ACTA IMEKO
ISSN: 2221-870X
March 2024, Volume 13, Number 1, 1 - 3

Introductory notes for the Acta IMEKO first issue in 2024

Francesco Lamonaca[1,2]

[1] *Department of Computer Science, Modeling, Electronics and Systems Engineering (DIMES), University of Calabria, Ponte P. Bucci, 87036, Arcavacata di Rende, Italy*
[2] *National Research Council of Italy, Institute of Nanotechnology (CNR-NANOTEC), Rende, Italy*

Section: EDITORIAL

Citation: F. Lamonaca, Introductory notes for the Acta IMEKO first issue in 2024, Acta IMEKO, vol. 13 (2024) no. 1, pp. 1-3. DOI: 10.21014/actaimeko.v13i1.1851

Received March 26, 2024; **In final form** March 28, 2024; **Published** March 2024

Corresponding author: Francesco Lamonaca, e-mail: editorinchief.actaimeko@hunmeko.org

Dear Readers,

A new year has begun, and many activities are planned to further improve the effectiveness of Acta IMEKO in serving our scientific Community of metrologists and scientists who use measurements daily for their research activities.

In this issue, you will find the second part of the papers related to the thematic issue concerning measurements for veterinary and animal sciences. These research activities are aimed at achieving some of the Sustainable Development Goals.

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. Although the presented research mainly concerns "zero hunger", "responsible consumption and production" and "climate action", the 17 SDGs are integrated - they recognize that actions in one area will affect outcomes in others, and that development must balance social, economic, and environmental sustainability [1].

The thematic issue organized together with Prof. Leopoldo Angrisani and Prof. Gianluca Neglia was highly attractive, with more than 30 papers. We hope that this issue will be an opportunity to stimulate metrological research in the veterinary and animal sciences sector with a broader international scope and facilitate networking among scientists globally to provide increasingly effective and sustainable solutions in this extremely relevant sector due to its immediate social impact.

This issue also contains papers not related to a specific theme, but also devoted to achieve the SDGs. As Editor-in-Chief, it is my pleasure to provide an overview of them.

The study presented in [2] aims to develop a laboratory method for the traceability of a rainfall weighing gauge, including an evaluation of the measurement uncertainty. The adopted procedure is similar to the one used for the non-automatic weighing instruments. A static approach is followed to achieve the calibration deviation of the precipitation scale. The method used to evaluate the measurement uncertainty is based on a nonlinear mathematical model. The Monte Carlo method is used to calculate uncertainties and validate estimates following the conventional Guide to the Expression of Uncertainty in Measurement (GUM) approach. Measurement uncertainty contributions of input quantities to the mathematical model used to calculate rainfall also require specific calibration procedures. Results show the accuracy level achievable with rainfall weighing gauges commonly used as a reference for meteorological monitoring networks and data modelling.

Continuous in-house measurement of gait of elderly people is relevant for health professionals. To be adopted by most, the system must be low-cost and non-intrusive. In [3], Authors present a solution for measuring the walking velocity based on a network of 4 electric potential sensors. With respect to Passive Infra-Red (PIR) sensors, electric potential sensors consume very little energy, they are inexpensive, and can be embedded and hidden in the home, which makes them less-intrusive. In their experiments, Authors also add PIR sensors used for comparative purposes. A temporary depth camera is used for training the model on walking velocity. Then a machine learning regression method is tested to reduce the uncertainty of the sensors. The results show that the electric potential sensors are suitable for the in-house measurement of walking speed of elderly people.

