**CIGRE Study Committee C4**

**PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP**

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| **WG C4.37** | **Name of Convenor :** Yoshihiro Baba (Japan)<br>**E-mail address**: ybaba@mail.doshisha.ac.jp |
| **Technical Issues # (2): 10** | **Strategic Directions # (3): 1, 4** |
| **The WG applies to distribution networks (4): No** | |
| **Title of the Group: Electromagnetic Computation Methods for Lightning Surge Studies with Emphasis on the FDTD Method** | |

**Scope, deliverables and proposed time schedule of the Group :**

**Background :**

Recently, electromagnetic computation methods (ECMs), which include the method of moments (MoM), the finite-element method (FEM), the partial-element equivalent-circuit (PEEC) method, the finite-difference time-domain (FDTD) method and so on, have been used frequently in analyzing lightning surges on electrical systems and related electromagnetic compatibility (EMC) issues. One of the advantages of ECMs, in comparison with circuit simulation methods, is that they allow a self-consistent full-wave solution for both the transient current distribution in a 3D conductor system and resultant electromagnetic fields. In Technical Brochure 543 (Guide for Numerical Electromagnetic Analysis Methods: Application to Surge Phenomena and Comparison with Circuit Theory-based Approach, June 2013), fundamental theories of representative ECMs are explained, and their typical applications are presented. Among ECMs, the FDTD method, which was first used in surge simulations in the early 2000s, is most frequently and successfully used. Interest in using the FDTD method still continues to grow, in part due to availability of commercial codes and increased computer capabilities. It is now in need of detailed study in a relevant CIGRE WG.

**Scope :**

The following issues will be studied by the working group:

1. Theory of the FDTD method
2. Advantages and possible disadvantages of the 2D- and 3-D FDTD method in comparison with other representative ECMs
3. Modeling techniques for lightning, thin wires, nonlinear components/phenomena, and so on
4. Other techniques, such as non-uniform gridding and sub-gridding, for applying the FDTD method to lightning surge and EMC simulations
5. Typical examples of applications: overhead transmission and distribution lines, power cables, substations, intelligent smart buildings, wind-turbine-generator towers, and others.

**Deliverables :** Report to be published in technical brochure with summary in Electra

**Time Schedule** : start : July 2014 **Final report** : 2018

**Comments from Chairmen of SCs concerned** :

**Approval by Technical Committee Chairman** : M. Wald

**Date** : 09/05/2014

(1) Joint Working Group (JWG) - (2) See attached table 1 – (3) See attached table 2
(4) Delete as appropriate

## Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

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| **1** | Active Distribution Networks resulting in bidirectional flows within distribution level and to the upstream network. |
| **2** | The application of advanced metering and resulting massive need for exchange of information. |
| **3** | The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation. |
| **4** | The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation. |
| **5** | New concepts for system operation and control to take account of active customer interactions and different generation types. |
| **6** | New concepts for protection to respond to the developing grid and different characteristics of generation. |
| **7** | New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control. |
| **8** | New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics. |
| **9** | Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network. |
| **10** | An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future. |

## Table 2: Strategic directions of the TC (cf. Electra 249 April 2010)

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| **1** | The electrical power system of the future |
| **2** | Making the best use of the existing system |
| **3** | Focus on the environment and sustainability |
| **4** | Preparation of material readable for non technical audience |