecture able to identify possible incipient failures in the most critical turbine’s components. An extract of the Reliability Centred Maintenance (RCM) for the wind turbine is proposed. Using this approach, maintenance and tasks policies are managed by the diagnostic mesh network. The paper suggests a group of measurement quantities and relative appropriate sensors to monitor the failure modes identified through the RCM. Finally, a warm standby architecture is designed for the root node, reliability with and without redundancy are compared in order to show the high increase of the reliability with the warm standby architecture. The proposed warm standby configuration activates the redundancy in case of failure guaranteeing, a probability of failure of the root node is lower than 0.01%.

The paper of *Catelani et al.* illustrates the different aspects of the maintenance policies, focusing on Maintainability Allocation (MA). This paper proposes as the optimal procedure the time-characteristics based MA technique because of it could weigh the influence of every item on the system parameters. Maintainability assessment during design stage represents one of the most

important phases to take structural decisions and select the best items to complete the mission. In particular, an electronic controller for railway signalling system has been studied for the objective Mean Time To Repair (MTTR). In the initial part of the study the objective is $MTTR_{sys} \in [1 h - 8 h]$ and the obtained result is $MTTR_{sys} = 4 h$. The comparison between the two cases highlights that increasing the objective MTTR the maintainability indices allocated to the items increase. Considering the most critical components a high objective MTTR provides a significant increase of the common repair time.

Martins et al. addresses the metrological quality of dimensional measurements based on images obtained from Close Circuit TeleVision (CCTV) inspections in drain and sewer systems. In this type of indirect visual inspection, a significant number of absolute and relative dimensional quantities can be quantified for the performance analysis of the drain and sewer systems outside buildings. Unfavourable environmental factors and conditions affect estimation of the quantities of interest and the quality of the recorded images (lighting, lack of reference points, geometric irregularities and subjective assessments, among others). This study contributes to improve the quality of the dimensional measurements by defining experimental procedures, applicable to the optical systems used in CCTV inspection. The paper describes the European normative framework for these inspection activities and proposes the metrological characterization of the optical systems used, as well as, to establish a traceability chain.

In the paper of *Paniti et al.*, the characterization of AlMn1Mg1 and Single Point Incremental Forming (SPIF) of the same material with 0.22 mm initial thickness have been conducted by

applying a Design of Experiments using L9 orthogonal array of Taguchi. Initial numerical simulations gave an unacceptable computing time in case of SPIF, but the Continuous Bending under Tension (CBT) simulations gave similar results for the examined foil as in other documented cases using thicker sheets. The monitoring of servo motor currents allowed the estimation of the forming forces and a new crack monitoring method based on light sensors was given too.

Lingitz and Sibn reported concepts to improve the quality of production plans using machine learning solutions. It was found that the reliability of the production plans and thus the planning quality (PQ) can drop down to 25% in the first three days after plan creation due to uncertainties, e.g. inaccurate or insufficient planning data. Production planners therefore use buffers in the form of inventories or extended transitional periods to create possibilities for implementing corrective measures. Buffers, however, lead to increased coordination and control effort and to negative effects, e.g. on inventory, throughput time and capacity utilization. Within a case study the authors demonstrate how machine learning can be used to predict cycle times. Furthermore, the increased accuracy compared to the current method is shown. Based on this, two approaches are presented, focusing on the reduction of gaps between master data and predicted data used during the production planning process.

Cipolletta et al. appointed that in order to enhance levels of security and reliability of power systems, allowing for advanced remote diagnostics, Merging Units (MUs) play a key role. Some of the benefits are a more efficient transmission of electricity and a better integration with renewable energy systems. In their paper an implementation of a Stand Alone Merging Unit (SAMU), compliant with the IEC 61850-9-2 standard and based on a low cost ARM microcontroller, is described. It acquires two signals, one voltage and one current, and it sends the samples over the Ethernet connection. The results from the metrological characterization of the SAMU are here presented, the system exhibits less than 0.02 % of error on the voltage measurement, less than 0.06 % on current and less than 0.08 % on power measurements.

The added value of harmonization and consistency of laboratories' accreditation to the development of the global market is appointed by *Ribeiro et al.* Accreditation plays a fundamental role in the economy on a fair trade basis and to achieve this objective, it is necessary to ensure that the application and assessment to the standard requirements of ISO/IEC 17025, which is the reference standard for Laboratory accreditation. The collaboration of the laboratory community for this purpose is necessary and the role of entities such as ILAC Laboratory Committee is particularly relevant. It is also known that "The conformity assessment community including accreditation bodies is a conservative community" what reinforces the importance and the need of the diagnosis provided by this survey. This approach has also enabled an independent evaluation of National Accreditation Bodies' performance as a way of supporting the evolution of accreditation.

The fields of the selected papers represent the great diversity and colourfulness of the *IMEKO TC10 Community* around the theme Testing, Diagnostics & Inspection that results in an exciting annual scientific conference series of our IMEKO confederation. For further details, please visit the TC10's website: <https://www.imeko.org/index.php/tc10-homepage>. We hope you will have a fruitful reading of this issue.

Zsolt János Viharos

Chair of IMEKO TC10 on Testing, Diagnostics & Inspection

Lorenzo Ciani

Guest Editors

Editorial to additional papers

Dear Reader, two additional papers are closing the first issue of Acta IMEKO in 2020.

The paper submitted by *Mikhalieva et al.* is to deal with the ability to determine and control the normalized concentrations using the experimentally obtained dependencies of the active and reactive constituents of conductivity in the wide frequency range on the composition of the multicomponent fluid and the impurity concentrations. A method for controlling the qualitative and quantitative composition in water (cooling liquids) is developed. It is based on the comparison of the measured and experimentally established active conductivity component. The developed electric method allows quantitative and qualitative estimation of the composition of the coolant on the contents of controlled components in the short time (up to 2 seconds) in a non-laboratory environment and to ensure uninterrupted operation of the equipment.

Yi Su et al. present investigation of the two methods, double weighing in air and hydrostatic weighing, for the determination of the volume of weights in the range from 5 kg down to 1 g. They present the mathematical equations of both methods and show that Monte-Carlo simulation is a suitable way to determine the measurement uncertainties and overcome the difficulties in dealing with correlated variables. It was found that the measurement uncertainties of the two methods are comparable and that double-weighing in air is an efficient method for determining the volume of weights below 1 kg.

Hope you will have an interesting and a fruitful reading of this issue of Acta IMEKO.

Dušan Agrež, Editor-in-Chief of Acta IMEKO