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Editorial
Special Section on "Power Quality in the Energy Transition: Selected Papers From ICHQP 2022"

ELECTRICAL power quality is a vital aspect when designing or assessing the operation of all modern power systems and forms an important part of the ongoing energy transition to more efficient and multi-vector systems. However, the ongoing proliferation and changing functionality of power electronic devices, coupled with new grid operating paradigms, such as renewable energy sources integration, microgrids, low-voltage dc distribution networks, and the large-scale integration of electric vehicles, present unique opportunities and challenges for grid operators the world over and require new assessment methods and fresh perspectives on the role of power quality.

In this context, this Special Section publishes a selection of technically extended versions of the best papers presented at the 20th edition of the International Conference on Harmonics and Quality of Power (ICHQP), which was held in Naples, Italy, from May 29 to June 1, 2022. Thus, its content is a collection of outstanding research on pressing topics in the power quality research area.

The selection of the eligible papers started from the recognition of the best 30 papers during the ICHQP paper review phase by the ICHQP International Technical Committee; then, a reduction to the final 20 invited papers was operated based on conference session chairperson's reports about the presentation quality and the level of audience interest of the 131 presented papers. Finally, submitted extended papers were peer-reviewed according to the journal's rules under the coordination of the guest editorial board and nine papers resulted in publishable quality for this Special Section.

The final selection of the papers covers an interesting but limited variety of power quality aspects with respect to the wider set presented at the Conference. This is the obvious consequence of the selection criteria based only on the papers' quality. Anyway, the covered topics range from unbalances and over/under voltages, voltage dips, and high impedance faults, to harmonic, interharmonic, and high-frequency distortion. The papers propose new models, new measuring and assessment methods, and countermeasures to reduce the impact of PQ problems. The scenario considered is always that of modern power systems in rapid transition towards a fully digital monitoring and control paradigm, in the presence of electric vehicles, photovoltaic plants, emerging electrical appliances, LED lamps, and new electronic or digital devices.

In what follows, a compact description of the content of each article fully identified in the references reported in the Appendix is given for the reader's convenience.

In [A1], the impact of electrical vehicle private charging stations on the quality of the Low Voltage supplying network is considered. The effects of residential and other charging stations located in parking lots of shopping malls or workplaces are evaluated. The main effect considered is the excessive voltage drop due to the simultaneity of such loads. A decentralized approach is proposed, based on a multi-agent system, to allow the different grid flexibility resources to act together to improve the voltage quality.

In [A2], the planning and operation of an intelligent power electronic series voltage regulator for PV-rich distribution feeders are analyzed. The results achieved with their application in electric distribution networks are shown with a real case study in the presence of a high penetration of photovoltaic-type renewable energy installations, which may cause the occurrence of excessive overvoltage or undervoltage.

In [A3], telephone interference from solar PV switching is considered. The article shows that in three-phase four-wire multi-point grounded MV systems, such as the ones used in the United States, the application of conventional grounding schemes to PV plants can lead to the unintended consequence of coupling high-frequency components to the grid through the neutral conductor and ground circuit. A novel setup is introduced to perform radiated measurements to assess the mechanism by which PV inverter switching frequencies are coupled with the grid.

In [A4], a new analytical model of single-phase diode bridge rectifiers in the presence of interharmonics in supply voltage is proposed. Its main and new characteristic is the ability to consider the presence of interharmonics in addition to harmonics in the background distortion. The proposed model presents all the advantages of analytical models (e.g., fastness); therefore, it can be easily

integrated with iterative harmonic and interharmonic analysis procedures.

In [A5], the adverse impact of harmonic and interharmonic supply voltage distortion on mass-market electrical appliances is analyzed. The immunity of twenty selected single-phase electrical appliances is evaluated. A comprehensive framework and a specially designed test procedure are employed to optimize the characterization of appliances with variable operating states and to ensure the reproducibility of results.

In [A6], a practical methodology is presented to improve the localization of the source of voltage dips in HV/MV interconnected grids. It takes advantage of synchronized dip data provided by power quality meters. Field data reporting events are used to validate the results obtained by the improved method and compared with the results of two alternative methods.

In [A7], measurement-based classification methods of LED lamps are considered. The authors observe that the applicability of the methods proposed in the literature may lead to a gap in knowledge needed for classification, which can be afforded using unsupervised machine learning (UML). Then, two UML methods are applied to a group of 21 LED lamps with active power consumption below 25 W, using electrical parameters and statistics proposed by four methods for classifying LED lamps based on traditional approaches.

In [A8], power symmetrical components are proposed as grid usage indicators for unbalanced prosumers. The authors show that current metrics of energy measurement and registration in three-phase revenue meters may fail in a fair charging for the distribution system used as an inherent phase-to-phase balancer. Alternatively, a positive sequence power/energy measurement-based metric is proposed and tested.

In [A9], a harmonic selection-based analysis for high impedance fault location using Stockwell Transform and Random Forest is proposed. The authors assess the potential of the considered approach when employed to locate high impedance faults in power distribution systems as an alternative to traditional fault location techniques that are inhibited from correctly functioning.

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APPENDIX: RELATED ARTICLES

[A1] G. Pisano et al., "Impact of electrical vehicle private charging stations on the quality of the low voltage network supply," *IEEE Open Access J. Power Energy*, vol. 10, pp. 351–362, 2023.

[A2] E. Ghiani, R. D. Gregorio, and S. Hoppert, "Planning and operation of an intelligent power electronics series voltage regulator for PV-Rich distribution feeders," *IEEE Open Access J. Power Energy*, vol. 10, pp. 363–372, 2023.

[A3] G. Singh, T. Cooke, J. Johns, L. Vega, A. Valdez, and G. Bull, "Telephone interference from solar PV switching," *IEEE Open Access J. Power Energy*, vol. 10, pp. 373–384, 2023.

[A4] J. Drapela, R. Langella, A. Testa, and V. Vendemia, "A new analytical model of single-phase diode bridge rectifiers in the presence of interharmonics in supply voltage," *IEEE Open Access J. Power Energy*, vol. 10, pp. 385–394, 2023.

[A5] V. Khokhlov, F. Moller, J. Meyer, and P. Schegner, "Adverse impact of harmonic and interharmonic supply voltage distortion on mass-market electrical appliances," *IEEE Open Access J. Power Energy*, vol. 10, pp. 395–405, 2023.

[A6] P. Castello, C. Muscas, P. A. Pegoraro, S. Sulis, J. Rens, and J. Van Zyl, "A practical solution for locating the source of voltage dips in HV/MV interconnected grids," *IEEE Open Access J. Power Energy*, vol. 10, pp. 406–414, 2023.

[A7] E. Gutierrez-Ballesteros, S. Rönnberg, and A. Gil-de-Castro, "Comparison of measurement-based classification methods of LED lamps," *IEEE Open Access J. Power and Energy*, vol. 10, pp. 415–425, 2023.

[A8] J. Klusacek, J. Drapela, and R. Langella, "Revenue metering of unbalanced prosumers in energy communities," *IEEE Open Access J. Power Energy*, vol. 10, pp. 426–437, 2023.

[A9] G. N. Lopes, T. S. Menezes, D. P. S. Gomes, and J. C. M. Vieira, "High impedance fault location methods: Review and harmonic selection-based analysis," *IEEE Open Access J. Power Energy*, vol. 10, pp. 438–449, 2023.