



## CIGRE Study Committee C4

### System Technical Performance

### 2011 Annual Report to CIGRE UK

Zia Emin

Chairman: Carlo Alberto Nucci (Italy)  
Secretary: Pouyan Pourbeik (USA)  
UK Regular Member: Zia Emin

#### Mission & Scope:

SC C4 deals with methods and tools for analysis related to power systems, with particular reference to dynamic and transient conditions and to the interaction between the power system and its apparatus/sub-systems, between the power system and external causes of stress and between the power system and other installations. Specific issues related to the design and manufacturing of components and apparatus are not in the scopes of SC C4, as well as those specifically related to planning and operation and control, apart from those cases in which component/apparatus/subsystem behaviour depends on, or significantly interacts with, the performance of the nearby power system. The fields on which the activity is carried include but are not limited to: Power Quality, Electromagnetic Compatibility/Electromagnetic Interference (EMC/EMI), Insulation Co-ordination, Lightning, Advanced Tools for the analysis of power system performance, and power system dynamic performance models and analysis.

#### Organisation:

The structure of Study Committee C4 was revised during the Paris 2010 annual meeting and now there are three Advisory Groups:

AG C4.1: Strategic Directions, convener C. A. Nucci (Italy)  
AG C4.2: Institutional Liaison, convener M. Uusitalo (Finland)  
AG C4.3: Tutorials and Conferences, convener E. Dialynas (Greece)

AG C4.1 covers all areas of technical work while AG C4.2 is responsible for liaison with other SC's and institutions (IEC, IEEE, CIRED etc). AG C4.3 is responsible for helping with the dissemination of SC C4 achievements/results by organising tutorials/workshops etc.

SC C4 has 24 Regular and 15 Observer Members representing 39 countries. Among the 41 (members plus chairman and secretary) constituent members 17 are from research organisations and universities, 12 are from utilities and 12 are from regulators/manufacturers or other entities.

### Technical Activities:

Current technical directions in various system technical performance related areas are:

*Power Quality:* Benchmarking of PQ performance in transmission systems; Compatibility levels; Monitoring.

*EMC/EMI:* EM vulnerability; EMC in vicinity of power systems; Requirements and solutions for HV substations and generating stations.

*Insulation Co-ordination:* Critical review of existing practice; UHV systems; Interaction between system and transformers; Resonance and ferroresonance; Transformer energisation studies; Insulator pollution influence on the system performance.

*Lightning:* Critical review parameter statistics; Attachment process; Protection of Low Voltage lines; Protection of wind generators.

*Advanced Theories/Tools:* Numerical EM analysis for surge propagation studies; Numerical techniques for the computation from steady state to switching transients; performance issues related to the application of long HVAC cables.

*Power System Dynamic Performance Models and Analysis:* Power balancing assessments; Influence of Embedded HVDC Transmission on System Security and AC Network Performance; Methods for modelling and aggregation of loads in active power networks.

Currently there are 21 active Working Groups within SC C4:

- WG C4.111: "Review of LV and MV Compatibility Levels for Voltage Fluctuation ", Convener: M. Halpin (USA).
- WG C4.112: "Power Quality monitoring in flexible power network", Convener: M Bollen (Sweden) and J. Milanovic (UK).
- WG C4.206: "Protection of the HV Power Network Control Electronics against Intentional Electromagnetic Interference", Convener: W. Radasky (USA).
- JWG C4.207: "EMC of Communication Circuits, LV Systems and Metallic Structures in the Vicinity of Power Systems", Convener: D. Thomas (UK).
- WG C4.208: "EMC Requirements and Solutions for HV substations and Generating Stations", Convener: W. H. Siew (UK).
- WG C4.303: "Pollution and Environmental Influence on Electrical Performance of Power Systems", Convener: C. Engelbrecht (Netherlands)
- WG C4.305 "Practices in Insulation Coordination of Modern Electric Power Systems Aimed at the Reduction of the Insulation Level", Convener: A. S. Telento (Croatia).
- WG C4.306: "Insulation Coordination for UHV Systems", Convener: E. Zaima (Japan).
- WG C4.307: "Resonance and Ferroresonance in Power Networks and Transformer Energisation Studies", Convener: Z. Emin (UK)
- JWG A2/C4.39: "Electrical Transient Interaction between Transformers and the Power System", Convener: A. Rocha (Brazil).
- WG C4.407: "Lightning Parameters for Engineering Application", Convener: V A. Rakov (USA).

