CIGRE Study Committee C2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG N° JWG C2/C4.37	**Name of Convenor :** Yongjie Fang (China) **E-mail address**: fangyongjie@sgepri.sgcc.com.cn	
Technical Issues # :5	**Strategic Directions # :2**	

The WG applies to distribution networks: No

Title of the Group: Recommendations for Systematic Framework Design of Power System Stability Control

Scope, deliverables and proposed time schedule of the Group :

Background :

Ensuring the reliable operation of the power system has always been a top priority in both industrial practice and academic research. CIGRE has undertaken extensive activities in the field of power system stability control by timely integrating requirements of power systems, with the most up-to-date understanding and technologies. High-quality brochures have been published including TB No.36 "Control of Power Systems during Disturbed and Emergency Conditions" (1989), TB No.155 "Advanced Angle Stability Controls" (December 1999),TB No.231 "Definition and Classification of Power System Stability" (June 2003), TB No.316 "Defense Plan against Extreme Contingencies" (April 2007), TB No.325 "Review of On-Line Dynamic Security Assessment Tools and Techniques" (June 2007), TB No.330 "Wide Area Monitoring and Control for Transmission Capability Enhancement" (August 2007), and so on. Also in recent years, more and more attention has been paid to on-line dynamic security assessment tools, wide area monitoring and control system, and many related applications have been extensively reported in various CIGRE conferences and events.

However, recent major blackouts and system wide events have highlighted some of the potential limitations of current stability controls and designs in helping to prevent system wide stability problems. These deficiencies normally manifest themselves directly in aspects of design and maintenance of control systems, but in a deep sense may indirectly result from insufficient attention to the systematic framework design of stability control, or inadequate adaptability of control decisions to changes in grid topology and operating condition, or incomplete consideration given to the coordination among various types of control technologies. This may naturally result from the fact that in the past more attention was paid to the principle and suitable application scope of each specific technology as it became mature. Up to now, less effort has been made to address the systematic framework design of power system stability control by taking full consideration of the unified coordination of various control technologies corresponding to different evolution stages of the disturbed power system. In fact, in the field of power system stability control, definitions and classifications are still not precise and consistent, and understanding on how different control types affect each other are not very clear. Also, proper sharing of information among all entities (TSOs, DSOs, Generators…) is crucial to control coordination, particularly in a large synchronous grid.

This has created a need to develop a systematic basis for designing power system stability control framework from a global and coordinated perspective. The aim of this WG is to build a coordinated systematic framework of power system stability control, with an integration of different types of power system stability control technologies, and considering spreading renewable energy sources.

Scope :

1. Proposal & analysis of definitions and classifications of power system stability control which cover the whole process of power system operation and are most suitable for the systematic control framework design.

   Theoretical analysis and industrial observations show that the classification should be based on control action timing and include the following four types, i.e. preventive control, emergency control, corrective control and restoration control.

2. Proposal & analysis of characteristics of various types of control technologies and their interrelations with particular emphasis on control coordination from a global perspective.

   For instance, preventive control is an operation style with the aim of ensuring reliable power supply without grid fault or subsiding system dynamics after grid faults. Emergency control aims at the specific grid fault that suddenly occurs and would cause system instability, and automatically activates generator tripping, load shedding, HVDC ramping, fast valving, dynamic braking, emergency forced excitation, and potential renewable generation source disconnection and so on, in order to ensure power system stability.

3. Proposal & analysis of key aspects and system performance for designing a systematic framework of power system stability control, referring to key techniques of identifying a clear scope of application for each type of control, and coordinating all types as a whole.

   For instance, any implemented preventive control may affect system stability and also affect type, location and quantity of emergency control in case of grid faults which may occur in the future. Both the system configuration and the decision-making of emergency control not only are affected by available preventive control measures but also have an impact on the configuration schemes of corrective control. Once an emergency control system is activated, its control effects have direct influence on actions of corrective control. Coordination among various control types is necessary. A systematic framework for the implementation of this coordination needs to be developed.

4. The framework recommended by this WG will address the following issues: (1) essentials for the implementation of control adaptability and coordination; (2) functional structure of the framework integrating information processing, stability analysis and control decision-making; (3) analysis on the mechanism of integrating and coordinating various types of stability controls.

5. The group aims at promoting the strategies and practice of coordination among preventive control, emergency control, corrective control and restoration control, rather than conducting research on any new type of control technology. In making recommendations, full consideration will be given to compatibility to the current practice of dynamic security analysis and stability control systems.

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

Time Schedule : start : September 2015 **Final report** : December 2017

Comments from Chairmen of SCs concerned :

Approval by Technical Committee Chairman : M. Waldron
Date : 09/10/2015

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

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)

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