Cigré Study Committee C4 - System Technical Performance

Proposal for the creation of a new Working Group

WG:	C4.307
Proposed Convenor:	Lubomir Kocis (EGU HV Laboratory)
Working Group title:	Resonance and ferroresonance in Power networks and transformer energization studies

Introduction: Resonance and ferroresonance (FR) in power networks are complex phenomena inherently falling to SC 4. – Firstly, they cause temporary overvoltages (TOV) and overcurrents deteriorating power quality and even leading to dielectric or thermal failures of transformers. Second, they appear as a result of interaction between the parts of the system and are strongly dependent on system configuration and parameters of its parts. Although the ferroresonance is known since almost ninety years, it resists to full understanding due to its non-linear nature and only last ten or fifteen years brought extensive and intensive research thanks to mastering of simulating methods on PCs by wide range of electrotechnical experts. The digital simulations made possible to map the problem in all its aspects and forms and it also gave answers to questions regarding sensitivity of the ferroresonance to various parameters of the systems. While formerly only simple ferroresonant circuits were treated (as is for example the circuit with CB grading capacitors and VT), now rather complex configurations can be analysed, as black start circuits with saturated three phase power transformers.

A particular but very common case of ferroresonance is that of unloaded transformer energization. Harmonic currents due to saturation may excite network parallel resonances and thus generate dangerous temporary overvoltages.
For these studies, CIGRE WG 33.10 published in 2000 (Electra, 188) some comparative analysis and gave some general recommendations, mainly in modeling transformers, generators, lines, cables, and loads. Nevertheless, some questions were not treated (e. g. stress calculation), some would require further clarification (e. g. saturation modeling, possible initial conditions, statistical methods), and others should probably be updated (e. g. generator modeling).
Moreover, many papers have been published recently (among which, those by CIGRE and IEEE WG) on modeling techniques for each of these network components, but their scope is more general, so they don't focus on essential points for energization studies.

Since in CIGRE only individual papers dealing with ferroresonance were presented, it is good time to gather new findings and give to electrical engineers a guide which show them, how to handle the problem of the ferroresonance in all up to date known forms.

Scope:

WG will treat ferroresonance - its characteristics, modeling techniques and elimination tools- in all known situations and configurations of HV and UHV circuits. For instance, in VTs in effectively and non-effectively earthed systems, in tertiary circuits of power transformers, in transformers connected to double circuit lines and in nonstandard circuits configured during restoration of system operation.
The more specific case of harmonic overvoltages due to transformer energization will receive special attention. For this, this WG will build up a description of the state of the art techniques for transformer energization studies, update recommendations of CIGRE WG 33.10, account for improvements since 2000, and give a more precise description of the best practices. Detailed modeling techniques for all key elements should be described to provide engineers with an up-to-date guide for transformer energization studies. This guide should be aware of actually available data, e. g. for transformers, so as proposed techniques can really be implemented.

Target Groups:

Designers Network experts Utilities Consultants

Deliverables and time schedule: A CIGRE Technical Brochure will be produced, gathering new findings and giving electrical engineers a guide on how to handle the problem of the resonance and ferroresonance in all up to date known situations and configurations of HV and UHV circuits. A summary will be published as a paper in Electra. Commence Q3 2009 and disband Q4 2011

Other SCs concerned by the Work A2, A3, B1, B3	
Approval by the TC Chairman: Klaus Fröhlich	**Date: 18/11/2009**