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Introductory notes for the Acta IMEKO fourth issue in 2025

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Dear Readers,

The fourth issue of Acta IMEKO for 2025 is now online and, as usual, this is the right moment to celebrate and reflect on the results achieved during the year.

Acta IMEKO is indexed in DOAJ, Scopus, and Web of Science, confirming its recognised standing within the international scientific community.

According to Scopus, Acta IMEKO is currently ranked in the second quartile (Q2) for the categories 'Electrical and Electronic Engineering' and 'Mechanical Engineering'. Although the journal is still in Q3 for other rankings, such as SCImago, this positive evolution clearly demonstrates that Acta IMEKO is steadily strengthening its bibliometric indicators, further attesting the high quality of the published papers.

These achievements are the result of the dedicated and coordinated efforts of the entire Acta IMEKO community. In recognition of the valuable contributions made by our Reviewers and Authors, we have therefore established an Award Committee composed of Dirk Röske, Leonardo Iannucci, Federico Tramarin, and Alessia Silvestri, and we are pleased to create the following awards: *Best Paper Award 2025* and *Outstanding Paper Award 2025*. The former recognises the best paper published in the Journal 'Acta IMEKO' in the years 2021-2024 and it is presented to the paper:

- "Digital Twin: a new perspective for cultural heritage management and fruition" authored by Francesco Gabellone, National Research Council, Institute of Nanotechnology, Lecce, Italy.

The *Outstanding Paper Award 2025* recognises the most impactful and influential papers published in Acta IMEKO between 2021 and 2024.

The award was determined exclusively on the basis of predefined bibliometric and editorial criteria, including the number of citations received and the evaluations provided by Reviewers and Section Editors. This award is therefore conferred on the following papers:

- "The use of image and laser scanner survey archives for cultural heritage 3D modelling and change analysis", authored by Gabriella Caroti, Isabel Martínez-Espejo Zaragoza, Andrea Piemonte;
- "Application of wearable EEG sensors for indoor thermal comfort measurements", authored by Silvia Angela Mansi, Ilaria Pigliautile, Camillo Porcaro, Anna Laura Pisello, Marco Arnesano;
- "From survey to semantic representation for cultural heritage: The 3D modelling of recurring architectural elements" authored by Valeria Croce, Gabriella Caroti, Andrea Piemonte, Marco Giorgio Bevilacqua;
- "An IoT measurement solution for continuous indoor environmental quality monitoring for buildings renovation" authored by Serena Serroni, Marco Arnesano, Luca Violini, Gian Marco Revel;
- "IoMT-based biomedical measurement systems for healthcare monitoring: A review", authored by Imran Ahmed, Eulalia Balestrieri, Francesco Lamonaca;
- "Indicators of reproducibility and suitability for assessing the quality of production services", authored by Oleksandr M. Vasilevskyi, Maryna Koval, Svetlana Kravets;
- "A comprehensive review of image super-resolution metrics: classical and AI-based approaches", authored by Mukhriddin Arabboev, Shohruh Begmatov, Mokhirjon Rikhsivoev, Khabibullo Kh Nosirov, Saidakmal Saydiakbarov;
- "An innovative correction method of wind speed for efficiency evaluation of wind turbines" authored by Alessio Carullo, Alessandro Ciocia, Gabriele Malgaroli, Filippo Spertino;

- "Comparative evaluation of three image analysis methods for angular displacement measurement in a MEMS microgripper prototype: A preliminary study", authored by Federica Vurchio, Giorgia Fiori, Andrea Scorza, Salvatore Andrea Sciuto;
- "Towards the development of a cyber-physical measurement system (CPMS): Case study of a bioinspired soft growing robot for remote measurement and monitoring applications" authored by Stanislao Grazioso, Annarita Tedesco, Mario Selvaggio, Stefano Debei, Sebastiano Chiodini.

Moreover, as already done in previous years, Acta IMEKO would like to acknowledge the valuable work of the reviewers, who check the quality of the submitted papers and support the activities of this Journal. In 2025, the *Best Reviewer Award* goes to Daniel Ramos Louzada. It is also my pleasure to announce the names of the *Top Reviewers* in 2025:

- Rodrigo Costa-Felix
- Carlos Hall
- Francesco Felicetti
- Ihtisham Ul Haq
- Marta Cecchitelli
- Alejandra Guerron
- Carmelo Scuro
- Gabriele Bocchetta
- Giorgia Fiori
- Jose Daniel Hernandez Vasquez.

As can be expected, given the large number of papers that Acta IMEKO has received and continues to receive, the identification of the awardees was a demanding process. I therefore extend my sincere thanks to the Committee for its dedicated and rigorous work, and I express the hope that it will be further strengthened through the inclusion of additional members in the coming years.

Finally, as the EiC, it is my pleasure to introduce the papers belonging to the general track.

In [1] the Authors present an optical system based on Infrared VCSEL Laser and NPN phototransistor. The output signal of each optoelectronic emitter-receiver couple is managed by a low-cost electronic circuit, which ensures high flexibility and the modularity of the various components of the system. At the end of the measurement chain, there is the Raspberry-Pi model 3B+. The aim of the work was to design a system able to monitor locomotor activity of small marine and freshwater animals: nudibranch Melibe viridis and cave decapod Typhlocaris salentina. The results showed that the optical system can detect the movement of small aquatic animals inside medium and large aquaria. From an ethological point of view, these results show that the device can be useful for monitoring the locomotor activity, including long-term monitoring needed to characterise the chronobiological parameters of these animals. This paper is in line with the UN-Goal 14, Life below water.