Nowadays, mitigating climate-altering emissions resulting from air conditioning and mechanical ventilation of indoor spaces is of utmost importance. Encouraging the adoption of renewable energy sources for power generation is a critical approach in this regard. Among the available technologies, photovoltaic technology stands as the most mature option. However, it does have limitations, such as reduced efficiency and performance degradation at elevated temperatures. To enhance the efficiency of photovoltaic systems, various solutions have been proposed over time, with significant research focusing on the exploration of new materials. One of the most promising solutions involves panel cooling through the utilization of

external fluids, either in a forced or natural manner. Furthermore, the extracted heat from this cooling process can be effectively reused in other industrial processes, increasing its appeal. Nonetheless, despite its potential, the application of panel cooling technology is relatively recent, and assessing its suitability in specific scenarios at an early stage can be challenging. Currently, there is a lack of clear and straightforward methodologies to evaluate the performance improvements achievable through the implementation of panel cooling. The primary objective of the research presented in [4] is to present an innovative methodology that can effectively assess panel cooling efficiency on an average daily-monthly basis. Specifically, Authors propose corrective parameters that modify the widely used Siegel method, which determines the monthly average daily efficiency of uncooled panels. Throughout the study, it has become evident that the input values derived from the UNI standard do not fully represent the real-world conditions. This finding may indicate the necessity for regulatory updates to accurately account for the practical operational environment.

Clove oil is an essential oil that has recently been used not only as a health or aromatherapy ingredient but is also widely used as an additive in fuel, especially for compression ignition engines. Essential oils are extracted through distillation from various parts of the clove tree, such as flowers, tree bark, leaves, and even fruit. The study presented in [5] aims to evaluate the combustion performance of a spark-ignition engine fuelled by gasoline and essential oil at a concentration of 5-20 % as a blend. The results show that increasing the essential oil content increases the fuel energy and indicative power, thereby increasing the thermal efficiency. However, the brake power will decrease because most of it is lost owing to heat transfer and friction; therefore, the mechanical efficiency decreases if the percentage of essential oil in gasoline increases. An evaluation of the gas emissions is also performed.

Image super-resolution is a process that aims to enhance the quality and resolution of images using various techniques and algorithms. The process aims to reconstruct a high-resolution image from a given low-resolution input. To determine the effectiveness of these algorithms, it's crucial to evaluate them using specific metrics. In [6], Authors take a closer look at the most commonly used image super-resolution metrics, including classical approaches like Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Peak Signal to Noise Ratio (PSNR), and Structural Similarity Index (SSIM). They also discuss advanced metrics like Learned Perceptual Image Patch Similarity (LPIPS), Fréchet Inception Distance (FID), Inception Score (IS), and Multi-Scale Structural Similarity Index (MS-SSIM). Furthermore, Authors provide an overview of classical and AI-based super-resolution techniques and methods. Finally, in the paper potential challenges and future research directions in the field are discussed.

The paper in [7] introduces a novel approach for multi-area state estimation in large transmission networks through the application of graph partitioning theory. By harnessing the eigenvalues and eigenvectors of the Laplacian matrix, a large-scale transmission network is partitioned into manageable sections. Within these partitions, state estimation processes run in parallel, markedly improving efficiency compared to conventional methods. The partitioning of the integrated network into multi areas has effectively mitigated computational loads, showcasing its potential for enhancing operational efficiency and reliability in complex power transmission systems. This approach not only offers a robust solution for state estimation but also represents a significant stride toward advancing the field of state estimation, promising to bolster the stability and performance of modern power grids.

The study in [8] presents a novel fault detection method in car gear steering systems, employing MSC Adams and MATLAB simulations to analyse angular acceleration from the outer tie rod. The approach closely mimics real accelerometer data to differentiate between normal and faulty conditions, including wear and obstacle navigation. Emphasis is on noise robustness, utilizing advanced noise injection and denoising techniques. The efficacy of wavelet scattering, discrete wavelet transform (DWT) methods, and classifiers like Support Vector Machines (SVM) and Neural Networks (NN) is extensively evaluated. The research highlights the importance of precise feature selection, employing techniques like Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), and Recursive Feature Elimination (RFE). This research significantly advances the reliability of autonomous driving systems and provides essential insights into fault detection in gear steering systems.

