EXECUTIVE SUMMARY
Session 2 – Power Quality and Electromagnetic Compatibility

SUMMARY
In Session 2 140 papers have been submitted. During the main session and the RIF 30 papers have been presented. The papers reflected the major recent developments in the area of Power Quality (PQ) and EMC. The massive increase of inverter-based loads and generation results in new phenomena and interactions. Digitalisation and big data have a huge influence in the field of PQ, namely with regard to the intelligent and automatic analysis and use of this information in distribution network planning and operation.

MAIN SESSION 2 - BLOCK 1
Electric and magnetic fields, grounding, transients and immunity of systems
In this block EMF exposure and mitigation measures by active and passive shielding, earth fault current measurement and earthing design, interference and immunity of systems were covered. The presentations included testing requirements of EMF directive 2013/35/EU, a new concept for the measurement of earth potential rise on live MV systems, introduction of risk for earthing design, optimization of magnetic field shielding of a building using active and passive methods, analysis of the harmonic performance of voltage transformers and the immunity assessment of household appliances in the frequency range from 2-150kHz. The block was visited by more than 75 delegates. There was a good discussion with direct questions from the audience.

MAIN SESSION 2 - BLOCK 2
Power Quality issues of new technologies
In this block PQ issues related to new technologies, like renewables (mainly PV), electric vehicles, LEDs and storage were presented, starting with the impact of fast charging stations on grid quality followed by PQ assessment for AC/DC hybrid networks and overvoltage due to single-phase and three-phase connected PV. Next, PQ improvement in a rural grid by grid storage systems and modelling of harmonics (up to 150kHz) produced by Compact Fluorescent Lamps were discussed. The session was closed with the presentation of Vineetha Ravindran, who received the Best Young Paper Award of Session 2. Her presentation included the characterization of Interactions between PV systems and energy efficient lighting (LED) in a mixed installation. More than 150 attendees visited this block. The interest of the audience was high, with a large number of questions, both from the audience and via the Q/A App with an average of 6 questions per presentation. Particularly, PQ issues with the use of local storage received a lot of attention.

MAIN SESSION 2 - BLOCK 3
Power Quality simulations, system studies, measurement and mitigation
This block covered simulation-/measurement-based studies of different PQ phenomena, mainly regarding harmonics, methods and devices for mitigation purposes, different aspects of instrumentation and advanced methods for data analysis based on artificial intelligence. Three studies about harmonic and supraharmonic summation and propagation have been presented along with one paper on a mitigation device for unbalance in low voltage networks and two papers on the application of artificial intelligence and machine learning on large amounts of data to detect incipient faults and to identify voltage dips. This block was visited by more than 80 attendees. The interest of the audience was high, reflected by a large number of questions, both from the audience and via the Q/A App and further individual discussions after the end..

MAIN SESSION 2 - BLOCK 4
Quality of supply, monitoring and Big Data analysis, standards and regulatory issues
This block covered monitoring campaigns related to harmonics and harmonic network impedance, applications of PQ monitoring and the use of big data analysis, process immunity assessment and the review of standards. Two presentations dealt with measurement campaigns of PQ in low voltage systems and network impedance in the frequency range 2-9 kHz in public low voltage networks. Two studies covered the utilization of big data for real-time monitoring and data analytics in a pilot smart grid project and the calculation of process immunity time for voltage dips. The need to review the standards for harmonic emission limits of modern mass-market equipment and the need for integral limits for non-intentional emissions in the supraharmonic frequency range have been presented. This block was visited by 50 attendees. The audience participated actively in direct discussions and the Q/A App.

ROUND TABLE 7

PQ-phenomena related to New Technologies (Results of CIGRE/CIRED Working Group C4.24)

Speakers: Jos Knockaert, Math Bollen, Sjef Cobben, Sharmistha Bhattacharyya, and Ana Maria Blanco Castaneda (Sasa Z. Djokic could not attend and was represented by Jan Desmet)

In this round table a summary of the recently published recommendations given by the joint working group CIGRE C4.24/CIRED with respect to PQ aspects in future distribution networks was discussed. The above mentioned group of seven experts presented these recommendations from their point of view, with particular emphasis on the impact of new technologies. 70 delegates attended the RT. There were no direct questions out of the audience, however, the Q/A App was well used with 5 major questions. These questions were always answered and discussed by at least 2 members of the panel.

ROUND TABLE 9

How much is too much? Present experiences and future challenges for large-scale Power Quality monitoring

Speakers: Tongxun Wang, Sarath Perera, Michael Schwenke, Friedrich Kupzog and Johannes Ferstl

This round table presented experiences of existing PQ monitoring campaigns in Australia, China and Austria as well as the challenges of a manufacturer of PQ instruments. The experts presented the challenges from the perspectives of network operator, regulator, instrument manufacturer and research institute, which provided a very good basis for the about 30 minutes of discussion. Special interest of the audience was related to the accuracy of instrument transformers, reliable operation of monitoring systems, efficient data analysis to obtain useful and valuable information. 70 delegates attended. Discussion was very lively both from the audience and the Q/A App.

ROUND TABLE 11

Network operators talk: Case studies of recent Power Quality issues

Speakers: Adrian Rupp, Dejan Matvoz, Gaurav Singh, Stefanie Reincke and Fahd Hashiesh

This round table presented a selection of emerging issues related to the increase of modern power electronics, which are faced by network operators and the increasing need for coordination at the interface between DSO and TSO. The round table focused on challenges in the area of distortion. Six experts from DSO, TSO and industry addressed cases related to public and industrial grids as well as generating and consuming installations. One major conclusion was that flicker analysis as performed during last decades requires an urgent revision in the future. 70 delegates attended. Participation of the audience was active and covered specific PQ issues as well as questions related to the interface between DSO and TSO.

RESEARCH & INNOVATION FORUM SESSION 2

Why should I know my Network Harmonic Impedance?

This RIF combined selected papers related to research in network harmonic impedance, which is the link between harmonic currents and voltages. It is required to determine harmonic emission limits, assess harmonic stability of inverters, allocate harmonic customer contribution and study harmonic propagation and resonances in the network. The RIF showed that importance of knowledge about network harmonic impedance has significantly increased and will further increase in future. The RIF was attended by 45 delegates. Discussion was very active and came directly from the audience and from the Q&A App.

POSTER TOURS

Session 2 had four poster tours, one tour per block of the session. The four tours covered similar topics as the main session blocks, namely earthing, PQ issues of new technologies, PQ studies, PQ mitigation, monitoring and big data analysis, PQ regulation. Attendance was as follows: T1 20 delegates, T2 35 delegates, T3 40 delegates, T4 45 delegates.

CONCLUSIONS

Overall session experience was very good. There was a good attendance for the main sessions, round tables and RIF. Audience was active in discussions with direct questions and the Q/A App.