Construction techniques employed in historical buildings reflect the diversity of historical and cultural eras, constituting tangible evidence that must be preserved and transmitted. Their preservation requires a complete and detailed understanding of the materials used. Therefore, several investigation methodologies are used, carefully chosen in order to provide useful data for specific and effective restoration interventions, assuring minimal invasiveness. In Italy, diagnostic services in the construction and cultural heritage sectors are regulated by NTC 2018 (Technical Standard for Construction). These technical standards, along with UNI (Italian Standards Body) norms, describe several investigation techniques for the characterisation of construction materials. However, the described methodologies are not always applicable or suitable for specific purposes, particularly for the determination of the mechanical strength class of the masonry in historic and protected buildings.

In [2], the Authors present an alternative and valid methodology, focusing on the strength classification of the masonry in the medieval bell tower of the Cathedral of Melfi (Basilicata, Italy). The study includes chemical and physical analyses of mortars and stone bricks using laboratory micro-destructive techniques such as optical microscopy, X-ray diffraction and thermogravimetric analyses. The results evidence the validity of the micro-invasive scientific method, providing reliable data that are important for specific and effective restoration and maintenance interventions, without the need for highly invasive and destructive approaches. This paper is in line with the UN-Goal 11, Sustainable Cities and Communities and UN-Goal 9, Industry, Innovation and Infrastructure.

In recent years, the theme of technological evolution and digitalization has determined the construction of a different methodological research approach, which is based on the experimentation of innovative models to support the activities of survey, as well as structural and chemical analysis. The paper in [3] presents the results of an interdisciplinary work on the bell tower of the Melfi Cathedral (PZ, Italy), where integrated survey technologies and semantic analysis of architectural elements have been applied to develop advanced Heritage Building Information Modelling (HBIM) solutions. The HBIM model connects geometric and informational data through defined parameters, preventing data redundancy and fostering more conscious heritage management. Three-dimensional survey campaigns generated georeferenced point clouds, forming the basis for the digital twin of the structure. This data-driven approach also supports immersive storytelling. A virtual tour of the bell tower was created, structured around the HBIM model and its Level of Information (LOI). Elements with higher LOI are prioritised in the narrative for their historical and heritage value. This immersive experience enables visitors to explore the architectural spaces, while simultaneously accessing data about structural conditions, material analyses, and sampling results. The result is a comprehensive, informative, and engaging atlas that supports both public education and conservation planning. This paper is in line with the UN-Goal 11, Sustainable Cities and Communities and UN-Goal 9, Industry, Innovation and Infrastructure.

The work in [4] presents a novel result in signal processing theory, addressing the statistical properties of least squares estimation when fitting sinusoidal models to noise-corrupted data - a fundamental operation in numerous signal processing applications. The Author rigorously demonstrates the previously unrecognised estimation bias in the root mean square (RMS) of residuals when processing signals with additive Gaussian white noise, even when the sinusoidal frequency is known. The theoretical framework derives a closed-form expression for this bias. The analytical derivations are validated through comprehensive Monte Carlo simulations. The work in [4] contributes to current trends in robust signal parameter estimation, uncertainty quantification, and performance analysis of signal processing algorithms under non-ideal conditions, which is an essential consideration for applications in communications, radar, sonar, audio, biomedical signal processing, and measurement.

A method for quantifying total mercury (HgT) in sediment samples has been validated in [5] using a Direct Mercury Analyzer (DMA). The validation was carried out according to the Eurachem Guides and the International Union of Pure and Applied Chemistry (IUPAC) validation guidelines. Linearity, limit of detection (LOD), limit of quantification (LOQ), repeatability, intermediate precision, trueness, expanded uncertainty, robustness, and matrix effects were evaluated. Certified reference materials of channel sediment and collected sediment samples were used for the method validation. The linear range was from 83 to 4855 µg/kg, with a LOD of 27 µg/kg and a LOQ of 83 µg/kg. Repeatability was 1.7 %–2.6 % at two concentrations tested, and intermediate precision was between 0.2 % and 0.4 %. The robustness of the method was assessed using the Youden test, which demonstrated that variations in experimental factors did not significantly influence the results. Furthermore, no significant matrix effects were observed. A proficiency test was also performed, with satisfactory outcomes. The results demonstrate that the method is reliable and suitable for the quantification of HgT in sediment samples. This paper is in line with the UN-Goal 11, Sustainable Cities and Communities.

The study in [6] presents a validation protocol for the atomic emission spectroscopy (AES) method for determining total silicon in biomethane, developed in alignment with ISO 2613-1:2023. The work serves as a practical demonstration, contributing to the forthcoming ISO validation guide for analytical methods assessing impurities in biomethane, prepared within ISO/TC 193 WG 25: Biomethane. The protocol describes the complete analytical process: absorption of volatile siloxane compounds in mineral acid, chemical derivatization into a suitable form for spectroscopy, and measurement of the resulting liquid sample using an optical plasma emission instrument. Method development included optimisation of sampling, derivatization, sample preparation, and quality control procedures. Validation was carried out through rigorous evaluation of linearity, stability, robustness, selectivity, sensitivity, precision, bias, and measurement uncertainty. Results confirmed the method's reliability for detecting very low mass fractions of silicon (µg/kg range) originating from siloxane species, such as L2, L3, D4, and D5, in biomethane. By demonstrating both methodological robustness and practical applicability, this study provides a model example for ISO's upcoming guidance on validation of analytical methods, supporting the harmonisation of impurity testing in renewable gases. This paper is in line with the UN-Goal 9, Industry, Innovation and Infrastructure.

I hope you will enjoy your reading.

Francesco Lamonaca
Editor in Chief

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