- WG C4.408: "Lightning Protection of Low-Voltage Networks", Convener: A. Piantini (Italy).
- WG C4.409: "Lightning Protection of Wind Turbine Blades", Convener: S. Yokoyama (Japan).
- WG C4.410: "Lightning Striking Characteristics to Very High Structures", Convener: T. Shindo (Japan).
- WG C4.501: "Numerical Electromagnetic Analysis and Its Application to Surge Phenomena", Convener: A. Ametani (Japan).
- WG C4.502: "Power System Technical Performance Issues Related to the Application of Long HVAC cables", Convener: W. Wiechowski (Poland).
- WG C4.503: "Numerical Techniques for the Computation of Power Systems, from Steady-State to Switching Transients", Convener: J. Mahseredjian (Canada)
- WG C4.603: "Analytical Techniques and Tools for Power Balancing Assessments", Convener: K. Uhlen (Norway).
- JWG C4/B4/C1.604: "Influence of Embedded HVDC Transmission on System Security and AC Network Performance", Convener: S. Henry (France).
- WG C4.605: "Modelling and Aggregation of Loads in Flexible Power Networks", Convener: J. Milanovic (UK)
- WG C4.25: "Issues related to ELF Electromagnetic Field exposure and transient contact currents", Convener: H. Kuisti (Finland)

#### Proposed WGs:

- C4.22: Insulation Co-ordination for GIS Substations Connected to Overhead Lines through Cables
- C4.23: Guide to Procedures for Estimating the Lightning Performance of Transmission Lines
- C4.24: Power Quality and EMC Issues associated with future electricity networks
- C4.26: Evaluation of Lightning Shielding Analysis Methods for EHV and UHV DC and AC Transmission-lines
- C4.27: Benchmarking of Power Quality Performance in Transmission Systems

#### Preferential Subjects for Paris 2012

PS1: Modelling and practical experience of the interaction of new generation/transmission technologies and related power electronics with the transmission and distribution systems

- Dynamic and transient performance of the network.
- Power quality and EMC issues related to the massive use of power electronics and external phenomena.

PS2: Advanced tools and techniques for power system performance analysis with particular reference to stochastic methods



- Incorporating risk in analysis through probabilistic tools and assessment in light of the increasing complexity of future networks
- Advanced numerical methods with particular reference to asymmetrical systems

PS3: Lightning protection and insulation coordination as it relates to new generation and transmission technology

- Wind generators
- UHV systems
- HVDC systems
- New models for the calculation of lightning performance of transmission lines

Special reporters for SC C4 Paris 2012 Session are appointed by the Chairman to be:

Zia Emin (UK) for power quality and EMC

Alain Xemard (France) for Insulation co-ordination and lightning

Danielle McNabb (Canada) for power system dynamic performance and security assessment

#### Annual Meetings and Other Events

The 2011 annual meeting took place in April 2011 in conjunction with CIGRE International Symposium on "Assessing and Improving Power System Security, Reliability and Performance in Light of Changing Energy Sources" supported by Study Committee's C1, C2 and C4 in Recife, Brazil.

The next SC C4 meeting will take place in August 2012 in Paris attached to CIGRE General Session 2012.

Two International Colloquiums are planned for 2012 by SC C4:

- Power Quality and Lightning in Sarajevo, Bosnia & Herzegovina, 13-16 May 2012.
- Fusion of Research and Practice for Power System in the Future in Hakodate Japan, 10-13 October 2012.

#### UK Liaison Meeting

The UK liaison meeting is planned to take place before end of 2011 jointly with SC B4, C1, C2, C3, C5 and C6.

For more information

See [www.cigre-c4.org](http://www.cigre-c4.org)

UK Regular member Zia Emin can be contacted at [zia.emin@pbworld.com](mailto:zia.emin@pbworld.com) or on 07920 138242.