EXECUTIVE SUMMARY

Session 2 – Power Quality and Safety

SUMMARY

This conference 92 papers have been selected by Session 2 for the conference. Of these contributions, 29 have been presented in main sessions and RIF and 90 as posters. The focus of the session were the developments in Power Quality driven by energy transition and digitalisation, as well as advances in earthing and EMC. Especially the interest in EMC including immunity, earthing and safety has considerably increased. Three round tables dedicated to the energy transition arose great interest and generated intense discussions. The paper " Identification of Tree-Related High-Impedance Faults Using BiLSTM Model " (paper 677) by Chunlan Yang received the BYAA of Session 2.

MAIN SESSION 2 - BLOCK 1

Electromagnetic Compatibility, earthing and safety

This conference the session had a strong focus on earthing system measurement, modelling and simulation. Validation of safety measures and criteria for global earthing systems had been discussed. Furthermore, electrical phenomena associated with vegetation in contact with medium voltage conductors and the application of machine learning to identify them have been presented. At the end of the block the key findings of the 4th EMI study report prepared by CENELEC TC219/WG11 on electromagnetic interference in the frequency range 2 kHz to 500 kHz have been presented.

MAIN SESSION 2 - BLOCK 2

Equipment-related Power Quality aspects

Block 2 focusses on the contributions related to the impact of new technologies, including control systems and their effects on the grid quality. Highlights of this conference were contributions to hosting capacity of low carbon technologies (LCT), grid impact of the integration of renewables, harmonic interactions and propagation in LV grids as well as island operations as a future solution.

MAIN SESSION 3 - BLOCK 3

System-related Power Quality aspects

In this conference a dominating share of papers is related to measurement methods, in particular for the frequency range 2-150 kHz. This included a discussion on CISPR quasi-peak as metric for evaluating power line communications and the high-frequency transfer characteristics of low power voltage transformers. Challenges of the increasing share of power electronics are addressed in presentations on small signal stability in MVAC networks with high share of grid following converters and DC microgrids as well as the increase of PV hosting capacity by network balancing in the context of a case study from Belgium. Furthermore, a method for the aggregation of harmonic emission characteristics of power electronics has been presented.

MAIN SESSION 4 - BLOCK 4

Standards, regulation, monitoring and advanced data analysis

This block focussed on new approaches in standards and regulation, monitoring as well as advanced data analysis. Highlights of this conference were presentation covering the following topics: Monitoring harmonic voltage and current levels using smart meters, emission limit allocation between networks, comparison of calculating harmonic emission limits in US and Europe, rapid voltage changes and their evaluation in IEC TR 61000-3-7 and EN 50160, as well as methods to assess the minimum number of measurement sites for PQ evaluation in MV networks.

ROUND TABLE 7

Power Quality Challenges in Networks with 100% Inverter-Based Resources

Round Table 7 discussed Power Quality challenges as well as specific needs for EMC coordination in PE-based networks from different views including network operators, EMC standardization, manufacturers and academia. The RT was chaired by Jan Meyer from TUD Dresden University of Technology (Germany). With panellists from system operators, research institutes, and standardisation bodies a common understanding of the challenges and how to address them for the effective management of network disturbances and EMC in PE-based distribution networks of the future has been developed.

ROUND TABLE 9

Industry experiences with Power Quality requirements in the process of connecting large customer installations

Round Table 9 focused on industry experiences with Power Quality requirements for the grid integration of large customer installations. The RT was chaired by Mark Halpin from Auburn University (USA). The panellists included speakers from network operators, academia and manufacturers. Case studies for the planning and commissioning of large installations were discussed with respect to general Power Quality limits and specific agreements between customer, manufacturer and network operators. Questions of responsibility in case of amplification of background distortion was heavily discussed. It became clear that the TSOs and DSOs are seen as responsible for many aspects regarding the management of Power Quality by all parties.

ROUND TABLE 11

Power Quality experiences due to the massive integration of e-mobility

Round Table 11 was focused on the rapid integration of e-mobility, which is noticeably impacting power systems and bringing challenges to Power Quality related issues. The RT was chaired by Jan Desmet, professor at Ghent University (Belgium) with panellists from the e-mobility sector. EV-charging introduces a lot of issues going from harmonic distortions over voltage fluctuations until unbalance. Next to that, fast charging stations cause sudden power demand spikes, impacting grid stability. Both voltage dips and overvoltages can occur during high-power charging sessions. Transformer overheating and increased losses are common concerns. Bidirectional charging (V2G) adds complexity by reinjecting power into the grid. Grid reinforcement and smart charging strategies are essential for mitigation. Addressing these challenges ensures a stable and efficient power system for the e-mobility era. The discussion with panellists and audience has been very lively.

RESEARCH & INNOVATION FORUM

Recent trends in the characterization of emission and impedance in the frequency range 2-500 kHz

The RIF included five presentations on the current research on emission and impedance in the frequency range 2-500 kHz. The topics included efficient computation and measurement techniques. Moreover, the impact of grid topology on the network access impedance and approximation of the network impedance for the definition of current emission limits for customer installations connected to LV networks has been discussed.

POSTER TOURS

This conference four interactive poster tours have been conducted. Each of the poster tours has covered on block of the session and draw a lot of interest including discussion with the authors.

CONCLUSIONS

Overall, the session had very good attendance and generated fruitful discussion with the audience. Live questions and Q&R were both used very actively by the participants. Over the last conferences the attendance of the Round Tables has increased in comparison to the main session. This conference this may have been partly due to the main session being on the last day of the conference.