European Association for the Development of Renewable Energies, Environment and Power Quality (EA4EPQ)

International Conference on Renewable Energies and Power Quality (ICREPQ'10)
Granada (Spain), 23rd to 25th March, 2010

Software tool for the analysis of electromagnetic disturbances propagation

M. Chindris[1], A. Cziker[1], A. Miron[1], A. Sumper[2,3], A. Sudrià-Andreu[2,3] and R. Villafafila-Robles[2]

[1] Department of Power Systems
Electrical Engineering Faculty, Technical University of Cluj-Napoca
15th C. Daicoviciu Street, 400020 Cluj-Napoca (Romania)
Phone number:+0040 264 401451, e-mail: Mircea.Chindris@eps.utcluj.ro, Andrei.Cziker@eps.utcluj.ro, Anca.Miron@eps.utcluj.ro

[2] Universitat Politècnica de Catalunya, Centre d'Innovació Tecnològica en Convertidors Estàtics i Accionaments; (CITCEA-UPC), Departament d'Enginyeria Elèctrica.
EU d'Enginyeria Tècnica Industrial de Barcelona. Comte d'Urgell, 187; 08036 Barcelona, Spain; Email: sudriá@citcea.upc.edu; sumper@citcea.upc.edu; roberto.villafafila@citcea.upc.edu

[3] Catalonia Institute for Energy Research (IREC); C. Josep Pla 2, B2, planta baixa, 08019 Barcelona, Spain.

Key words
Electromagnetic disturbances, virtual instrumentation, disturbances propagation, real operating state

Extended abstract

The paper's main objective is the study of typical electromagnetic disturbances (harmonic distortions, unbalance, voltage dips) propagation in distribution power grids using a software tool. The analysis of propagation of disturbances is a complex issue, which involves: detection and analysis of electromagnetic disturbances, modelling of power grids' elements, and study of existing disturbances influence upon the grids' elements.

The software tool described in the paper is a virtual instrument developed for analyzing the propagation of electromagnetic disturbances. It serves the study of harmonics, unbalance and voltage dips propagation phenomenon in radial distribution power grids.

The paper contains the following aspects: theoretical support of the software tool, description of the created virtual instrument and its usage; paper ends with a section of conclusions where it is underlined the virtual instrument importance.

The propagation of conducted electromagnetic disturbances in distribution power grids is a complex phenomenon whose study implies the necessity of many financial investments, because it supposes the realization of simultaneous in-situ measurements in different grid's points. The use of PCs for the simulation of this phenomenon represents a simpler and accessible alternative. In paper are presented the methods for the analysis of propagation and a virtual instrument developed for the analysis of harmonics and unbalance propagation through the distribution grids. Thus, it is proposed a particular grid that supplied 3 types of consumers. The virtual instrument procedure supposes: (i) the introduction of input data whose effect is the generation of consumers' currents injected in the distribution grid; (ii) the propagation of existing disturbances calculus; (iii) display of output data that is the power quality indicators at the grid transformers busbars.

As a result to the performed analysis, the followings have been observed:
1). The disturbances propagate entirely along the electric lines, but when they go through the grid's transformers, their characteristics change regarding to the transformer connection;
2). The zero sequence components of harmonics from the secondary side of transformers that have the Dy_n connection, are not found at the primary side;
3). The harmonic currents produce harmonic voltages at the transformers busbars; as a result, the non-linear customers influence the proper function of the linear ones.

The usage of the presented software tool offers the following advantages:
1). Simulation of harmonic polluted and unbalanced operating states;
2). Friendly graphic interface;
3). Workable results in a short time.