Interaction and coordination between multi control centers
---- Theory and practice

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Power systems in China are being interconnected together into a unified power system. This unified power system is running according to its physical rules but is being managed and controlled by each of the regional control centers in it separately and independently. Each sub-system of the unified power system gathers SCADA data real time from its own regional network and makes dispatching decision itself independently. How the Energy Management System (EMS) and Dispatcher Training Simulator (DTS) in each regional control center follow the variation of whole power system correctly and timely, especially when some transmission line outage occurs in its external network, is a very concerned and real problem. To solve this problem, some interaction and coordination between control centers in different hierarchies are needed to ensure that EMS/DTS in each separate control center can achieve a consistent result.

Based on the principle of power network diakoptics, several decomposition and coordination calculation modes with three different interaction levels for EMS are proposed in this discussion. The target of the interaction and coordination is that the EMS network analysis in each sub-system control center achieves a consistent result with that for whole network.

A practical and efficient interaction and coordination mode for EMS/DTS applications for multi control centers are designed and implemented. A real time tracking equivalence system (TES) is developed and put into online operation in Guangdong provincial power grid, the largest provincial power grid in China.

The TES developed by us reads network model and SCADA data from EMS in Guangdong provincial control center by IEC 61970 CIM/XML, and produces a condensed equivalence system model for each of the 21 sub-systems belongs to it, and then sends each external equivalence model down to the corresponding sub-system by IEC 61970 CIS/CORBA through WAN (here an appropriative data communication links between control centers). The sub-system receives the equivalence model of it
and combines the equivalence model with detail internal network model of itself for further real time network analysis calculation. Once a large disturbance occurs, the TES starts up and updates the equivalence model for all the sub-systems. Normally, the TES starts up on a given time period (1 min).

A site experiment has been done to testify the effect of the interaction and coordination of the TES.

This TES has been put into real operation at the end of 2004. Through the interaction and coordination from Guangdong Electric Power Grid (Master), correctness and exactness of the EMS/DTS simulation in sub-systems (for example, ShenZhen Electric Power supply Co.) have been greatly improved.

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