

EXECUTIVE SUMMARY

Session 2 – Power quality and electromagnetic compatibility

SUMMARY

Special focus in session 2 is put on voltage quality in connection with distributed generation (voltage level, flicker, unbalance and harmonics). This session also had a look at power quality system monitoring, electromagnetic compatibility, electromagnetic interferences and electric and magnetic fields issues. A special issue was the design of substation grounding systems. 107 papers were selected after careful reviewing. During the main session 22 papers were presented. The research and innovation forum, this year with focus on supra-harmonics, gave floor for another 6 presentations. The round table discussion had 6 contributions summarising the results of the CIGRE working group C4/C6.29.

MAIN SESSION 2: Block 1

Electric and magnetic fields, safety and interference

Introduction of risk in substation grounding is currently under investigation by CIGRE B3.35/CIRED. One of the stated objectives is to make recommendations for incorporating probabilistic risk analysis, as discussed in this block, in international earthing standards.

There is a certain concern about the influence of supra-harmonics, generated by modern electronic devices (e.g. PV inverter) on power line communication (PLC) as utilised by smart meters. Several contributions stated that high frequency electric and magnetic fields caused by PLC is not an issue. High performance shielding of 50 Hz- magnetic fields can be achieved with sandwich materials, combining conductive and ferromagnetic materials.

MAIN SESSION 2 - BLOCK 2

Power quality issues of distributed generation and electric vehicles

Harmonic emission of wind parks strongly depend on location dependent conditions, particularly the harmonic grid impedance and background distortion. An increase of specific harmonic currents in the windfarm can reduce the respective harmonic voltages due to secondary cancellation. Therefore harmonic voltages should be also assessed. To achieve reasonable results in harmonic load-flow the traditional assumption of constant harmonic current sources (calculation in frequency domain) should be replaced by hybrid methods with locally applied time domain simulations to assess harmonic emission.

An approach for defining a universal filter for wind park installations was presented in this block. It was concluded that with only three different parameter sets of a C-type filter can cover 95% of the typical network conditions. Thus it's possible to derive basic filter requirements at an early planning stage of a wind park with rather low effort.

Two issues related to PV installations were highlighted. Unbalanced connection might limit the hosting capacity of a LV grid. However, it's unlikely - but not impossible - that for a larger number of PV installations, randomly connected to the three phases, voltage unbalance will exceed 2%. Another issue are possible controller instability in weak grids.

MAIN SESSION 2 - BLOCK 3

Power quality measurement, analysis and mitigation methods

Harmonic grid impedance was highlighted as crucial parameter. This is true for the classical harmonic range as well as for supra-harmonics. Amongst others, the impedance is significantly influenced by connected inverters and their EMC filters. This has an effect on resonances and damping of ripple control signals. There seems to be a lack in product standards with regard to the mentioned issues.

A contribution about synchronised measurement of rapid voltage changes to estimate flicker emission, triggered a discussion about future of flicker, considering with new lighting. Immunity requirements of lighting devices will become an issue.

The presented case of the tripping of a conventional power plant due to the use of inverters in the process highlighted the importance of analysing the immunity to PQ phenomena during planning.

MAIN SESSION 2- BLOCK 4

Power quality monitoring systems, data mining, economic and regulatory issues

Voltage dips are still a major power quality problem. International standards limiting the number of voltage dips are not likely to be expected in the near future but national standards are developed respectively had been set up in a number of countries. They are usually based on the principle of sharing responsibility among different parties, as introduced by CIGRE C4.110/CIRED. Process immunity time as measure to investigate vulnerability of processes with respect to dips was mentioned in the previous block

On the other hand, synchronised dip measurement can be used for fault location estimation.

In the case of rather poor reliability, a significant improvement can be achieved by optimal placing of reclosers in the MV grid. Marginal costs of that measure are low in comparison to avoided outage costs.

PQDIF is more or less established as standard power quality data interchange format although some minor issues were brought up in this block. However, the underlying IEEE std. 1159.3 is currently under revision.

ROUND TABLE 1

Power quality aspects of solar power

The results of the CIGRE working group C4/C6.29 "Power quality aspects of solar power" were discussed in the round table. The principal aim of this working group was a mapping and quantification of the impact of solar power installations on power quality disturbances. The discussion highlighted, that the presence of PV installations in the distribution network will increase the probability of overvoltages. Taking into account PQ phenomena of solar power installations during planning is important as well as monitoring. Indices and criteria for the classification of supra-harmonics as well as their impact on customer devices were discussed.

RESEARCH & INNOVATION FORUM SESSION 2

Power quality and electromagnetic compatibility

In this conference, the RIF session was dedicated to the domain of high frequency related phenomena, known as supra-harmonics and included the work of six contributors in this domain. Next to the work of analysing different case studies, including a household installation in island operation, also some more fundamental aspects about how to measure higher frequency components on a robust and reproducible way. The presentations triggered discussions with respect to the used measurement techniques, standardisation, and the feasibility of making conclusions out of the measured data. As a conclusion it is found that the effects of supra harmonics on the system or vice versa will still be in the domain of the continuously gaining experience and one of the greatest challenges will be how to model non-linear loads with respect to their high frequency behaviour.

POSTER TOURS

Parallel tours were organised in the morning and in the first block of the afternoon. Six tours in total with 10 to 25 delegates provided the possibility for intensive discussion and interaction, covering all topics of session 2.

CONCLUSIONS

The main session was of high quality with intensive interaction. The majority of questions came directly from the audience, the usage of the CIRED-app was rather low. An average of 80 to 125 attendees was present for the four blocks. The RIF-session was a good format and could be re-used for the next conference. During the round table, the panellists represented basically the same ideas since they all belonged to the same working group. Thus an exciting controversial discussion did not develop. Generally presentation time could be trimmed in the future, allowing longer discussion.