In [9] the new design of the Rockwell-Brinell-Vickers hardness standard machine developed also for Martens hardness in macro range (3 kgf – 150 kgf) and preliminary Martens hardness measurements are explained. TÜBİTAK UME Hardness Laboratory has been working on instrumentation in the field of hardness metrology since 2005 and three generations of hardness standardizing machines were developed since then, to be used as reference (calibration/standardizing) machines in Turkey. In former designs, conventional hardness methods such as Rockwell, Brinell and Vickers scales were the main scope of the projects. In the final Project that was supported and funded by TÜBİTAK UME to develop three hardness standard machines to be used as national standards for the conventional hardness scales mentioned, the Instrumented Indentation Test (IIT) was also addressed and some parameters like Martens hardness, creep, indentation hardness, (elastic and plastic) indentation work, etc. were also implemented onto the machines developed.

The iPhone's validity for measuring steps has been mainly investigated under laboratory conditions, while studies that include real-world conditions are still scarce. The Authors in [10] examined the validity of iPhones in measuring steps in real-world walking conditions, while using direct observation with video as reference. A sample of 100 adults who owned an iPhone 5S or higher was included and participants were randomly allocated to one of two protocols. Limits of Agreement (LoA), Mean Absolute Percentage Error (MAPE), linear-regression and Bland-Altman analyses were carried out. Protocol-1 includes straight-line and zigzag conditions, protocol-2 includes three 50-step conditions: an upward 5 % slope, a flat surface, and a downward -5% slope. The presented experimental results revealed that iPhone might be a reliable tool for monitoring walking in real-life conditions, however, downward slope seems to generate overestimation, which deserves future investigation.

I hope you will enjoy your reading.

Francesco Lamonaca
Editor in Chief

REFERENCES

[1] https://www.undp.org/sustainable-development-goals

[2] C. Simões, Á. S. Ribeiro, M. C. Almeida, D. Covas, L. Dias, G. Coelho, Validation of a laboratory method for the traceability of a rainfall weighing gauge, Acta IMEKO 13 (2024) 1, pp. 1-6. DOI: 10.21014/acta_imeko.v13i1.1322

[3] B. Pichon, E. Benoit, S. Perrin, A. Benoit, N. Berton, D. Coves, J. Cruvieux, Y. Faye, A low-cost machine learning process for gait measurement using an electrostatic sensors network, Acta IMEKO 13 (2024) 1, pp. 1-5. DOI: 10.21014/acta_imeko.v13i1.1323

[4] A. Rollo, V. Ferraro, P. Bevilacqua, Photovoltaic cooling techniques' effect on the average monthly performance, Acta IMEKO 13 (2024) 1, pp. 1-9. DOI: 10.21014/acta_imeko.v13i1.1660

[5] M. Paloboran, T. Atarezcha Pangruruk, M. Lamada, Zulhajji, H. H. Latang, S. Widodo, Performance evaluation of a spark ignition engine using gasoline and essential oil fuel blend, Acta IMEKO 13 (2024) 1, pp. 1-8. DOI: 10.21014/acta_imeko.v13i1.1687

[6] M. Arabboev, S. Begmatov, M. Rikhsivoev, K. Nosirov, S. Saydiakbarov, A comprehensive review of image super-resolution metrics: classical and AI-based approaches, Acta IMEKO 13 (2024) 1, pp. 1-8. DOI: 10.21014/acta_imeko.v13i1.1679

[7] B. Karim Sarmadi, A. Salehi Dobakhshari, A parallel approach for ultra-fast state estimation in large power system using graph partitioning theory, Acta IMEKO 13 (2024) 1, pp. 1-9. DOI: 10.21014/acta_imeko.v13i1.1704

[8] Y. Alaraji, S. Alp, An investigation into vibration analysis for detecting faults in vehicle steering outer tie-rod, Acta IMEKO 13 (2024) 1, pp. 1-9. DOI: 10.21014/acta_imeko.v13i1.1742

[9] C. Kuzu, K. Kazmanlı, Realization of Martens hardness method in macro range with high accuracy force and indentation depth, Acta IMEKO 13 (2024) 1, pp. 1-7. DOI: 10.21014/acta_imeko.v13i1.1750

[10] P. B. Júdice, J. Fouto, M. Horta, S. Pereira, Validity of iPhone health application step count in semi free-living conditions , Acta IMEKO 13 (2024) 1, pp. 1-7. DOI: 10.21014/acta_imeko.v13i1.1673